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DEPARTMENT OF CHEMICAL ENGINEERING

Laboratory of Industrial & Energy Economics

PhD Thesis

Knowledge intensive entrepreneurship, innovation and production technologies in low-technology sectors

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ΕΘΝΙΚΟ ΜΕΤΣΟΒΙΟ ΠΟΛΥΤΕΧΝΕΙΟ

ΤΜΗΜΑ ΧΗΜΙΚΩΝ ΜΗΧΑΝΙΚΩΝ

Εργαστήριο Βιομηχανικής κι Ενεργιακής Οικονομίας

Διδακτορική Διατριβή

Επιχειρηματικότητα Εντάσεως Γνώσης, καινοτομία και τεχνολογίες παραγωγής σε παραδοσιακούς βιομηχανικούς κλάδους

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Αθήνα 2016

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Dedicated to

my wonderful husband, Nikos,
Nikos was the one who encouraged me to do this PhD thesis.
Without his determination, strength, love and practical support,
I might not have been able to overcome expected and unexpected difficulties.

Nikos passed away in November, 2014.
He had promised to stand by me
till the end of this PhD adventure and
I am sure that he keeps his promise!

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It is commonly said that the PhD road is an extremely lonely one. It has been, indeed, a long fascinating journey but by no means a lonely one. Since the very beginning, I met people who inducted me in exciting ways of searching for knowledge and helped me broaden my research horizons and scientific understanding. I made friends and I became a member of a research group I admire and I am proud of. It also appears that I came closer to my family; Nikos and my two little girls Eleni and Stella (who grew up from children to teenagers among my PhD issues, questions and papers) endured stoically the obsession of wife and mother for almost a decade. This piece of work is certainly dedicated to you, my girls, reflecting your father's unconditional love and unwavering support, and indicating paths to hard work and perseverance for the achievement of dreams, no matter the circumstances!

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ΠΕΡΙΛΗΨΗ

Σημείο εκκίνησης της διατριβής είναι το αναδυόμενο κοινωνικο-οικονομικό φαινόμενο της Επιχειρηματικότητας Έντασης Γνώσης (ΕΕΓ) το οποίο έχει πρόσφατα περιγραφεί ως μια ειδική μορφή επιχειρηματικότητας με μεγάλες δυνατότητες και ισχυρή σύνδεση με την καινοτομία και την οικονομική ανάπτυξη. Έχει σχετιστεί με την ίδρυση νέων επιχειρήσεων ή την επέκταση υφιστάμενων επιχειρήσεων και βασίζεται στην δυναμική δημιουργία κι εφαρμογή νέας γνώσης. Παράλληλα, η διατριβή εστιάζει στους κλάδους χαμηλής τεχνολογίας, οι οποίο παίζουν κομβικό ρόλο στην παγκόσμια οικονομία και λειτουργούν σήμερα στο πλαίσιο μερικώς αλλά - παρόλα αυτά - διαρκώς μεταβαλλόμενων και ιδιαίτερα ασαφών και ταραγμένων αγορών. Μέχρι πρόσφατα, ήταν κοινή αντίληψη ότι η επιχειρηματικότητα που βασίζεται στη γνώση ήταν δύσκολο να υπάρξει σε παραδοσιακούς κλάδους εξαιτίας των θεμελιωδών χαρακτηριστικών αυτών όπως για παράδειγμα, η χαμηλή ή ανύπαρκτη ένταση Ε&Α και ισχυρές εμμονές των κλάδων αυτών στην πεπατημένη.
Η διατριβή φιλοδοξεί ακριβώς να συμβάλει στη σφαιρική κατανόηση της ΕΕΓ ως μηχανισμού μεταφοράς πολυποίκιλης γνώσης σε καινοτόμες οικονομικές επιχειρηματικές δραστηριότητες αλλά σε κλάδους χαμηλής τεχνολογίας. Πιο συγκεκριμένα, το αντικείμενο της έρευνας είναι η Επιχείρηση χαμηλής τεχνολογίας αλλά Εντάσεως Γνώσης, ενώ το φαινόμενο υπό μελέτη είναι η αντίστοιχη επιβίωση και ανάπτυξη αυτού του συγκεκριμένου τύπου είτε πολύ νέων επιχειρήσεων ή, στο πλαίσιο υφιστάμενων επιχειρήσεων, εταιρικών εγχειρημάτων που λειτουργούν σε ώριμα και ιδιαίτερα κορεσμένα επιχειρηματικά οικοσυστήματα.

Το κεντρικό ζήτημα της διατριβής είναι *πώς* και *γιατί* συγκεκριμένες επιχειρήσεις χαμηλής τεχνολογίας αλλά με ένταση γνώσης (ΧΤ-ΕΓ) επιβιώνουν από τον πρόωρο θάνατο και αναπτύσσονται μέσα σε παραδοσιακά επιχειρηματικά οικοσυστήματα. Η αφετηρία της έρευνας ήταν το γενικό ενδιαφέρον για τους μηχανισμούς και τις διαδικασίες που διέπουν την ΧΤ-ΕΕΓ. Στη συνέχεια επεκτάθηκε κι επικεντρώθηκε στους πόρους και τις ικανότητες που αναδύθηκαν ως κρίσιμα στοιχεία του φαινομένου. Η έρευνα απέδωσε πάνω από 500 σελίδες απομαγνητοφωνημένου υλικού και πάνω από 2000 σελίδες επιμέρους δεδομένων και σημειώσεων. Οι επιμέρους στόχοι της έρευνας, όπως τελικά διαμορφώθηκαν για να δομήσουν μια

σφαιρική και ολοκληρωμένη εικόνα του υπό διερεύνηση θέματος, είναι οι ακόλουθοι: α) πώς δημιουργούν οι επιχειρηματίες / επιχειρηματικές ομάδες ΧΤ-ΕΓ καινοτόμες επιχειρηματικές ιδέες ΕΓ; β) πώς εντοπίζουν, αποκτούν πρόσβαση και χρησιμοποιούν τη γνώση για να παράγουν καινοτομία; γ) πώς συγκεντρώνουν τους πόρους, τη γνώση, τις δεξιότητες κι άλλες εισροές για να μεταφέρουν την ιδέα τους σε παραγωγή και προϊόντα; δ) πώς οι νεοφυείς επιχειρήσεις ΧΤ-ΕΓ ξεπερνούν τις αδυναμίες που προκύπτουν από τους συνήθως λιγοστούς πόρους, δημιουργούν ισχυρό ανταγωνιστικό πλεονέκτημα κι αναπτύσσονται;

Ερευνητική φιλοσοφία: Η έρευνα επιδιώκει μια ολιστική κατανόηση του φαινομένου της ΕΕΓ-ΧΤ . Για το σκοπό αυτό υιοθετήθηκε η προσέγγιση του εποικοδομητισμού έως η πλέον κατάλληλη για την διερεύνηση του φαινομένου.

Η ερευνητική μεθοδολογία που χρησιμοποιήθηκε είναι η επαγωγική προσέγγιση και πιο συγκεκριμένα η μέθοδος μελέτης πολλαπλών περιπτώσεων για παραγωγή θεωρίας. Οι περιπτώσεις αφορούν την ίδρυση Ελληνικών νεοφυών επιχειρήσεων ή περιπτώσεις εταιρικών εγχειρημάτων χαμηλής τεχνολογίας που έλαβαν χώρα την δεκαετία 1998-2007. Στην επιλογή των περιπτώσεων η ένταση γνώσης, η καινοτομικότητα, ή ύπαρξη ικανής αβεβαιότητας και η επίδειξη εξαιρετικής δραστηριότητας (όπως π.χ. ηγεσίας στην αγορά) θεωρήθηκαν θεμελιώδη κριτήρια. Το τελικό δείγμα αποτελείται από 30 περιπτώσεις πλούσιες σε δεδομένα (δεκατρείς νεοφυείς και δεκαεπτά περιπτώσεις εταιρικών εγχειρημάτων) που ανήκουν σε τρεις παραδοσιακούς κλάδους και πιο συγκεκριμένα στον κλάδο του ξύλου–επίπλου, των τροφίμων και ποτών και τέλος της κλωστοϋφαντουργίας κι ένδυσης. Τα δεδομένα συγκεντρώθηκαν με 42 ημι-δομημένες συνεντεύξεις με βασικά στελέχη των επιλεγμένων επιχειρήσεων κατά τη διάρκεια της έρευνας. Επιπρόσθετα, χρησιμοποιήθηκε κι ένας αξιόλογος αριθμός άλλων πηγών όπως εγγράφων (αναφορές στον τύπο, ετήσιες εκθέσεις, υλικό από τις εταιρικές ιστοσελίδες, κλαδικές αναφορές κ.α.) κι εσωτερικά έγγραφα των επιχειρήσεων (οικονομοτεχνικές μελέτες, πρακτικά συνελεύσεων κ.α.). Στις περισσότερες περιπτώσεις, μελετήθηκε λεπτομερώς η ιστορία των επιχειρήσεων πριν και μετά το υπό εξέταση εγχείρημα (π.χ. νέες καινοτομίες, νέα εγχειρήματα, συγχωνεύσεις κλπ), για την καλύτερη και σφαιρικότερη κατανόηση του φαινομένου. Στην ίδια γραμμή, μελετήθηκε και η εξέλιξη των εγχειρημάτων μετά την ημέρα της συνέντευξης κι ως την τελική παράδοση του συγγράμματος για την καλύτερη αξιολόγηση της απόδοσης κι επίδοσης των επιλεγμένων περιπτώσεων. Στο σκοπό αυτό συνέβαλε επιπλέον η

ιδιαίτερα βαθιά και μακροχρόνια οικονομική κρίση που μαστίζει την Ελλάδα ως ένα επιπλέον (και μη προ-αποφασισμένο φυσικά) σημαντικό κριτήριο.

Η ανάλυση υπέδειξε την ανάγκη ανάπτυξης νέας θεωρίας στο γενικότερο πλαίσιο του φαινομένου της επιχειρηματικότητας έντασης γνώσης σε παραδοσιακούς κλάδους. Σύμφωνα με το προταθέν θεωρητικό πλαίσιο, η ΕΕΓ-ΧΤ σχετίζεται με ένα ολοκληρωμένο σύνολο συγκεκριμένων δυναμικών επιχειρηματικών ικανοτήτων (ΔΕΙ). Πιο συγκεκριμένα, προτείνεται α) νέα θεωρία σχετικά με τη φύση, τις διαστάσεις και την εννοιολογική ανάλυση των ΔΕΙν και β) μια πιθανή οικολογία μεταξύ των δυναμικών επιχειρηματικών ικανοτήτων, των δυναμικών ικανοτήτων, των τεχνολογικών ικανοτήτων και της μακροπρόθεσμης επιβίωσης κι ανάπτυξης. Το προτεινόμενο πλαίσιο αντικατοπτρίζει απόψεις του ευρύτερου άξονα της επιστημονικής βιβλιογραφίας που σχετίζεται με την επιχειρηματικότητα, τις τεχνολογίες παραγωγής και το στρατηγικό μάνατζμεντ εστιάζοντας στην περιοχή της επιχειρηματικότητας χαμηλής τεχνολογίας αλλά έντασης γνώσης και χρησιμοποιώντας τη θεωρία των ικανοτήτων.

Οι προτεινόμενες μετρήσιμες και πρότυπες ικανότητες είναι απλές, ιδιοσυγκρασιακές, με επαναληπτικό χαρακτήρα και φαίνεται να σχετίζονται με την επιβίωση του νέου εγχειρήματος, επηρεάζοντας της αρχικές βασικές επιλογές, την ανάπτυξη, την καινοτομικότητα και το αρχικό ανταγωνιστικό πλεονέκτημα. Οι δυναμικές επιχειρηματικές ικανότητες ορίζονται ως οι ικανότητες εκείνες που επιτρέπουν την εμπλοκή σε μη-συνήθεις δραστηριότητες, σε αυτοσχεδιασμό και σε ένα ευέλικτο και φαινομενικά αντιφατικό ως προς την κοινή γνώμη (παράδοξο) τρόπο συλλογής και δημιουργίας πόρων γνώσης και συνδυασμών αυτών, με στόχο την πραγμάτωση υπερβατολογικών επιχειρηματικών ιδεών με τη μορφή νέων εγχειρημάτων για την ενσωμάτωση αυτών στο σύγχρονο πολύπλοκο επιχειρηματικό περιβάλλον. Στο πλαίσιο της διατριβής οι ΔΕΙς θεωρούνται ικανότητες ανώτερης βαθμίδας που επηρεάζουν τον εντοπισμό, την επιλογή και τους τρόπους επιλογής των πόρων και δεξιοτήτων αλλά και την χρήση *a priori* γνώσης για τη συλλογή κι αξιοποίηση πόρων γνώσης από ποικίλες περιοχές, δημιουργώντας αλλαγές σε επιχειρηματικά οικοσυστήματα και ισχυρά αρχικά ανταγωνιστικά πλεονεκτήματα. Οι επιχειρηματίες και οι διευθυντές είναι οι βασικοί υπεύθυνοι της ανάπτυξης των ΔΕΙς. Σύντομα όμως, οι ΔΕΙς ενσωματώνονται σε οργανωσιακές ρουτίνες ως «πρόγονοι» κάποιων διαστάσεων των δυναμικών ικανοτήτων και παραμένουν σε αυτή τη μορφή έως το επόμενο εγχείρημα του οργανισμού. Σύμφωνα με τα ευρήματα, οι ΔΕΙς δεν

είναι στατικές. Καθώς αυξάνει η εμπειρία, η νέα πληροφόρηση χρησιμοποιείται για την τροποποίηση, την προσθήκη ή την αλλαγή προηγούμενων μοτίβων και διαδικασιών κι έτσι αναμορφώνονται και οι ικανότητες όπως οι τρόποι αναζήτησης της γνώσης, οι τεχνολογικές ικανότητες, οι μέθοδοι παραγωγής κ.α. Αυτή τους η συμπεριφορά οδηγεί στην υπόθεση πως οι ΔΕΙς μπορούν να καλλιεργηθούν εκούσια, να αναπτυχθούν και να διαμορφωθούν από τους βασικούς αρμόδιους για τη λήψη αποφάσεων.

Τα ευρήματα από την ανάλυση όλων των περιπτώσεων υπέδειξαν μια πληθώρα διαδικασιών και ικανοτήτων, από τις οποίες αναδύθηκαν οι τρεις προτεινόμενες Δυναμικές Επιχειρηματικές Ικανότητες με τις διαστάσεις τους και πιο συγκεκριμένα: α) *η ικανότητα του bricolage* η οποία επιτρέπει τους επιχειρηματίες να εξερευνούν και να εκμεταλλεύονται τις νέες ευκαιρίες σε αντίθεση με ασύμφορους και κοστοβόρους (ή και χρονοβόρους) παραδοσιακούς τρόπους. Οι διαστάσεις της προκύπτουν κύρια από τη σχετική θεωρία και είναι *η δόμηση ενός «ρεπερτορίου»* και η *δικτύωση τύπου «ομόκεντρου κύκλου»* με τις υπο-διαστάσεις τους, β) *η ικανότητα αυτοσχεδιασμού* που επιτρέπει τους επιχειρηματίες ΕΕΓ-ΧΤ να δημιουργούν και να εκτελούν απευθείας νέα σχέδια με τη χρήση πόρων που είναι διαθέσιμοι εκείνη τη στιγμή που αναδύονται οι ευκαιρίες ή μορφές μη αναμενόμενης γνώσης και πληροφόρησης. Οι βασικές διαστάσεις της ικανότητας αυτής αναπτύχθηκαν με βάση τη σχετική θεωρία και βιβλιογραφία και είναι *η ικανότητα ροής της πληροφορίας* και *οι ικανότητες σκόπιμα προκλητικής («προβοκατόρικης») οργάνωσης* με τις υπο-διαστάσεις τους και *γ) η υπερβατολογική ικανότητα,* μια πρωτότυπη έννοια στην συγκεκριμένη επιστημονική περιοχή. Πρόκειται για μια καθαρή δυναμική επιχειρηματική ικανότητα στρατηγικής φύσης που εμπεριέχει την ικανότητα *ανάπτυξης υπερβατολογικών συνθηκών* και την *υπερβατολογική σύνθεση* (υπο-διαστάσεις). Η δημιουργία της ικανότητας αυτής στηρίζεται στην «Κριτική του Καθαρού Λόγου» του Καντ σε συνδυασμό με σκέψεις και απόψεις πολλών θεωρητικών περί επιχειρηματικότητας και δημιουργίας της γνώσης στην πορεία εξέλιξης αυτών των επιστημονικών περιοχών. Η ικανότητα αυτή θεωρήθηκε ως θεμελιώδης στην επεξήγηση του «πώς» δομούνται οι καινοτόμες επιχειρηματικές ιδέες έντασης γνώσης προτείνοντας την ύπαρξη διακριτών διαδικασιών παραγωγής *a priori* γνώσης. Οι υπερβατολογικές ικανότητες είναι οι βασικές ικανότητες σχηματισμού ανορθόδοξων ιδεών μέσω της χάραξης νέων οδών προς την καινοτομία και τη γνώση ενώ είναι υπεύθυνες για τον συντονισμό κι

οργάνωση των άλλων δύο ΔΕΙν για την πραγμάτωση αυτών των ιδεών. Οι επιχειρηματίες / επιχειρηματικές ομάδες δημιουργούν εκ προμελέτης γνήσιες νέες έννοιες που βασίζονται σε γνωστικές ικανότητες οι οποίες οφείλονται στις υπερβατολογικές ικανότητες. Αυτές καθορίζουν τις πηγές, την έκταση και την αντικειμενική αξία της γνώσης και διευκολύνουν τη χάραξη «οδών» μέσα στο χάος του «αρχάριου» φιλόδοξου επιχειρηματία. Η εμπειρική ανάλυση υπέδειξε ότι μια τέτοια ενεργοποίηση μηχανισμών που απαιτούνται για να οδηγήσουν σε ανεξερεύνητα μονοπάτια γνώσης και για να παράγουν καινοτόμες επιχειρηματικές ιδέες αποτελεί και τη βασική διαφορά ανάμεσα στο εξεταζόμενο φαινόμενο και την απλή επιχειρηματικότητα χαμηλής τεχνολογίας. Ο καρποί της υπερβατολογικής ικανότητας φαίνεται να μπορούν να επιτρέπουν σε έναν νεοεισερχόμενο να γίνει αποδεκτός σε ένα περιβάλλον ήδη ώριμο και φαινομενικά υπερκορεσμένο, να δελεάσει πελάτες, να παράξει αξία και να πείσει τους πελάτες να πληρώσουν γι αυτή.

Η ανάλυση των δεδομένων επίσης υποδεικνύει ότι οι ΔΕΙς φαίνεται να υποστηρίζουν και να προωθούν την ανάπτυξη τεχνολογιών παραγωγής που δημιουργούν υπεραξία και συνεπώς την ανάπτυξη των τεχνολογικών ικανοτήτων των νέων επιχειρηματικών εγχειρημάτων, οι οποίες με τη σειρά τους εστιάζουν «στην αποτελεσματική χρήση της τεχνολογικής γνώσης στην παραγωγή, επένδυση και καινοτομία» (Westphal, et al., 1985, σελ. 171). Οι κατάλληλες τεχνολογίες παραγωγής συμβάλλουν στην ενίσχυση των ανταγωνιστικών πλεονεκτημάτων, την επιβίωση, ανάπτυξη και καινοτομία των επιχειρήσεων ΕΓ-ΧΤ. Μάλιστα, η ανάλυση φαίνεται να αμφισβητεί και την καθεστηκυία αντίληψη ότι οι επιχειρήσεις χαμηλής τεχνολογίας ακολουθούν την πεπατημένη, όπως για παράδειγμα ότι «δανείζονται» τεχνολογία για να εισέλθουν σε υφιστάμενες αγορές αναζητώντας ανταγωνιστικό πλεονέκτημα στη χαμηλή τιμή, την αύξηση της παραγωγικότητας και τους καλύτερους όρους παράδοσης.

Ένα ακόμη σημαντικό θέμα που πραγματεύεται η παρούσα διατριβή αφορά στην επαλήθευση της ύπαρξης των δυναμικών ικανοτήτων σε νέες επιχειρήσεις ΧΤ-ΕΓ. Η αντίληψη της αγοράς και της τεχνολογίας, η ανάπτυξη νέων προϊόντων, η δικτύωση και οι ικανότητες συνεργασίας φαίνεται να αποτελούν τις πλέον αξιόλογες δυναμικές ικανότητες σε πολλούς βιομηχανικούς κλάδους στις εξεταζόμενες περιοχές. Επιπλέον, τα ευρήματα υποδεικνύουν ότι οι δυναμικές επιχειρηματικές ικανότητες παίζουν σημαντικό ρόλο στη δημιουργία και ανάπτυξη των δυναμικών ικανοτήτων

επηρεάζοντας έτσι έμμεσα την καινοτομικότητα κι ανάπτυξη των νέων επιχειρήσεων ΧΤ-ΕΓ. Οι μορφές με τις οποίες συνδέονται οι ΔΕΙς και οι ΔΙς δεν φαίνεται να εξαρτώνται από τον κλάδο κι αυτό ενισχύει την προτεινόμενη γενίκευση των παρατηρούμενων τρόπων με τους οποίους οι ΔΕΙς ενσωματώνονται ή αποτελούν «προγόνους» συγκεκριμένων διαστάσεων των δυναμικών ικανοτήτων. Παρόλα αυτά, συχνά οι δυναμικές ικανότητες υφιστάμενων επιτυχημένων οργανισμών πιθανά να εμποδίζουν την απόδοση των ΔΕΙς σε περιπτώσεις εταιρικών εγχειρημάτων και πιο συγκεκριμένα, όσο πιο ισχυρή είναι η εξάρτηση από την πεπατημένη (π.χ. λόγω επιτυχιών του παρελθόντος), τόσο μικρότερη είναι η επιτυχία των δυναμικών επιχειρηματικών ικανοτήτων.

Η συμβολή της διατριβής είναι τόσο θεωρητική όσο κι εμπειρική. Σύμφωνα με όσα γνωρίζουμε, η διατριβή ανήκει στις πρώτες ερευνητικές προσπάθειες εντοπισμού μοναδικών χαρακτηριστικών του φαινομένου της Επιχειρηματικότητας Έντασης Γνώσης και ιδιαίτερα όσο αφορά στην εστίαση στην μάλλον παραμελημένη έως σήμερα περιοχή των παραδοσιακών βιομηχανικών κλάδων. Η έρευνα των παραγόντων επιτυχίας κι αποτυχίας σε επίπεδο επιχειρηματικού εγχειρήματος παραμένει ελάχιστη τόσο γενικά όσο και στην συγκεκριμένη περιοχή της χαμηλής τεχνολογίας. Στον χώρο αυτό, παρά το γεγονός ότι υπάρχουν κάποιες επιστημονικές εργασίες σχετικά με το ανταγωνιστικό πλεονέκτημα και τις ικανότητες, η συζήτηση παραμένει περιορισμένη κύρια σε θέματα της θεωρία καινοτομίας στους κλάδους χαμηλής τεχνολογίας.
Πιθανά, η κύρια συμβολή της μελέτης να έγκειται στην επιχειρούμενη εννοιολογική δόμηση και την προτεινόμενη λειτουργικότητα των δυναμικών επιχειρηματικών ικανοτήτων καταδεικνύοντας το γεγονός ότι δεν πρόκειται για ασαφείς και αόριστες αφηρημένες έννοιες που καθοδηγούνται μόνον από το ταλέντο κα την διαίσθηση. Στην πραγματικότητα, φαίνεται πως οι ΔΕΙς και οι υπο-διαστάσεις τους αποτελούν ένα σετ ιδιοσυγκρασιακών στη λεπτομέρειά τους ικανοτήτων που όμως είναι αναγνωρίσιμες και μετρήσιμες και γι αυτό ακριβώς το λόγο διαχειρίσιμες. Τα αποτελέσματα της διατριβής μπορεί επίσης να θεωρηθεί ότι συμβάλλουν θεωρητικά κι εμπειρικά στη θεωρία των δυναμικών ικανοτήτων εφόσον ρίχνουν φως στις απαρχές και τον τρόπο δημιουργίας των δυναμικών ικανοτήτων απαντώντας σε ερωτήματα όπως εκείνο της ύπαρξής τους από τη δημιουργία μιας επιχείρησης. Παράλληλα, απαντούν σε ερωτήματα σχετικά με την εφαρμογή τους σε περιπτώσεις

χαμηλής τεχνολογίας ή σε περιβάλλοντα με μέτριο δυναμισμό. Η σχέση ΔΙ-ΔΕΙ, όπως περιγράφεται στην παρούσα μελέτη, μπορεί επίσης να εξηγήσει ικανοποιητικά την ετερογένεια των νέων επιχειρηματικών εγχειρημάτων ΧΤ-ΕΓ όσο αφορά στην επιβίωση και ανάπτυξη. Επίσης, είναι γνωστή η εκπληκτική έλλειψη έρευνας σχετικά με το πώς μια επιχείρηση χαμηλής τεχνολογίας χτίζει το λειτουργικό της περιβάλλον παρά το γεγονός ότι είναι ευρέως αποδεκτή η αξία της φυσική της δημιουργίας (της υλοποίησης των παραγωγικών μέσων π.χ.). Όμοια, είναι ελάχιστος ο αριθμός των εργασιών που έχουν ασχοληθεί με το ρόλο των τεχνολογιών παραγωγής στο πλαίσιο της ΕΕΓ-ΧΤ και ιδιαίτερα σε επίπεδο κλάδου. Η παρούσα θέση είναι ανάμεσα στις πρώτες προσπάθειες που καταδεικνύουν ότι οι δυναμικές επιχειρηματικές ικανότητες μπορούν να δράσουν καταλυτικά στην απόκτηση τεχνολογικών ικανοτήτων τέτοιων επιχειρήσεων.

Η διατριβή προσφέρει πολύτιμη τροφή για σκέψη σε ερευνητές, θεωρητικούς και όλους όσους ασχολούνται με την επιχειρηματικότητα, το στρατηγικό μάνατζμεντ και πολλά συναφή ερευνητικά πεδία. Στο πλαίσιο της παγκοσμιοποιημένης οικονομίας, οι αγορές των παραδοσιακών κλάδων έχουν μετατραπεί σε ιδιαίτερα εχθρικά, ασταθή και ευμετάβολα περιβάλλοντα. Πέραν της θεωρητικής της αξίας, επιχειρηματίες, στελέχη επιχειρήσεων και φορείς χάραξης πολιτικής μπορούν να βρουν ενδιαφέροντα στοιχεία στις προτάσεις που περιέχονται στην παρούσα διατριβή. Επιπλέον, ενώ τα ευρήματα που παρουσιάζονται σε αυτή έχουν προταθεί κύρια για τις παραδοσιακές βιομηχανίες, αξίζει να ερευνηθεί η δυνατότητα εφαρμογής τους και σε βιομηχανίες μεσαίας και υψηλής τεχνολογίας.

Η προσέγγιση των δυναμικών επιχειρηματικών ικανοτήτων, ο συσχετισμός τους με τις δυναμικές ικανότητες αλλά και με τις τεχνολογίες παραγωγής σε περιπτώσεις χαμηλής τεχνολογίας βρίσκεται στην γένεσή της. Παρόλα αυτά, δίνει τη δυνατότητα περαιτέρω εμπειρικής και θεωρητικής διερεύνησης. Οι αναδυόμενες θεωρίες έχουν πάντα ανάγκη μακρών περιόδων εξέλιξης και διερεύνησης. Όπως τονίζει ο Williamson (1999) «οι μεγάλες ιδέες συχνά απαιτούν πολύ χρόνο για να αποκτήσουν ακόμη και έναν ορισμό».

Σημείωση: Η παρούσα ερευνητική εργασία παρακινήθηκε από την εκκίνηση του ερευνητικού έργου AEGIS FP7 (Ιανουάριος 2009 - Σεπτέμβριος 2012), η οποία εστίαζε στη διερεύνηση του φαινομένου της Επιχειρηματικότητας Έντασης Γνώσης από το Εθνικό Μετσόβιο Πολυτεχνείο.

Extended Abstract

The starting point of this thesis is the emerging key socio-economic phenomenon of knowledge-intensive entrepreneurship (KIE). KIE has been recently described as a special type of high potential entrepreneurship strongly connected to innovation and economic growth enhancing the competitiveness of firms and countries. It has been related to the establishment of new ventures or the expansion of existing ones based on the dynamic creation and application of new knowledge. On the other hand, low-technology industries constitute an important part of the global economy, operating within moderately but still ever-changing and highly ambiguous and turbulent markets. Until very recently, the common belief was that entrepreneurship based on knowledge was difficult to be found in traditional sectors due to the very basic features of these industries such as low or non-existent R&D intensity and strong path dependencies.

The thesis purports to contribute to the comprehensive understanding of knowledge-intensive entrepreneurship as a mechanism for the transfer of multifaceted knowledge into innovative economic entrepreneurial activities, in low-tech sectors. More precisely, the object of the research is the low-tech but knowledge-intensive venture while the phenomenon under study is the corresponding survival and growth of this particular type of either very young firms or, in the context of existing organizations, in the form of corporate venturing within mature and highly saturated business ecosystems.

The research question of the dissertation is *how* and *why* certain low-tech but knowledge-intensive (LT-KI) ventures survive early death and prosper within traditional business ecosystems. The research started with a broad interest in LT-KIE mechanisms and processes and honed down the resources and capabilities that emerged as important. It yielded over 500 pages of transcripts and over 2000 pages of secondary data and notes. The individual research objectives, eventually framed in order to build an integrated and comprehensive picture of the subject under question, are the following: a) how do LT-KI entrepreneurs/teams create innovative KI business concepts?; b) how do they locate, access and use knowledge in order to produce innovation?; c) how do they accumulate the bundle of resources, knowledge, skills and other inputs to transform the idea into production lines and products?; and d)

how do just established LT-KI ventures overcome resource base weaknesses, create strong initial competitive advantages and evolve?

Research philosophy: this research seeks to gain a holistic understanding of the LT-KIE phenomenon which is viewed as a situated phenomenon. Following this rationale, the **constructivist approach** is considered by the researcher as a paradigm which fits perfectly with the nature of the phenomenon under investigation.

Research method: the **inductive research approach** was used and more precisely the **theory-building multiple-case study** method. Cases should regard Greek newly founded and corporate low-tech ventures created within the 1998-2007 decade while knowledge intensiveness, innovativeness, significant uncertainty and exceptional activity (such as market leadership) were the main selection criteria. Thirty information-rich cases (thirteen start-ups and seventeen cases of corporate venturing) of three traditional industries and namely the wood and furniture, the textiles and clothing and the food and beverages sectors were carefully selected, explicitly observed and analyzed. Data were collected through 42 semi-structured interviews with key informants in the venture organizations throughout the investigation period. In addition, public documents (press releases, annual reports, web pages, industry reports) and internal documentation (business plans, minutes of meetings) were used to support and complement the main data. In most cases, their historical background before and after the venture creation (e.g. new innovations, new spin offs, mergers and acquisitions etc.) has been studied in detail to provide a better understanding of the phenomenon explored. In the same vein, the evolution of the ventures after the day of the interview has been taken into consideration, in order to assess the performance of the selected cases. The occurrence of the severe Greek long-lasting crisis provided a further (unexpected) significant criterion for that purpose.

The cross-case theory-building analysis indicated the need of developing further new theory on the LT-KIE phenomenon, and allowed for the addition of new theoretical and empirical insights on the issue; the **conceptual framework delineated** proposes that KIE in low-tech sectors can be related to a comprehensive set of specific ***dynamic entrepreneurial capabilities (DECs),*** and more precisely, a) emerging theory on the nature, the dimensions and specific conceptualizations of the DECs; and b) suggestions of a potential ecology between DECs, dynamic capabilities, technological capabilities and long-term survival and growth. The suggested framework reflects views at the broad nexus of the entrepreneurship, production management and

strategic management literature, focusing on the area of low-tech and knowledge-intensive entrepreneurship and using a capability approach lens.

The suggested measurable and patterned DECs are simple, idiosyncratic and iterative and they appear to be related with the new ventures' survival, affecting initial core choices, growth, innovativeness and initial competitive advantage. DECs are actually defined as the dynamic entrepreneurial capabilities to engage in non-routine activities, improvisation and a flexible and seemingly contradictory to common belief (paradox) way of collecting and establishing knowledge assets and asset combinations in order to realize transcendent business ideas and address complex entrepreneurial environment through new LT-KI ventures. They have been treated as higher-order capabilities that influence the location, selection and the ways of selection of resources and skills and use a priori knowledge in order to capture existing knowledge from various domains, denoting changes in business ecosystems and creating initial competitive advantages. Entrepreneurs and managers are the key agents of DEC development; however, DECs are soon embedded in organizational routines, becoming precursors of DC dimensions, and remain in this form till the very next venturing of the organization. A significant role of DECs is to activate the 'entrepreneurial' and cognitive component of the dynamic capabilities and provide their flexible shaping and use. According to our findings, DECs do not appear to be static. As experiences occur, the new information is used to modify, add to, or change previously existing patterns and processes and thus reform capabilities and behaviors such as ways of knowledge seeking, technological competences and production methods, and business model formation. This behavior gave us the faith to believe that DECs can be deliberately cultivated, developed and influenced by the core decision-makers of the LT-KI entrepreneurial act.

Across all thirty case studies, findings pointed to a rich fabric of processes and competencies, which formed **the three DECs** with a number of dimensions each and namely: a) *bricolage capability* enables entrepreneurs both explore and exploit new opportunities that might otherwise be too expensive to investigate by more traditional means. Its dimensions derive from the relevant bricolage theory and are *repertoire building* and *concentric cycle networking* with their sub-dimensions; b) *improvisation capability* allows LT-KI entrepreneurs create and execute new plans "on the fly", using resources available at the moment when opportunities or unexpected pieces of

knowledge and information emerge. Core dimensions are developed on the basis of the relevant improvisation theory and they are *information flowing* and the *provocative organization competencies* with their sub-dimensions; c) *Transcendental Capability* is a totally novel concept, a purely dynamic entrepreneurial capability of strategic nature, that implies the development of *transcendental conditions* and *transcendental synthesis*. This DEC is based mainly on the Kantian "Critique of Pure Reason" and several thoughts and views of entrepreneurship and knowledge-creation theorists. It explains *'how'* innovative knowledge-intensive concepts are built suggesting that they are results of a priori knowledge generation processes. It regards mainly the process of intangible assets' creation, such as novel knowledge and know-how which according to Teece (2011) constitute the new, hard to "build" and difficult to manage "natural resources". Transcendental capabilities (TCs) are the key drivers of shaping unorthodox ideas, curving the directions towards novelty and knowledge seeking and orchestrating the other two DECs to realize these ideas. Entrepreneurs form by anticipation genuine concepts based on cognitive capabilities derived from TCs; these determine the origins, the extent, and the objective validity of knowledge, facilitating a path carving within the KI "beginner's" chaos. The empirical analysis indicated that such an enactment of mechanisms needed to allow unexplored knowledge paths and produce innovative business ideas constitutes the specific difference between LT-KIE and plain LT entrepreneurship. The fruits of TCs seem to be able to permit a newcomer be accepted in an already established and seemingly saturated market environment, entice customers, deliver value to them and persuade them to pay for value.

The data analysis also suggests that DECs seem to support and enhance the value-creating development of **production technologies** and consequently, the development of the new LT-KI ventures' technological capabilities; these, in turn, focus on efforts to "make effective use of technological knowledge in production, investment and innovation" (Westphal, et al., 1985, p. 171). Appropriate production technologies assist the integration of competitive advantages supporting the new firm's survival, growth and innovative performance. The analysis actually seems to challenge the established opinion of common entrepreneurial processes in low-tech sectors according to which low-tech firms follow well-trodden paths, complying with market and manufacturing *status quo*; i.e. they act as "technology borrowers" using existing

technologies to satisfy and penetrate existing markets, seeking advantages in low prices, productivity increase, and better delivery terms.

Another important issue of the thesis regarded **the verification of the existence of dynamic capabilities (DCs) in the LT-KI new firms**: market and technological sensing, new product development, networking and collaboration capabilities appear to be the most significant DCs entailing processes to acquire knowledge and understand technology developments in a variety of industrial sectors and relevant scientific fields for all three sectors examined. Findings indicated that **DECs have a role to play in the creation and development of DCs** impacting thus in an indirect way a new LT-KI firm's innovativeness and growth. The potential links among DECs and DCs do not seem to be sector-specific indicating generalizability in the way DECs get embedded or become antecedents of certain DC micro-foundations. However, DCs in established organizations may hinder the performance of DECs in cases of LT-KI corporate venturing and more specifically, the more the path dependency, the less the DECs' effectiveness.

The **thesis' contribution** is both theoretical and empirical. According to our best of knowledge, it is among the very first research efforts to unearth several unique insights on the KIE phenomenon, shifting focus and advancing knowledge on the rather neglected area of low-tech industries. Research on firm-level success and failure at the stage of LT-KI venturing remains scarce; while there is some talk on competitive advantage and capabilities, this discussion remains caged mainly within the borders of the LT- innovation theory.

Perhaps the major contribution of the study regards ***DECs' conceptualization and operationalization, as it provides a multidimensional measure of DECs***, indicating that they are more than just vague and fuzzy abstractions guided only by human talent and intuition; in fact, it appears that the DEC construct and its underlying dimensions are a set of idiosyncratic in their details but identifiable, measurable and, therefore, managerially amenable options that can be used to address the changing low-tech environment during the gestation, start-up and early development stages. It can be also considered a significant theoretical and empirical contribution to the ***Dynamic capabilities theory*** since it throws some light on the origins of DCs and the debate on their existence at the outset of new firms, confirming, in parallel, their applicability in

low-tech industries or otherwise areas of moderate environmental dynamism. Up to date, a very small stream of empirical research has been slowly emerging, trying to capture the DCs impact in low and medium-tech sectors. The described DEC-DC evolution in the LT-KI venture context may help also to explain heterogeneity of new LT-KI ventures' survival and development. Last but not least, there is a surprising shortage of studies that investigate ***how low-tech ventures build up their operational environment***, although it is widely accepted that the commitment to physical creation is a significant transition point in venture creation, in general. Similarly, there are only a handful of studies that probe the role of production technologies within a low-tech but knowledge-intensive context mainly at a sectoral basis. The present thesis is among the first to suggest that DECs can act as a catalyst and endue new ventures with technological capabilities, explaining the foundations of the technological capabilities of such firms.

The thesis offers some valuable insights and food for thought for researchers, theorists and postgraduate students in entrepreneurship, strategic management and several other fields. Besides the theoretical value, entrepreneurs, company representatives and policy-makers may find some interest in the proposed insights in the low-tech field that has been so far neglected. Almost with the dawn of the new millennium and the evident globalization of the international economy, the market environment of the low-tech sectors has become highly volatile and instable. The findings of this dissertation are applicable in a wider context regarding the low-tech, traditional industries; examination of their applicability to high and medium-tech industries is strongly suggested.

The DEC-approach together with the proposed interactions among DECs – DCs and production technologies is in its infancy but it *does* have the potential to be further empirically and theoretically researched. Emerging and evolving theories develop slowly, over long periods of time. As Williamson (1999) observes, 'big ideas often take a long time to take on definition'.

NOTE: This research was spurred by the beginning of the AEGIS FP7 multi-partner research project (January 2009 - September 2012) at the National Technical University of Athens which focused on KIE.

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1 Introduction

Ἀρχὴ ἥμισυ παντός.
The beginning is the most important part of the work.
Laws 6, 753 E, Plato, 427-327 B.C

1.1 Background, Motivation and problem statement

Traditional, low-tech industries were among the pioneers of the production and distribution of a continuous flow of branded goods since the beginnings of economic history. According to literature (Economist, 1998; Hirsch-Kreinsen et al., 2005; Smith, 2008), they underwent a shorter or longer evolution, which resulted in the emergence of recognized standards, methods, and knowledge related to both products and processes. This is perhaps one of the most important reasons for the generally difficult competitive position of many of these industries in Europe: the basic technologies and relevant procedures in these sectors are well known and can be often easily copied by foreign competitors with a lower cost base. Furthermore, setup costs are low and a large number of firms operate at marginal costs competing fiercely on price (Scarpetta and Tressel, 2004). Therefore, the majority of low-tech firms seem to be prone to competition from low-wage countries and less aggressive in terms of competition and innovation being found in an unusually instable environment mainly with the endowment of the new millennium.

A more spherical and updated view, that reflects the astonishing evolution of low-tech industries within this decade, is portrayed in the chapter of Protogerou, Caloghirou and Karagouni on *The relevance of the dynamic capabilities perspective in low-tech sectors*[1] in the book "KIE in low-tech sectors" (2014). The authors describe the globally changing business environment in low-tech industries and in particular,

- the *instability* caused by globalization and trade liberalization,
- the *technology pressures* due to changing industry structures, "industry convergence" (Bröring *et al.,* 2006) and the transformation of the technology base of mature industries
- the increase of *regulations* and *social pressures* from action groups, communities, governments, other shareholders and consumers to produce safer

[1] Fort the detailed analysis please refer tot he book chapter

and more environmentally friendly items (Gereffi et al., 2001; de Bakker and Nijhoff, 2002).

- the changes caused by the recent *financial crises* at national, European and global level which have turned the environment to highly volatile

However, besides the before-mentioned difficulties, low-tech sectors are still central to economic well-being; whether measured in terms of output, capital invested or employment, they dominate the economies of highly developed as well as developing nations, providing more than ninety percent of output in the European Union, the USA and Japan. Established low and medium-tech industries comprise 97 per cent or more of GDP and still make up the largest part of the manufacturing industries in OECD countries. Goods and services provided by all types of such sectors are absolutely vital for all societies (no matter how modern they are) and low-tech firms' preponderance is falling at a very slow rate (Kaloudis et al., 2005; Potters, 2009). Low R&D intensity sectors make up a considerable fraction of employment and production and are important for economic growth and knowledge formation in European economies (Kaloudis, 2005; Potters, 2009; Robertson and Patel, 2007).

Besides their role in the economic growth, "low and medium tech (LMT) firms and sectors are by no means technologically and economically stagnant" (Kreinsen and Schwinge, 2014). There is a significant volume of studies of LMT industries regarding the achievements of the so-called traditional industries within volatile and hostile environments. Moreover, after the initial shock of the Asia-based low-wage competition in the early 2000, firms in the low-tech sectors are responding successfully to the challenges by becoming significant generators of new production technologies, by exploiting or developing new materials (e.g. technical textiles in the textile industry) and other forms of innovation.

Actually, low-tech industries have become the subject of the innovation debate in the past few years; since the beginning of the new millennium and within the highly volatile business environments, low-tech industries have intensified their efforts towards both incremental and radical innovation. They have been characterized as active contributors, rather than passive adopters regarding changing technologies and technology paradigms (e.g. Mendonça, 2009). They have been called "carrier industries" by incorporating new technologies elsewhere produced into making new products or implementing new manufacturing processes (von Tunzelmann and Acha,

2005). Furthermore, technology flows between low-tech and high-tech industries are highly dominated by the flows into low-tech industries (Hauknes and Knell, 2009). Thus, during the first decade of the new millennium, it appears that "a tradition of dynamism" (Mendoca, 2009) is generally accepted for low-tech, traditional sectors which is related to innovation and knowledge: "Knowledge search, identification and proof ... are likely to be of particular importance to innovation in the non-manufacturing activities of LMT [low-tech and medium low-tech] industries" (von Tunzelmann and Acha 2003, p. 4, SPRU on Innovation in Low-Tech Industries).
In this vein, market and technology knowledge availability and sharing have been considered as significant elements of firm-level LMT entrepreneurship (e.g. Sciacia et al., 2008). According to researchers, this knowledge often stems from various sources outside the firm's sectoral boundaries (Hirsch-Kreinsen and Schwinge, 2011; Robertson and Smith, 2008). However, until very recently, the common belief on LMT was that entrepreneurship based on knowledge was difficult to be found in traditional sectors due to the very basic features of these industries. LMT sectors and firms appeared to offer only very limited opportunities for knowledge-intensive activities due to the fact that innovations in these contexts are more or less path-dependent i.e. they are based on technological knowledge and capabilities that have been slowly evolving around established technological trajectories (Hirsch-Kreinsen and Schwinge, 2011). Even in 2014, Hirsch-Kreinsen, and Schwinge (2014, pp 21-22) would claim that: "Unlike high-technology sectors where technological risks and uncertainties prevail, the technologies of LMT sectors are considered as well-known and mature. … The same applies for the LMT sector's knowledge base which is largely embracing codified and transferable components…."

It was then rather expected that the new interest on the emerging view of knowledge-intensive entrepreneurship (KIE) would neglect low-tech industries. KIE has been considered a new strategy paradigm based on knowledge; a type of high potential entrepreneurship which helps renew the economy. It is considered a key socio-economic phenomenon that drives innovation and economic growth enhancing the competitiveness of both firms and countries (Malerba and McKelvey, 2010). It indicates ventures whose initiation or expansion is based on the dynamic application of new knowledge. According to Malerba and McKelvey's (2010) formal definition

of knowledge-intensive entrepreneurship, KIE is associated with new firms (new ventures) that are innovative and engage in activities that are knowledge intensive.
Actually before the AEGIS FP7 project[2], low-tech sectors had been characterized as innovative (at firm-level) but were clearly left out of the KIE discussion. KIE was confronted as only occurring in certain high-tech industries such as biotechnology, information and communication technologies or in certain types of firms e.g. university spin-offs. As Caloghirou, Protogerou and Tsakanikas (2014, p.18) state "in policy circles and in press it was used as a basis for defining and discussing knowledge-intensive in contrast to traditional or non-knowledge-intensive industries". Yet, this focus on a rather direct, R&D-based creation of knowledge could not any more explain the observed interdependence and diffusion of knowledge between different fields and sectors (Smith, 2002; Robertson and Smith, 2008).
It appeared that the relevant field of literature was then quite ready to accept and further explore the challenge to confront KIE as a phenomenon that can be equally traced in low -tech (LT) industries. Accumulated knowledge becomes very important since it can support a new way of combining inputs or resources based on exploitative learning processes, increase effectiveness and create sustainable competitive advantage. Knowledge intensity is translated in external and/or internal 'knowledge seeking activities', 'initial knowledge capital' and relevant 'human capital' (Caloghirou et al., 2012). Low-tech firms appear to seek mainly new technical and practical knowledge linking external knowledge with the firm-specific knowledge base (e.g. Medanoça 2009; Robertson and Smith 2008). Theoretical and empirical research encourages the shift of low-tech players to knowledge and innovation. Actually, Hirsch-Kreinsen and Schwinge (2011) refer to statistical data that indicate a relatively large number of newly-founded low-tech companies that are based on new knowledge and novel technologies as well as the existence of "gazelles", i.e. fast-growing companies that induce low-tech sectoral growth.

Therefore, today, low tech knowledge-intensive entrepreneurship is at least accepted as a phenomenon that drives innovation and economic growth in low-tech but knowledge-intensive firms. Furthermore, it has become quite clear that a changing

[2] The AEGIS project (2009-2012) contacted both qualitative and quantitative research in a number of European countries in order to provide a comprehensive understanding of the KIE phenomenon including low-tech sectors. It will be discussed further in Chapter 2

business environment is not exclusively associated with high-tech sectors as it can also exist and play a significant role in low and medium-technology industries especially in the contemporary turbulent years and in the midst of the financial crisis that most European countries are experiencing. Theoretical and empirical work has confirmed the existence of KIE processes in low-tech sectors and is exploring several aspects such as its distinctive features, mechanisms and strategic perspectives. Ongoing research produces significant insights related to the basic building blocks of low-tech KIE, regarding LT-KIE types, forms of knowledge, knowledge bases and sources, ways of knowledge exploitation and combination as well as insights regarding knowledge-intensive innovation, mechanisms and processes of KIE, among others. Furthermore, there is a plethora of skills, entrepreneurial characteristics and other antecedents and factors used as input, KIE management and output in KIE processes.

However, one of the major issues in LT-KIE regards the venture creation and early growth stages; research on KIE focused mainly on the mechanism of translating knowledge into innovation, indicating that this translation through LT- KIE is more complex than expected, compared to high-tech sectors. In the same vein, the limited research on LT-KIE shows that the sectoral conditions seem to affect to a significant extent the creation or exploitation of opportunities through knowledge, market, institutions, etc. as well as the creation of LT-KI ventures. Even more, the ultimate objective in LT-KIE is market success and not just the development of a successful, knowledge-based innovation.

Thus, **from a theoretical point of view,** understanding how low-tech but knowledge-intensive ventures are created, survive and grow within their mature and highly saturated business ecosystems constituted a significant gap in the exploration of the LT-KIE phenomenon. Consequently, the effort to conceptualize LT-KIE addressing the very LT- KI venture creation from business idea to established low-tech business and its physical implementation (production level) posed a real challenge for the low-tech KIE researcher. To our best of knowledge, even today (i.e. 2015)[3] there is no research or any approach to explain firm-level success and failure at the stage of LT-KI venturing. While there is some talk on competitive advantage and capabilities, this discussion remains caged mainly within the borders of the LT- innovation theory.

[3] Back in 2009, relevant literature, research and insights on KIE in general and in LT-KIE more precisely was almost inexistent

Besides the theoretical motivation for LT-KIE deeper understanding and conceptualization, it appears that **practical reasons are equally significant.** In today's economies, the foundation and growth of low-technology and knowledge-intensive businesses is more important than it has ever been before. A major reason for this requirement is the ongoing globalization and trade liberalization that has altered the rules of the game substantially. A few decades ago, low-tech industries such as textiles and clothing, prospered in 'protected', semi-closed environments and provided major benefits to the economic growth in Greece and in Europe. The success of these 'micro-worlds' was rooted in quality manufacturing and built on a heritage of craftsmanship and skilled labor.

Nowadays, low-tech firms follow the paths of global competition; low-price leadership has been transferred to regions that allow substantial labor cost reduction. In addition, small and mid-sized companies' courses at national, European or even global markets, which had been very successful over many decades, experienced declining revenues, have slowed down in their development or even have been violently interrupted by their shutdown. This trend, in combination with the severe financial and public debt crisis that Greece is now experiencing, leads to the death of mature industries such as the clothing industry and supports the stagnation of the Greek economy, increasing unemployment even more.

Unfortunately, the mentioned threat is not limited in Greek's business environment. The global crisis that several countries are now facing has revealed certain pre-crisis weaknesses of their traditional mature sectors too (mainly textiles and furniture) due to the types of strategies used (e.g. low-cost and focus on financial innovations). Within such vulnerable and volatile environments, the foundation and development of knowledge-intensive low-tech businesses is generally expected to enhance the performance of these sectors and create new jobs and wealth for societies. Besides the growth-oriented technology industries which have evolved over the past decades, the more or less neglected traditional industries have still a lot to offer as they did in the past. Knowledge-oriented strategies may play an important role in the enhancement of low-tech companies' performance and competitiveness by creating and sustaining strong competitive advantages. Such businesses can justify higher labor costs and provide the country with a competitive edge on the global market that leads to higher employment rates and economic growth and wealth.

It should be mentioned that the discussion on the development perspectives of such industries in the "weak" countries of the old industrialized world of the European Union is a fundamental criticism of the widely held focus on high *vs.* low technology and necessitates a reexamination of the relevance of low-tech sectors. Knowledge-based mature industries will need considerable financial support in order to realize the suggested mechanisms for KIE. However, the real problem that is much more severe than the financing needs is the lack of entrepreneurial spirit. Regarding the number of new businesses with reasonable growth potential, Greece misses the European average by far (e.g. Papadopoulos et al., 2010) and the same goes for other countries too, such as Germany (e.g. Lehrer, 2000). This is mainly due to the nature of low-tech industries; they are craft-based, highly fragmented, with most entrepreneurs to have only a basic education background. Furthermore, Greece, at least, encounters a lack of expertise regarding the ability to found, develop, and nurture new businesses to a substantial size. Furthermore, more than 99% of all LT-start-up firms have less than five employees (e.g. Katzy and Strehle, 2004; Papadopoulos et al., 2010).

This weakness has been traced by EU policy-makers; several efforts have been made to incorporate entrepreneurial education in schools and universities (i.e. Entrepreneurship 2020 Action Plan). However, as it will be evident from the study, becoming an LT-KI entrepreneur is not simple at all; such entrepreneurs are actually "knowledge operators" who work at the intersection between science, technology, innovation and markets. They may utilize existing knowledge, combine different knowledge assets, or even create new knowledge. Many successful entrepreneurs do all three. However, up to date, Technical Universities and Institutes in Greece seem to be skeptical about the aspect, reacting with rudimentary and scattered efforts.

Therefore, **another practical motivation** to further unlock the riddles of LT-KIE can be the well recognized need to increase the quality of LT-KI entrepreneurship education; research has to be focused on the in-depth analysis of new LT-KI venture success which affects firm performance; this, in turn, is related to survival, growth innovativeness and profitability (e.g. Baum and Wally, 2003).

This research was spurred by the beginning of the AEGIS FP7 multi-partner research project (January 2009 - September 2012) at the National Technical University of Athens which focused on KIE. Previous work in low-tech industries prepared the ground for this dissertation. Due to the promising results, additional research is expected to provide further insights in this direction.

1.2 Research objective

The main purpose of this thesis is to contribute to the comprehensive understanding of KIE as a mechanism for the transfer of multifaceted knowledge into innovative economic entrepreneurial activities in low-tech sectors. As mentioned above, the LT-KIE literature underscores the importance of a variety of factors, resources and even innovation-related capabilities, but little work examines these from a new venture's survival perspective. With so much attention devoted to the conceptualization of KIE, significance of resources and skills, and the role of knowledge and innovation, the LT-KIE literature has been concerned primarily with *"what"* questions. There has been less attention paid to *"how"* questions; in other words, there is a significant gap in the understanding of how LT-KI ventures are created, survive and grow within their mature and highly saturated business ecosystems. Therefore, it is important to explore how LT-KI entrepreneurs/ entrepreneurial teams or entrepreneurial managers recognize or create opportunities; how they collect and process information, knowledge and other resources; how they arrive at valuations; and how they decide to act in order to survive and succeed. Accordingly, the core research objective addresses the understanding of the *entrepreneurial approach* of the LT- KIE phenomenon regarding the mechanisms by which new founders and founding teams will accumulate the bundle of resources, knowledge, skills and other inputs which have been quite expensively investigated in KIE literature. More precisely, the core research question is:

How and why certain low-tech but knowledge-intensive ventures survive early death and prosper within mature ecosystems?

In its general view, LT-KIE follows the KIE definition and therefore regards new knowledge and innovation-based venturing. Literature has offered a significant amount of insights related to the basic building blocks of LT-KIE, i.e. knowledge, its sources and ways of exploitation, knowledge-intensive innovation, mechanisms and capabilities of achieving it, as well as types of LT-KIE venturing, among other issues. Furthermore, there is a plethora of skills, entrepreneurial characteristics and other antecedents and factors used as input, KIE management and output in KIE processes. These valuable constructs can assist the further exploration of the phenomenon, providing the initial building blocks for the preliminary attempt to explore the low-tech knowledge-intensive entrepreneurship phenomenon further. In addition, the role

of production technologies in the physical implementation will also be considered since LT-KI venture creation regards the whole process of establishing a new low-tech firm. Accordingly, the core research question will be sub-divided into the following guiding sub-questions:

a) ***How do LT-KI entrepreneurs/teams create innovative knowledge-intensive business concepts?***
b) ***How do LT-KI entrepreneurs / entrepreneurial teams locate and access knowledge, and how they use knowledge in order to produce innovation***
c) ***How do LT-KI entrepreneurs / entrepreneurial teams transform the idea into production lines, products and market success?***

Furthermore, LT-KIE cannot be limited to the gestation phase; it stresses to the creation of preconditions for sustainability and growth. Therefore, in order to provide an integrated approach to the core research question, the following sub-question is also set:

d) ***How can just established low-tech knowledge intensive ventures overcome resource base weaknesses, create strong initial competitive advantages and evolve?***

A perspective of particular importance in LT-KIE regards the assumption that the phenomenon includes both newly founded companies as well as cases of change processes in established companies. Actually, LT-KIE is expected to be found more within established organizations[4] but it is quite ambiguous if KIE will mean the same in both modes and whether they share the same characteristics. This is an issue not yet well captured in LT-KIE research.

1.3. Positioning of the thesis, emerging theory and contributions

The initial effort of this research was mainly to start the discussion on the strategic side of the vulnerable early stages of low-tech and knowledge-intensive entrepreneurship in general, since it proves to be the dominant type of entrepreneurship nowadays and within the globalization context. Therefore, the concepts of *"knowledge-intensive entrepreneurship"* and *"low-tech industries*" were the two core pillars to begin.

[4] See the discussion of Hirsch-Kreinsen and Schwinge (2011)

The starting point of the author's long delving in this research was actually a discussion paper of Keith Smith (2002) "What is Knowledge Economy? Knowledge Intensity and Distributed Knowledge Bases", downloaded early in the morning, on Thursday, June 12th, 2009; the author discussed the concept of "knowledge economy", described quantitatively the creation and use of knowledge across industries and developed an approach to understand knowledge-intensity of mature low-technology industries. That very day more than thirty papers were downloaded regarding the above mentioned issues. Most would bear the concepts of innovation, low-tech and knowledge economy in their titles. It was the "Keith Smith – Gerd Bender –Paul Robertson - Nick von Tunzelmann and Virginia Acha download day". The same day a Special Issue of a series of papers on "Innovation in low- and medium-technology industries" of the Research Policy journal was also downloaded. It should be mentioned that the majority, if not all of the papers were published after 2000, since there were only scarce references on the issues before the new millennium. Continuing to search for the above topics, the 30th of June 2009 was mainly the "Hirsch-Kreinsen and PILOT project deliverables day". The papers downloaded provided food for study and thought for the summer of 2009. In the years that followed, the topics of innovation / firm innovativeness, knowledge, knowledge management and the Knowledge – Based View (KBV) as well as deeper, sector-specific knowledge of low-tech attitudes and performances were carefully studied.

However, the phenomenon under research was a "type of high potential entrepreneurship". Thus, with the coming of autumn 2009 a long journey in the **research field of entrepreneurship** started; literature studied is presented shortly in the relevant chapter. Within this extremely broad research area, the focus was placed on the concept of **knowledge-intensive entrepreneurship (KIE).** Deliverables of the KEINS research project assisted the author to find her way in the evolution of the entrepreneurship topic up to the notion of knowledge-based entrepreneurship and to form the quite delicate differences between knowledge-based and knowledge-intensive entrepreneurship. Meanwhile, KIE was quite rapidly evolving due to both theoretical and empirical ongoing research. Indicatively, in these five years a number of KIE-models have been proposed while KIE's role and relationship to innovation and venturing have been largely investigated mainly within high-technology and science-based contexts.

A further segmentation of the entrepreneurship research**,** useful for the more accurate positioning of the present work regards the following three domains:

- Researchers of the first domain (e.g., Knight, 1921; Schumpeter, 1934; Leibenstein, 1966, 1968; Kirzner, 1979) focus on the economic role and contribution of entrepreneurship.
- The second direction in entrepreneurial research addresses objective and subjective reasons for entrepreneurship such as environmental influences as well as personal targets, values, and motivations (e.g Fallgatter, 2004).
- The third direction assumes a more *managerial perspective* on the actions taken by the entrepreneur and the corresponding strategies, structures, and processes (e.g., Low and MacMillan, 1988). In this vein, **Industrial dynamics** study the determinants of new firm formation, entry and exit and have outlined the importance of innovation. Within this relatively young field (Carlsson, 1987), researchers analyze the knowledge base of industries and the structure and dynamics of innovation networks (Malerba, 2007) A significant group takes *sectoral variety* into account as well, making clear distinctions between high tech and low-tech industries. This stream of entrepreneurship literature often deploys concepts and theories from **strategic management** and applies them to new ventures (Shane and Venkataraman, 2000).

Key topics that received critical attention by the author in the broad domain of entrepreneurship was the venture creation dimension, which is at the heart of entrepreneurship (Chandler, 1990), nascent entrepreneurship and corporate venturing ***(****a sub*-field of corporate entrepreneurship, Kunkel, 2000), the role of resources and personal, firm and contextual characteristics.

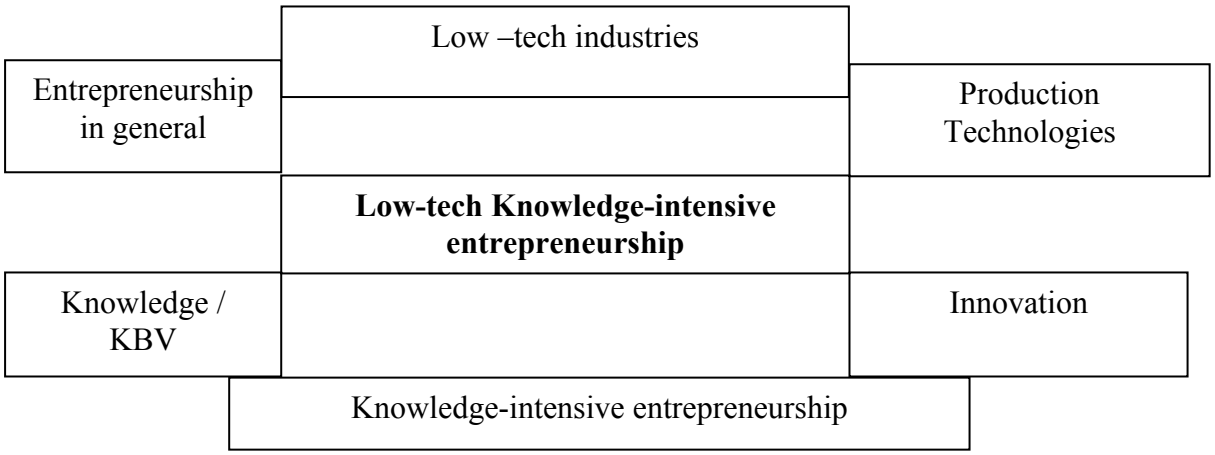
Delving in the venture creation topic – since KIE regards new ventures – the author came across the article of Bhave (1994), "A process model of entrepreneurial venture creation". The proposed model was based on interviews with entrepreneurs who started twenty-seven businesses in a range of industries in upstate New York. The author defined venture creation as the process that roughly begins with the idea for a business and culminates when the products or services based upon it are sold to customers in the market. Technology set-up was considered the most visible stage in venture creation which concluded when a product ready for the customer was created

for the first time. **Production technologies** were stated as "the heart of this venture sub – process". This paper would inspire some time later and during the study of the first cases the formation of the third research sub-question as a vital part for an integrated approach of the LT-KIE phenomenon. Production technologies constitute a significant strategic decision, critical for the venture's survival and future success (Vranakis and Chatzoglou, 2012). According to Lall (1992) they constitute ***basic or operational technological capabilities*** or otherwise the zero-order competencies that are needed for producing particular products. Therefore, the literature review moved to the direction of production-oriented relations in the broader area of production theory and the more general topic of industrial management. The cycle of this "deviation" would lead once again to the core role of knowledge and capabilities; a research paper of Virginia Acha (2000)[5] where she presented her doctoral thesis would connect knowledge and skills with technologies and techniques and the role of technological capabilities.
The main areas engaged in the beginning were then as presented in figure 1.1

The initial results of the analysis drove research to other research streams and more precisely **the capabilities view;** actually, observed patterns supported the suggestion that the creation and /or identification of LT-KIE opportunities and develop the necessary tacit or tangible resources to pursue them was a matter of capabilities. Therefore, the author had to gain deeper insight in the areas of **the resource-based view (RBV) and the entrepreneurial capabilities aspect** following theorists who discussed the use of RBV into the examination of entrepreneurial actions (e.g. Alvarez and Busenitz, 2001; Alvarez and Barney, 2004) and had similarly turned to the concept of entrepreneurial capabilities. In this vein, **bricolage and improvisation theories** were engages since some of their dimensions had been traced in the studies cases. These areas supported as core concepts the development of the bricolage and improvisational dynamic entrepreneurial capabilities.

Figure 1.1: Research fields initially involved in the study

[5] Acha V., 2000, "The Role of Technological Capabilities in Determining Performance: The Case of the Upstream Petroleum Industry", SUBTOPIC: Measuring technological strength, DRUID Winter Conference on Industrial Dynamics, Hillerød, January 6 – 8, 2000.

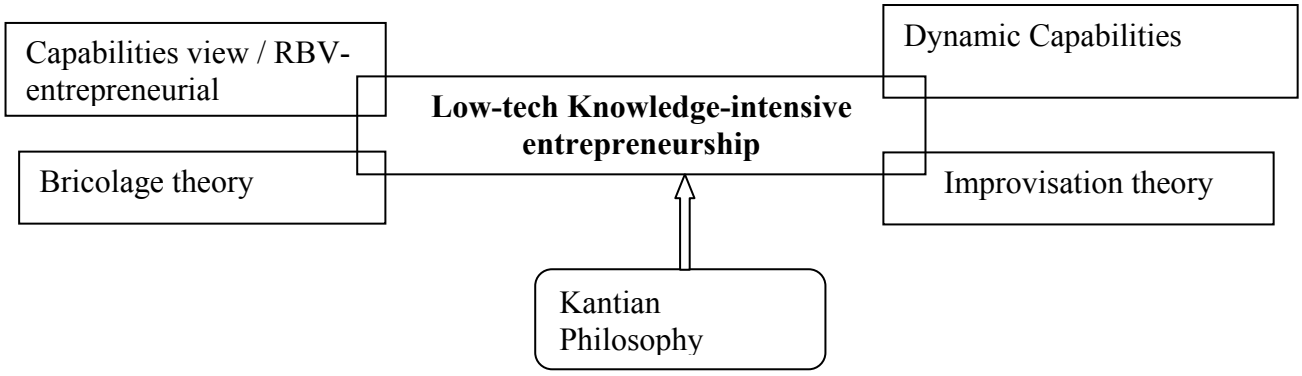


However, the core research question would not be fully answered if exploration stopped with the physical implementation of the LT-KI idea. As mentioned above, LT-KIE stresses to the creation of preconditions for survival, sustainability and growth. Therefore, in order to answer the last research sub-question and with the engagement of a capabilities view, the author turned to **the dynamic capabilities perspective,** a major stream in the field of strategy research over the past 15 years (e.g. Teece, 2007; Eisenhardt and Martin, 2000). Although the role of DCs was highly questionable in mature traditional industries and equally disputed in the early steps of new firms, **the dynamic capabilities (DCs) approac**h was quite promising to answer questions on the creation and sustainability of competitive advantage and thus the successful future of a new LT-KI venture.

While the development of the bricolage and improvisational entrepreneurial capabilities are quite well supported by the relevant theories, the difficulty lied in the effort to conceptualize and parameterize the capability to develop novel LT-KI business ideas. The author could not match the patterns with any existent theoretical schema. The entrepreneurship theory was replete with entrepreneurial skills, heuristics and talents for the genesis of novel ideas, but no mechanisms or processes could be found that could be transferred under a capability umbrella. Then, it was a discussion with a friend and a comment on the Kantian Critique of Pure Reason that brought up the Prussian philosopher Immanuel Kant and his way of thinking; the core question of the work regards the relationship between knowledge and "things- in-themselves" that is the "knowledge products". But this was exactly what bothered the author too much; her inability to delineate and define the exact relationship between the knowledge of the entrepreneurs and the LT-KI entrepreneurial idea besides the

interesting data of the thirty cases. How could the patterns observed be parameterized? The author found Vokos' (2004) argument astonishingly interesting: "Schematizing Kant's philosophy, it is quite evident that it can be reduced to a number of simple and thus difficult principles"; Therefore, Kant could provide a guide to produce a number of "conscious rational processes" (based on Kant, 1781) which could set up specific capability dimensions. This was the beginning of the author's acquaintance with the **Kantian Critique of Pure Reason…**

Figure 1.2: Research fields involved in the study after the first analysis of the data



Building therefore on the above research fields and these specific streams of relative literature, research analysis focused on the sampled low-tech but knowledge-intensive entrepreneurship case studies; patterns then were treated as a "bundle of firm-specific capabilities" which is "a crucial precondition for low-tech KIE" (Hirsch-Kreinsen and Schwinge, 2011). They actually formed specific ***dynamic entrepreneurial capabilities*** *(DECs).* The discussion on "dynamic entrepreneurial capabilities" (DECs) had started to emerge together with the present thesis. More precisely, the very first efforts were the ones of a) Lanza and Passarelli (2013) who viewed DECs as peculiar higher-order capabilities in small business settings, with limited resources, which enable product innovation and technological change; b) Corner and Wu (2012) who tried to define DECs considering venture creation as a number of phases but within a high-tech context again. Both efforts are based on limited empirical research (one case study) and reflect rather *very specific* cases. Furthermore, in both works, DECs lack precise definitions and measures.

The research journey ended with the delineation of the conceptual framework of Figure 1.4, and new theory that proposed a dynamic entrepreneurial capabilities framework for LT-KIE and more precisely:

a) new theory on the nature, the dimensions and specific conceptualizations of the dynamic entrepreneurial capabilities in relation to competitive advantage (CA), survival, growth and innovativeness in LT-KI new ventures

b) the specification of the role and the significance of production technologies and their relation to DECs in LT-KI new ventures, and

c) the existence and significance of DCs and the way they are related to DECs in LT-KI new firms.

A comparison of the developed theory to literature indicated that a capabilities approach is actually in accordance to the general entrepreneurship literature and the latest insights of relevant scholars and researchers (e.g. the call for the entrepreneurial management by Teece). However, it also justified the selected gap, since six years later (2009-2015) little work was done to tie together the theory of entrepreneurial and dynamic capabilities or the importance of production technologies with venture survival and growth both in cases of LT-KIE and in KIE literature in general. On the other hand, the individual research domains of DCs, KIE and Low-tech KIE appear to grow.

Figure 1.3: Positioning of the thesis

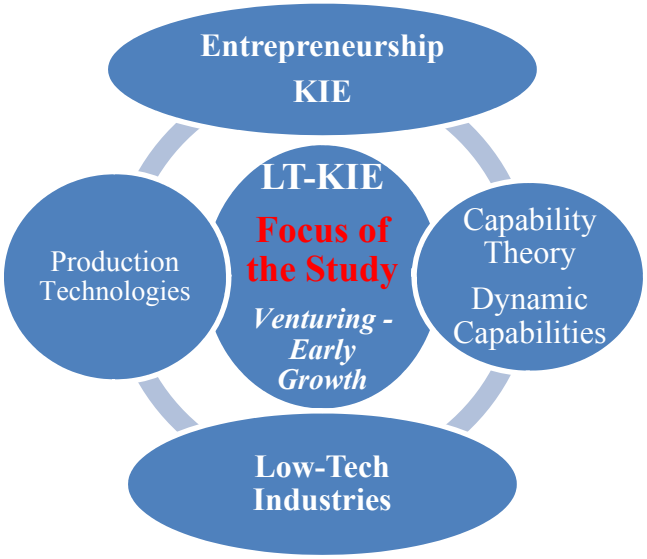


Figure 1.3 schematizes the positioning of the study. The main research area is the low-tech and knowledge-intensive entrepreneurship emerging field for low-tech industries in the intersection with the broad fields of the dynamic capabilities view and the production technologies theory. Main contributions can be considered to regard these areas. More precisely, the new theory emerging of this thesis seems to:

- advance significantly the knowledge and understanding of LT-KIE; the comprehensive set of measurable *dynamic entrepreneurial capabilities* suggests a potential ecology between entrepreneurial capabilities, DCs and long-term survival and growth and appears to be the first effort in KIE literature to conceptualize a capabilities framework in order to explain LT-KI venture creation
- advance the role and significance of the production technologies in venturing, - and more precisely in low-tech knowledge-intensive venturing and tries to explain the foundations of the technological capabilities of such firms
- add to several gaps of the DC theory and mainly to the empirical evidence on the existence of DCs in low-tech industries and in newly established firms and the provided suggestion on the genesis of DCs

However, the new theory's contribution should be considered, according to the author's opinion, within the more general domains of entrepreneurship and capabilities theory. Based on the extant review of entrepreneurship literature, it can be argued that it is among the few efforts to try to capture the "how" dimension of the entrepreneurial phenomenon *per se.* In a more narrow sense, it adds to the knowledge regarding the knowledge-intensive entrepreneurship research topic as well as the theories on entrepreneurial capabilities, venture creation and early growth of firms.

The **core practical contribution** of the dissertation, i.e. the development of the dynamic entrepreneurial capabilities framework and the enhancement of the role of production technologies in LT-KIE, addresses entrepreneurs as well as investors, universities, venture coaches, and consultants. It actually endeavors to motivate and provide guidance to all interested to establish a low-tech but knowledge-intensive venture for avoiding failure that may result when attempting to enter mature, saturated markets. Al*most with the dawn of the new millennium* and the evident globalization of the international economy, the market environment of the low-tech sectors has become highly volatile and instable. The dynamic entrepreneurial capabilities

construct and its underlying dimensions are a set of idiosyncratic in their details but identifiable, measurable and, therefore, managerially amenable options that can be used to address the changing low-tech environment during the gestation, start-up and early development stages.

Furthermore, according to the findings, this is the time that the foundations of dynamic capabilities are laid: the first moments of the firm's life include the transition of certain DECs' dimensions into DC micro-foundations. This highlights also the need for actors to take care of the DEC-DC transition and create, in the very early steps of LT-KIE, dynamic capabilities to secure survival and enhance the new LT-KI firm's performance.

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1.4. Research philosophy and methodology

In this study, the object of the research is the low-tech but knowledge-intensive venture while the phenomenon under study is the corresponding survival and growth of this particular type of embryonic and growing entity. In this case, the boundaries between the object and the phenomenon are not clear. Moreover, this was also influenced by the fact that the main theory of KIE, pertinent to this study was at its very infancy lacking defined constructs at the beginning of the present thesis. The consequence was a need to uncover meaning in the original context and to allow for a theory-building rather than theory-testing approach.

The research seeks to gain a holistic understanding of the LT-KIE phenomenon; however, knowledge-intensive entrepreneurial actions are, after all, a human construct and the success or failure of implementing KIE is dependent upon the perspective of the individuals or teams affected. Furthermore, LT-KIE is viewed as a situated phenomenon in historical / sociao-economical and cultural context. Following this rationale, the author suggests a **likely research philosophy approach of *interpretivist* / *social constructivism* / *interactionism*** (Mertens, 1998, Denzin, 2001, Aram and Salipante Jr., 2003 which fits perfectly with the nature of the phenomenon under investigation.

Due to the exploratory and descriptive nature of this research, data collection, organization and analysis will be guided primarily by an inductive perspective, whereby the collection, examination and process of continual re-examination of data

will determine the research findings. The best way to accomplish this is through ***qualitative methods*** (Eisenhardt & Graebner, 2007) with case studies method to be the most popular one. The in-depth examination provided by case studies facilitates observation of a larger number of variables, rather than the larger number of records provided by surveys providing deep insights. This makes case study research the suitable method to uncover novel theory (Eisenhardt, 1989). Furthermore, Yin (1994) stresses the significance of multiple case study analysis against a single case since it offers increased robustness of results, strengthening the credibility of the research and enhancing the generalizability of the theory developed. As multiple-case studies retain only relationships that are replicated across most if not all of the cases, the resulting conceptual frameworks or hypotheses are often more parsimonious and generalizable compared to single-case studies (Eisenhardt and Graebner, 2007; Yin, 2003)

Therefore, the **multiple exploratory case study** method was chosen as the research vehicle for this study. The individual low-tech company was selected as the unit of analysis; case study firms were chosen from three traditional sectors and namely the wood and furniture, the textiles and clothing and the food and beverages sectors, on the basis of particular characteristics and more precisely on the condition that they should evidently be KIE and low-tech.

The final sample included **thirty information-rich case studies**, ten from each industry. The interviews were carried out from November 2009 to September 2011. According to relevant literature, qualitative case studies' common sources of case data include three major categories and namely interviews, documents and observation, covering both objective and subjective sides of studying a phenomenon. This principle was followed in the present research; the core of the data came from forty face-to-face, open-ended, semi-structured, in-depth interviews with the key informants; the entrepreneurs themselves in their majority, as well as CEOs and technical directors, especially in the larger companies.

Additional sources of information employed, were long plant visits, supplementary telephone conversations, talks with clients, company and public documents, such as administrative documents, reports, press releases, awards and company websites. In a number of cases there were also, informal chats with consultants, sectoral experts and even friends who had assisted the entrepreneurs in their business idea implementation.

Collecting data from multiple sources supports triangulation; such data offer potential new insights and can confirm ideas from interviews' data (Yin, 2008).

Another important factor which was taken into consideration for the collection of data was the need for a *longitudinal approach*. Such a design is important when investigating the creation, early growth and performance of the new LT-KI business. In order to ensure that important research-related events are not overlooked (Pettigrew, 1990) new published information regarding the issues of interest were collected and included in the research. However, while data were accurate and in detail described from the time of establishment up to the date of the interview, the subsequent activities of the selected firms were limited to those released in press or transferred to the researcher by the entrepreneurs themselves.

For the **analysis of the data** the two main approaches, and namely within-case and cross-case analysis, were used according to the suggestions of Eisenhardt (1989b) for theory building from qualitative case research. The data was analyzed using Russell and Bernard's (2003) three-level abstraction process; i.e. 1) the identification of repetitions, 2) the identification of similarities and differences, and 3) the cutting and sorting of notable quotes. Tables, graphs and charts are used as the basis for the analysis and presentation of the findings.
Theory development was realized in a dynamic manner with continuous iterations backwards and forwards between data and note studying and hypotheses' reshaping, evaluation of the new theory by going back to existing literature, patterns' retranslation and concepts' redefinition.

1.5. Outline of the Dissertation

The ***first chapter*** introduced the reader to the background and motivation of the present doctoral endeavor, the research objective and the research questions as well as to a brief description of the emerging theory and its contributions. In addition, it provided the research domains and fields involved, the research methodology of the study and the outline of this piece of work.

The theoretical part of the dissertation is mainly included in the ***second chapter***. Literature review builds on the three core pillars of the research; i.e. entrepreneurship,

low-tech industries and production technologies. The evolution of entrepreneurship constitutes the backbone of this pillar around which concepts and views that are used later in the dissertation are presented, such as the capabilities view, dynamic and entrepreneurial capabilities, bricolage and improvisation. Entrepreneurship evolution provides also a nice way to introduce knowledge-intensive entrepreneurship around which the notions of knowledge, innovation and venturing are discussed. Section 2.4 depicts the notion of production technologies as a significant dimension of venturing when regarding manufacturing sectors. The section commences with the vary basics of the nature of technology to finally discuss production technologies as a significant dimension of technological capabilities and their relation to the latest views on dynamic and entrepreneurial capabilities. The production-technologies literature review aims mainly to satisfy the attempt to indicate their importance when discussing KIE especially within low-tech contexts. This is of course and the core of the present thesis; thus, section 2.5 synopsizes existing literature on the role and significance of low technology sectors and explores in detail all existing literature up to the end of 2014 on the existence and role of knowledge-intensive entrepreneurship within the low-tech context (LT-KIE), the peculiarities and specificities of knowledge, KIE relations to low-tech innovation, venturing and capabilities as well as literature regarding production technologies and LT-KI Entrepreneurship.

The ***third chapter*** is devoted to the discussion of the background of the topic and the comprehensible description of the research questions. Discussion pointed out the gaps in the current body of LT-KIE knowledge which refer mainly to the understanding of how LT-KI ventures are created, survive and grow within their mature and highly saturated business ecosystems.

Chapter 4 discusses the research approach in the empirical part of the study and puts forth the methodological choices made in this dissertation. The tactics for meeting the scientific criteria for good research are presented. Issues such as reliability, validity, sampling, and objectivity are dealt with, and the data collection and the analysis process are discussed. The chapter includes the tables that present the profiles of the interviewees, the general information of the cases and the case venturing profiles.

Cases were selected from three traditional industries with a significant role in the Greek as well as the European and global economy: the food and beverage, the wood and furniture and the textiles and clothing sectors. ***The fifth chapter*** delineates the nature and the courses of these three industries in Greece, in order to justify their selection and introduce the reader into the sectoral contexts and the national (Greek) environment the selected cases applied KIE. The descriptions of the cases belong also to this chapter; however, due to the significant number of cases, they have been included in Appendix C.

Chapters 6 and 7 form the main empirical part of the dissertation. In these chapters, theoretical models are developed, and the evidence on which the analysis is based is shown. The within and cross-case analysis formed the basis for theory development by indicating variables, shaping and defining concepts and relations between them, and integrating them into a tentative theoretical model.

Chapter 6 presents the development of the initial conceptual framework in its general form, discusses its core elements and builds the research hypotheses. It opens with references to the several rounds of the case study analysis by presenting the different categorizations, the themes that emerged from the data and the new directions indicated. More precisely, the first round of within-case analysis focused on developing an outline of constructs and relationships within the low-tech but knowledge intensive entrepreneurship issue in an inductive way; these turned mainly around venture creation, knowledge, resources, traits and characteristics connected to innovation and differentiation, performance issues and of course the entrepreneur and the entrepreneurial team. In addition, the production technologies issue emerged as of major importance during the implementation phase of the novel business idea. The first round analysis indicated further the existence of a dynamic environment where a capabilities' approach could actually trigger answers to the research questions. In this phase: a) the notion of entrepreneurial capabilities was engaged as suitable to explain "'the ability to identify a new opportunity and develop the resource base needed to pursue the opportunity" (Arthurs and Busenitz, 2006), b) the role of the development of an initial competitive advantage (found to exist in all cases) was questioned and c) the DC question was posed as a potential research area involved in this research for both the dynamism involved and their contribution in supporting sustainability and therefore performance.

With short but comprehensive references to literature related to the building blocks of the conceptual frame and after the within-case data analysis, the concept of *dynamic entrepreneurial capabilities* (DECs) is introduced as the "bundle of firm-specific capabilities" which is "a crucial precondition for low-tech KIE" (Hirsch-Kreinsen and Schwinge, 2011) and which constitutes the novel capability framework for LT-KIE. The rest of the chapter introduces the research hypotheses regarding a) the impact of DECs on new LT-KI venture's performance and more precisely the competitive advantage, survival, growth and innovativeness; b) the existence of dynamic capabilities in LT-KI firms and their relation to DECs; and c) the role of production technologies in LT-KIE and their relation to DECs.

Utilizing the results of the within-case and cross-case analysis of the thirty case studies, the ***7th Chapter*** addresses the four research hypotheses. A principal aim of cross-case analysis is to derive conclusions, moving beyond initial impressions of individual cases. Key findings across cases are discussed within the context of the conceptual model as deployed in Chapter six. Actually, this chapter purports to give some answers to the *how, what*, and *why* of findings emanating from the case study analysis in relation to current literature. Data analyses and literature reviews were carried out concurrently in order to support findings and build theory around them in a more concrete way avoiding in parallel the danger of "reinventing the wheel". An important basis on building theory was the focal role of distributed knowledge bases and the capability of LT-KI entrepreneurs to collect and combine that knowledge (e.g. Bender, 2004; Robertson and Smith, 2008). Here, the nature of DECs is established, defined and discussed and their core dimensions are outlined within the context of KIE in low tech sectors. In advance, the examination of the new DECs' impacts on performance measures questions can further the significance of the new framework in order to prove or reject the second hypothesis.

The examination of the third hypothesis is based on the fact that the conversation with the entrepreneurs and CEOs of the interviewed firms gave satisfying material on the existence of dynamic capabilities in their lifespan. This was later strengthened by a new, very small and just arising stream of literature which argues that DCs can be also found in low-tech companies. Meanwhile, another small but much like increasing stream of research suggests the single entrepreneur or the entrepreneurial team as a source of DCs indicating that these capabilities can exist at the outset of the venture

(Helfat et al., 2007; Boccardelli and Magnusson, 2006) and calls for a further exploration of their entrepreneurial side, focusing on the analysis of "non-routine activities and leadership skills" [quoting Teece in Felin et al. (2012)]. This view stimulated the exploration of potential relations among DECs and DCs.
Last but not least, the importance of production technologies and process innovation in low-tech industries triggered the fourth hypothesis which seems to be verified by the data analysis. It also offers further evidence on the role of knowledge on production technology formation and advance and production technologies' relationship to DECs as operational capabilities and technological assets. However, this is an additional proof that DECs can be assigned as higher order capabilities.

Chapter 8 discusses the findings in relation to the research objectives. The conceptual LT-KIE framework is presented in its final version (see Figure 1.4) purporting to offer a comprehensive picture of the specific entrepreneurial phenomenon. The LT-KIE domain is therefore about analyzing the whole *entrepreneurial process* – from the *venture idea* to its physical implementation and the new firm's survival and growth. The actions associated with these dimensions are complex and challenging. Introduction briefly presents the research problem explaining shortly the gap it purports to fill and the suggested theory's novelty. The rest of the chapter presents some discussion on the findings of this study which are related to the indicated knowledge gaps. The developed theory is briefly outlined; novelties are explained and further discussed. Generalizability of theory is further established by indicating similarities in all three selected industries while sector-specific and type-specific (nascent or corporate venturing) differences are further supporting the suggested propositions.

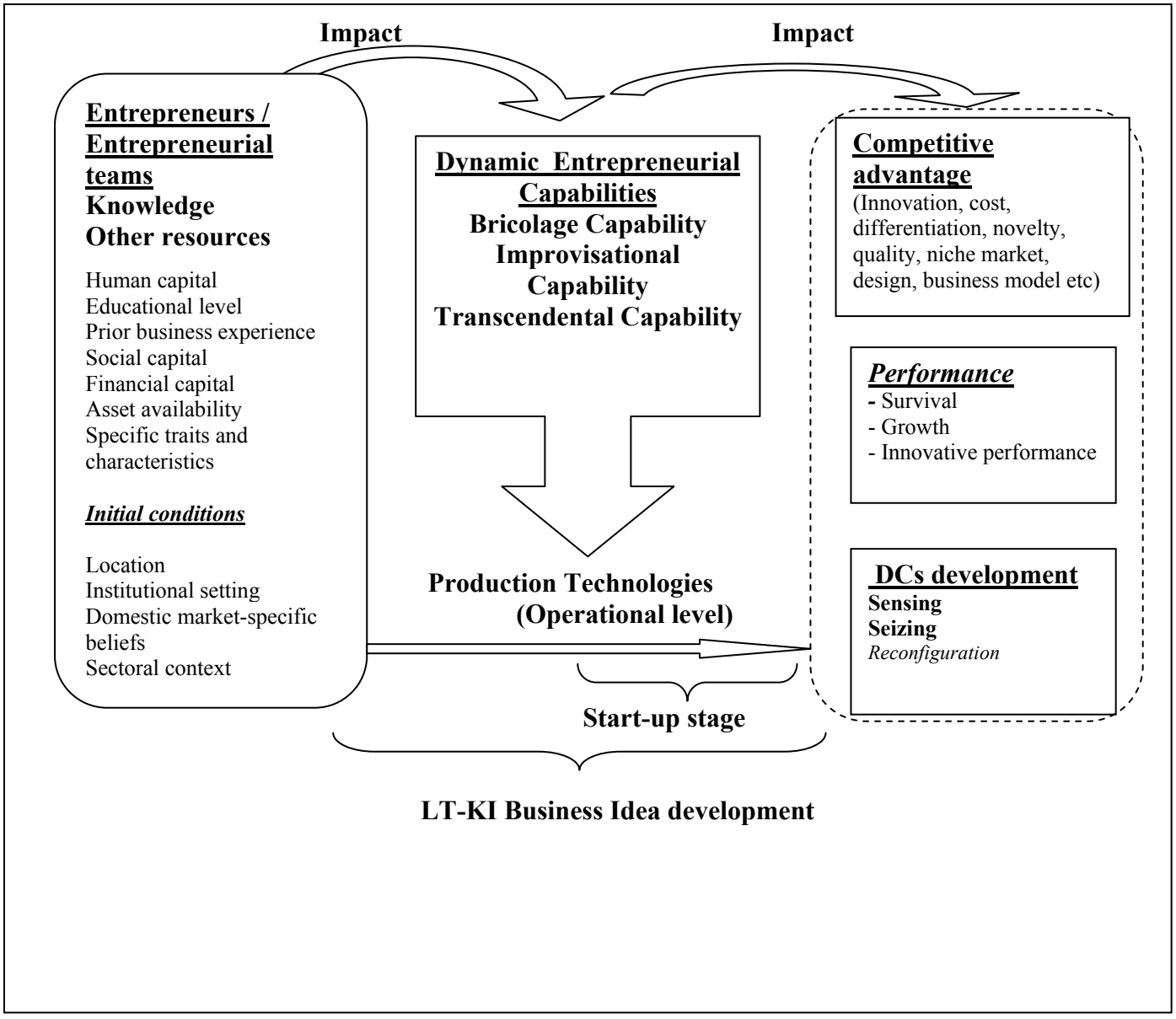
Finally, in ***Chapter 9***, theoretical and practical contributions, policy implications and limitations of this research are summarized and analyzed while some ideas and directions for further research are recommended.

The study unearths several unique insights on the LT-KIE issue and produces rich – according to our opinion – theory, as it will be presented in the following chapters. The research started with a broad interest on LT-KIE mechanisms and processes and honed down the resources and capabilities that emerged as important. It yielded over

500 pages of transcripts and over 2000 pages of secondary data and notes. What is also unique is the depth of analysis for the really large number of case firms and massive amount of data that the study drew on.

Low-technology industries constitute an important part of the global economy. Knowledge intensiveness in such industries emerges as the one-way solution to survival and growth nowadays. Despite the importance of low-tech firms, little is still known on how new resource-constrained LT-KI ventures can be successful and create the preconditions for financially and even scientifically capitally intensive innovations and early growth. This study is among the very first to shift focus to the rather neglected LT-KIE area. It purports to make some contribution mainly by establishing some further dialogue regarding the limited but gradually growing discussion on the LT-KIE phenomenon and, hopefully, by offering some valuable insights and food for thought in researchers, theorists and postgraduate students in entrepreneurship, strategic management and several other fields. Besides the theoretical value, entrepreneurs, company representatives and policy-makers may find some interest in the proposed insights. The reader is welcomed to join the research adventure and offer both constructive criticism and proposals.

Figure 1.4: Conceptual fra Due to the exploratory and descriptive nature of this research (Robson, 2002), data collection,
organization and analysis will be guided primarily by a grounded theory, or inductive perspective, whereby the collection, examination and process of continual re-examination of data will determine the research findings. Due to the exploratory and descriptive nature of this research (Robson, 2002), data collection,
organization and analysis will be guided primarily by a grounded theory, or inductive perspective, whereby the collection, examination and process of continual re-examination of data will determine the research findings.**mework of LT-KIE**



Chapter 2

Literature review

Chapter Objectives:

- To discuss the evolution of the entrepreneurship literature (major schools and perspectives on entrepreneurship)
- To explore entrepreneurship in the context of the most recent views i.e. the resource-based view, the dynamic capabilities view and the role of competitive advantage
- To review the field of production technologies
- To synopsize existing aspects and directions on knowledge-intensive entrepreneurship regarding knowledge, innovation, new venturing and the role of production technologies

- To epitomize existing literature on the role and significance of low technology sectors and to focus on the existence and role of knowledge-intensive entrepreneurship within the low-tech context

2.1 Introduction

The Winner is always part of the answer.
The Loser is always part of the problem.
The Winner always has a program.
The Loser always has an excuse.
The Winner says, "Let me do it for you."
The Loser says, "That's not my job."
The Winner sees an answer for every problem.
The Loser sees a problem for every answer.
The Winner sees a green near every sand trap
The Loser sees two or three sand traps near every green.
The Winner says, "It may be difficult but it's possible."
The Loser says, "It might be possible but it's too difficult."
Be a Winner.
Vince Lombardi

Contemporary entrepreneurship research focuses on "the more nuanced view where high potential entrepreneurship is what matters for economic development" (Delmar and Wennberg, 2010). Knowledge intensive entrepreneurial activities are therefore of particual interest today, since they appear to link knowledge, manufacturing and commercialization (Acs, 2002). Furthermore, there seems to be an arising interest when such activities regard the so-called mature, low-technology industries such as food and manufacturing. According to late discussions there is an alarming gap in both theoretical and empirical research, besides the recent indications that knowledge intensiveness is to be found in these industries too (Caloghirou, Protogerou and Tsakanikas in Hirsch-Kreinsen and Schwinge, 2014).

This chapter attempts initially a short review of the evolution of entrepreneurship (section 2.2) examining the historical development of the phenomenon and exploring its myths. Major schools of the entrepreneurial thought and process approaches of the the study of entrepreneurship prepare the reader to gain an unbiased understanding of the research environment, set around the issue of entrepreneurship. The section starts with first-found thoughts on entreprneurship in Ancient Greek mythology and literature (e.g. Xenophon) and ends with the most recent views on the nature and role of dynamic and entrepreneurial capabilities.

Section 2.3 epitomizes existing theoretical and empirical research on the notion of knowledge-intensive entrepreneurship (KIE); although the term has been found in work within the field of entrepreneurship almost in the beginning of the new millennium, it was not until the late ’10s that the phenomenon would become more widely discussed and explored. In the last five years a number of KIE-models have been proposed while KIE’s role and relationship to innovation and venturing have been largely investigated mainly within high-technology and science-based contexts.

Section 2.4 depicts the notion of production technologies as a significant dimension of venturing when regarding manufacturing sectors. Besides the intense involvement of the issues of technological knowledge and science in KIE exploration, it appears that little attention has been paid to the exact mechanisms and technology-related capabilities in the physical implementation of KIE activities. The section starts from the vary basics of the nature of technology to finally discuss production technologies as a significant dimension of technological capabilities necessary in a new manufacturing venture and their relation to the latest views on dynamic and entrepreneurial capabilities. The production-technologies literature review aims mainly to satisfy the attempt to indicate their importance when discussing KIE especially within low-tech contexts. This is of course and the core of the present thesis; thus, section 2.5 synopsizes existing literature on the role and significance of low technology sectors and explores in detail all existing literature up to the end of 2014 on the existence and role of knowledge-intensive entrepreneurship within the low-tech context (LT-KIE), the peculiarities and specificities of knowledge, KIE relations to low-tech innovation, venturing and capabilities as well as literature regarding production technologies and LT-KI Entrepreneurship.

2.2Entrepreneurship

2.2.1 Introduction

Entrepreneurship has been correctly characterized as one of the most intriguing but equally elusive concepts (Baumol, 1968 in Peneder, 2006). Scholars of entrepreneurship have struggled to create an appropriate conceptual framework for the field (see among others Gartner, 1990; Bruyat and Julien, 2000; Busenitz *et al*., 2003; Storey, 2000; Gartner, 2001; Low, 2001; Acs & Audretsch., 2002;Venkataraman, 1997; Ihrig et *al*., 2006; Shane and Venkataraman, 2000) and have created dozens of definitions of entrepreneurship (e.g. Knight,1921; Schumpeter, 1934; Kirzner, 1973; Covin and Slevin, 1991; Gimeno et *al.* 1997; Zahra and Garvis, 2000; Lyon et *al*, 2000; Ireland et *al*, 2001; Brush et *al*, 2001; Langlois, 2005; Groen, 2005, Henrekson, 2007).

Even today the various theories of entrepreneurship in the economics literature as well as other fields offer essential but only partial explanations of the phenomenon. Twenty years after the quotation of Wortman (1992) "*researchers from one discipline still tend to ignore entrepreneurship studies by researchers in other disciplines*". Like the Kipling parable about the blind man and the elephant, we go on touching one leg or any other part of the animal but cannot provide a synthetic view of the creature (Busenitz *et al.*, 2003). The main argument may be the *polyhedric nature* (Garavaglia and Grieco, 2005) of entrepreneurship.

2.2.2 Concept and Nature of Entrepreneurship through a historical lens

The study of the entrepreneur also has a long tradition, and yet there continues to be no widely-accepted definition of the term „entrepreneurship"
(Hornaday, 1992, Ucbasaran, Westhead, & Wright, 2001, Watson, 2001)

The word ‘entrepreneur’ comes from the French word *entreprendre* which means ‘to do something’, “to undertake” with origins from the Latin synthetic word; “entre” means “between” and “prendre” means “to take”. It further sounds close to the Sanskrit word anthaprerna which means self motivation (Lerner, 2009). According to deSoto (2008) both the Spanish word *empresa* and the French and English expression *entrepreneur* derive etymologically from the Latin verb *in prehendo-endi-ensum*, which means *to discover, to see, to capture* with the Latin term *in prehensa* to imply action meaning *to take, to seize*. In ancient Greek the word “epixeiro” (επιχειρώ) meant “to put my hands on something” (otherwise “deal with”), while today the word means a) *attempt, pursue, aspire, aim at something*, *experiment*; b) *manage in a systematic way the completion of a plan or the integration of a target*; c) *act,* indicating a kind of a strong inner will of the person that acts to reach an excellent fulfillment of whatever he/she “has put hands on” (Babiniotis, 2002).
Considering the etymologies of words as rather apocalyptic the word “entrepreneur” seems to describe in a perfect way all agents who “undertake” things and are “self-motivated”. According to Hoselitz (1951) the term was originally used in the Middle Ages for people who are active in getting “things done” and was given general currency by John Stuart Mill in the mid-nineteen century.

The phenomenon of entrepreneurship was known in Ancient Greece. Greeks narrated the myth of Hermes, the god of merchandisers and entrepreneurs, according to which, Hermes made a lyre out of a tortoise’s shell and exchanged it with a cattle of herds with Apollo; therefore he gained important profits understanding the specific value of the manufactured musical instrument for the god of music! In the same line the philosopher or “intellectual” Thales (6 c. B.C.) has bought in advance all olive presses, because he had seen during the springtime that the olive trees were full with fruits. In fact he made big business as the only owner of oil making manufactures in his home country, Asia Minor proving that knowledge is perfectly consistent with and needed for practical issues. Entrepreneurship issues had also attracted attention by ancient Greek authors who referred to the positive impact of investments on production increase, private and public economic increases (Aeschines, *Against Timarchus,* 25-6; Hyperides, *Euxenippus,* 36; Demosthenes, *Against Nausimachus*, 25-6 in Karayannis, 2002). Especially Xenophon dealt with the content and scope of “economy”, described the entrepreneur-manager and the administrator (Lowry, 1987),

and related revenues to capitalist-entrepreneur notion (Trever, 1916) in regard to "cities" though and not individuals. Demosthenes (Against Aphobus, I, 815-817) assigns raw materials and human capital as the productive capital of an enterprise. Terms like profit, risk-taking, management, loans, capital etc are used, explained and related to performance. The development of entrepreneurship and innovation was held up by the feudal system dominating in Europe in the Middle Ages to emerge again among the merchant class in cities of mainly Italy, France, and Southern Germany (Carlsson et al., 2013).

Traditionally it is Jean Baptiste Say (1767-1832) who is credited for coining the word and advancing the concept of the entrepreneur in his *Treatise on Political Economy* (1803). In fact, it was Richard Cantillon (1680-1734), an Irish-French economist , successful banker and merchant at an early age, who first introduced the term in his *Essai sur la Nature du Commerce en Général* (written in 1730, published in 1755) and becoming the "father of enterprise economics" (Hebert in Thorton, 2010). Hebert & Link (1988) going through the history of the term 'entrepreneur' show that the interest of the economic theory towards entrepreneurship traced back to Cantillon was soon followed by works like the ones by Francois Quesnay (*Tableau économique* , 1758), Jean-Baptiste Say who broadened the concept by putting "the entrepreneur at the core of the entire process of production and distribution" (1840; 1845), Jules Dupuit (1804 –1866), and Baudeau (1730-1792), the first to suggest the entrepreneur as an innovator, who brought invention and innovation into discussion (1919).
Besides the French writers, among the earliest most influential writers that provided different nuances of its meaning, one can recall the English classical economists such as Jeremy Bentham (1748-1832) who saw the entrepreneur as an agent of economic progress and Adam Smith (1723-1790); his entrepreneur is a prudent man "frugal (i.e. he accumulates capital) and an agent of slow but steady progress". The concept is further enriched by the German writers such as the significant distinction among capital providers and entrepreneurs by Von Thunen (1785-1868), Albert E.F. Schäffle (1831-1903), the one to first introduce the 'entrepreneur-as-innovator' idea and H.K. von Mangoldt (1824-1868) who focused on risk taking in entrepreneurship.
Discussions on Entrepreneurship crossed also the Atlantic with authors such as Francis Walker, Fredrick Hawley, and John Bates Clark. The most famous is still the

American Frank Knight (1885-1972); he was the one to bring risk and uncertainty (the old idea of Cantillon) back into the picture, produced the classic theory of profit.
Soon classical economics evolved into "neoclassical economics" emphasing mathematical and scientific precision, resource allocation and pricing decisions developed three branches (otherwise called Schools): The Austrian School, led by Carl Menger (1840-1921) and Von Mises (1881-1972); the Lausanne School led by Leon Walras (1834-1910) and the English school led by Alfred Marshall (1842-1924)[6]. The modern Neo-Austrian synthesis of entrepreneurial competition is defined by Kirzner (1997a,b) who stresses the entrepreneurial alertness to unexploited opportunities such as "the continual change in tastes, resource availabilities, and known technological possibilities".
The literature on entrepreneurship recognizes a variety of distinct roles for the entrepreneur, such as:

- the person who bears the risk associated with uncertainty (Knight 1921);
- an innovator (Schumpeter 1934);
- a decision maker (Casson 2003);
- an industrial leader (Schumpeter 1934);
- an organizer and coordinator of economic resources (Marshall 1890);
- an arbitrageur, alert to opportunities (Kirzner 1973, 1997);
- an allocator of resources among alternative uses (Schultz, 1975)
- The supplier of financial capital, manager or a superintendent, creator of a start-up, owner, contractor pr an employer of production factors (Hébert and Link, 1989

Yet, early economic theorists left largely undeveloped the concept of entrepreneurship as a source of structural change. This theoretical gap was actually filled with the early-twentieth-century seminal work of Schumpeter, the "*Theorie der Wirtschaftlichen Entwicklung"* (1912), later translated and published as *The Theory of Economic Development* (Schumpeter, 1934). According to Nagarajan (2009) in his review on the book of Hebert & Link (2009) Joseph Alois Schumpeter (1883-1950), the Austrian-American economist and political scientist, "the superstar proponent of the role of the entrepreneur deserves a chapter of his own (in the History of

[6] Campbell (1987) saw several similarities between Marshall's and Xenophon's definition of "economy".

Entrepreneurship) and he gets it". The authors narrate and explain Schumpeter's background, currents of economic thought and sources of inspiration.

They write:

> Schumpeter combined ideas from Marx, Weber, and Walras, along with insights from his Austrian forebrears, Menger, von Weiser, and his teacher von Bohm-bawerk. Rather than slavishly imitate the work of others he melded these elements into something uniquely his own. (p. 70).

Within the well-known Schumpeterian entrepreneurial dynamics, entrepreneurs are innovators (individuals who tend to break the equilibrium by introducing innovations -"new combinations"- into the system), and profits, however temporary, come from these successful innovations. For Schumpeter (1911, 1938) entrepreneurship is a particular economic function which can introduce novelty to the system and drive economic changes. Soon enough, (1942), Schumpeter realizing the increasing dominance of large corporations changed his initial view of entrepreneurship shifting from the achievements of single individuals to "innovative activities in existing organizations (Carlsson et al. 2013). The 20th century saw the evolution of entrepreneurial literature developing its most recent form with numerous examples to demonstrate the influence of Schumpeter's theory of entrepreneurship and its dominant presence in core definitions; influence which is further continued in the 21st century (Table 2.1). Such an example is the definition of entrepreneurial activity as the *"enterprising human action in pursuit of the generation of value, through the creation or expansion of economic activity, by identifying and exploiting new products, processes, or markets."* by Ahmad and Seymour (2008, p.14) in the relevant OECD Statistics Working Paper.

Table 2.1: A Superficial Review of Extant Historical Definitions of entrepreneur / entrepreneurship in a chronological order

Essence and aspects of definition	***Authors***
Entrepreneurs are non-fixed income earners who pay known costs of production but earn uncertain incomes. Entrepreneur is "*someone who exercises business judgment in face of uncertainty"*.	Cantillon, 1734
Entrepreneurs buy at certain prices in the present and sell at uncertain prices in the future. The entrepreneur is a bearer of uncertainty.	Cantillon, 1755/1931
An entrepreneur is an economic agent who unites all means of production-land of one, the labour of another and the capital of yet another and thus produces a product. By selling the product in the market he pays rent of land, wages to labour, interest on capital and what remains is his profit. He shifts economic resources out of an area of lower and into an area of higher productivity and greater yield.	Jean-Baptiste Say, 1803

The entrepreneur shifts economic resources out of an area of lower and into an area of higher productivity and greater yield. The agent who unites all means of production and who finds in the value of the products…. the re-establishment of the entire capital he employs, and the value of the wages, the interest and the rent which he pays, as well as the profits belonging to himself	Say, 1816
Entrepreneurs are „pro-jectors".	Defoe, 1887
Entrepreneurship equals a national system of political economy/institutional complementarities or synergies	List, 1909
Entrepreneurs attempt to predict and act upon change within markets. The entrepreneur bears the uncertainty of market dynamics.	Knight, 1921
The entrepreneur is the innovator who implements change within markets through the carrying out of new combinations. These can take several forms: □ the introduction of a new good or quality thereof, □ the introduction of a new method of production, □ the opening of a new market, □ the conquest of a new source of supply of new materials or parts, □ the carrying out of the new organisation of any industry.	Schumpeter, 1934
"The carrying out of new combinations we call 'enterprise'; […] the individuals whose function is to carry them out we call 'entrepreneurs'	Schumpeter, 1936
"The person or group of persons who assume the task and responsibility of combining the factors of production into a business organization and keeping this organization in operation… he commands the industrial forces, and upon him rests the responsibility for their success or failure."	Ely and Hess, 1937
The entrepreneur is the person who maintains immunity from control of rational bureaucratic knowledge.	Weber, 1947
the entrepreneur never has the benefit of perfect knowledge and therefore must have the ability to adapt quickly. This concept is elaborated upon later.	Hayek,1948
"Entrepreneurs – very broadly defined – are those who organize, manage, and actively control the affairs of the units that combine the factors of production for the supply of goods and services."	Evans, 1949
"the driving force of the market process is provided neither by the consumers nor by the owners of the means of productions – land, capital goods, and labor – but by the promoting and speculating entrepreneurs… Profit-seeking speculation is the driving force of the market as it is the driving force of production."	Mises, 1949
The entrepreneur is co-ordinator and arbitrageur.	Walras, 1954
"The purposeful activity (including an integrated sequence of decisions) of an individual or group of individuals, undertaken to initiate, maintain, or aggrandize a profit-oriented business unit for the production or distribution of economic goods and services."	Cole, 1959
An entrepreneur is a person with a high need for achievement. Entrepreneurial activity involves (a) risk-taking, (b) energetic activity, (c) individual responsibility, (d) money as a measure of results, (e) anticipation of future possibilities, and (f) organizational skills.	McClelland (phsychologist), 1961
Entrepreneurs are "the pioneers of new paths"	Marshall, 1961
An entrepreneur searches for change, responds to it and exploits opportunities. Innovation is a specific tool of an entrepreneur hence an effective entrepreneur converts a source into a resource.	Drucker, 1964
"The entrepreneur (whether or not he in fact also doubles as a manager) has a different function. It is his job to locate new ideas and put them into effect. He must lead, perhaps even inspire… he is the Schumpeterian innovator and more. He is the individual who exercises what in the business literature is called 'Leadership.' And it is he who is virtually absent from the received theory of the firm."	Baumol, 1968
Entrepreneurial activity involves identifying opportunities within the economic system.	Penrose, 1959/1980
The successful entrepreneur was defined as a man or woman who started a business where there was none before, who had at least 8 employees and who	Hornaday and Bunker , 1970

had been established for at least 5 years.	
Emphasizes the role of an imitator entrepreneur who does not innovate but imitates technologies innovated by others. Are very important in developing economies.	Kilby, 1971
The entrepreneurial function involves primarily risk measurement and risk taking within a business organization.	Palmer, 1971
Entrepreneurship – the act of founding a new company where none existed before. Entrepreneur is the person and entrepreneurs are the small group of persons who are new company founders. The term is also used to indicate that the founders have some significant ownership stake in the business (they are not only employees) and that their intention is for the business to grow and prosper beyond the selfemployment stage.	Draheim, 1972
The entrepreneur recognises and acts upon profit opportunities, essentially an arbitrageur.	Kirzner, 1973
Entrepreneurs take initiative, accept risk of failure and have an internal locus of control.	Shapero, 1975
Entrepreneurship is "the pursuit of opportunity without regard to resources currently controlled	Stevenson, 1975
An entrepreneur is defined as a major owner and manger of a business venture not employed elsewhere.	Brockhaus, 1980
A person who organizes and manages a business undertaking assuming the risk for the sake of profit.	Hull and Bosley, 1980
"Entrepreneurs are, by definition, founders of new businesses."	Mescon and Montanari, 1981
"An entrepreneur is someone who specializes in taking judgmental decisions about the coordination of scarce resources."	Casson , 1982, 2003
"The overall field of entrepreneurship is loosely defined as the creation of new business enterprises by individuals or small groups.	Vesper, 1982
Entrepreneurship is the dynamic process of creating incremental wealth. This wealth is created by individuals who assume the major risks in terms of equity, time, and/or career commitment of providing value for some product or service. The product or service itself may or may not be new or unique but value must somehow be infused by the entrepreneur by securing and allocating the necessary skills and resources.	Ronstadt, 1984
Entrepreneurship is the act of innovation involving endowing existing resources with new wealth-producing capacity.	Drucker, 1985
"The entrepreneur is someone who specializes in taking responsibility for and making judgmental decisions that affect the location, the form, and the use of goods, resources, or institutions." Roles of the entrepreneur in the history of economic theory include: 1) assumes risk associated with uncertainty, 2) supplies capital, 3) innovator, 4) decision maker, 5) leader, 6) manager, 7) organizer and coordinator, 8) owner, 9) employer of factors of production, 10) contractor, 11) arbitrager, 12) allocator of resources.	Hebert and Link, 1988
Entrepreneurship is the process by which new organizations come into existence.	Gartner, 1989
"Entrepreneurship is the process by which individuals pursue opportunities without regard to resources they currently control."	Stevenson and Jarillo, 1990
entrepreneurs are persons who are ingenious and creative in finding ways that add to their own wealth, power, and prestige	Baumvol, 1990
"An Entrepreneur is someone who perceives an opportunity and creates an organization to pursue it"	Bygrave andHofer 1991
"Increased consensus has been attained on the concept of entrepreneurship as the process of uncovering and developing an opportunity to create value through innovation and seizing that opportunity without regard to either resources (human and capital) or the location of the entrepreneur – in a new or existing company"	Churchill, 1992
entrepreneur is the principal 'agent of change"	Audretsch, 1995
The essential act of entrepreneurship is new entry. New entry can be accomplished by entering new or established markets with new or existing	Lumpkin & Dess, 1996

goods or services. New entry is the act of launching a new venture, either by a start-up firm, through an existing firm or via „internal corporate venturing".	
The entrepreneur is always a speculator. He deals with the uncertain conditions of the future. His success or failure depends on the correctness of his anticipation of uncertain events. If he fails in his understanding of things to come he is doomed	von Mises, 1996
Taking advantage of opportunity by novel combinations of resources in ways which have impact on the market	Wiklund, 1998
"Entrepreneurship is the manifest ability and willingness of individuals, on their own, in teams, within and outside existing organizations, to: • perceive and create new economic opportunities (new products, new production methods, new organizational schemes and new product-market combinations) and to • introduce their ideas in the market, in the face of uncertainty and other obstacles, by making decisions on location, form and the use of resources and institutions." In a previous study (Wennekers et al, 1997, p. 5) a third aspect was included as well: "[…] -compete with others for a share of that market."	Wennekers and Thurik, 1999
The field of entrepreneurship involves the study of sources of opportunities; the processes of discovery, evaluation, and exploitation of opportunities; and the set of individuals who discover, evaluate, and exploit them.	Shane & Venkataraman, 2000
"Entrepreneurship embraces all businesses that are new and dynamic, regardless of size or line of business, while excluding businesses that are neither new nor dynamic as well as all non-business organizations. This leaves the entrepreneurial process, opportunity and the nature of organizational interaction as core topics."	Acs & Audretsch, 2003
Entrepreneurship is a context dependent social process through which individuals and teams create wealth by bringing together unique packages of resources to exploit marketplace opportunities.	Ireland, Hitt, & Sirmon, 2003
Entrepreneurship is the mindset and process to create and develop economic activity by blending risk-taking, creativity and/or innovation with sound management, within a new or an existing organisation.	Commission of the European Communities, 2003
entrepreneurship is the 'endogenous equilibrium disturbing element as the centerpiece of economic development	Grebel et al., 2003
The entrepreneur is the single most important player in a modern economy	Lazaar, 2004
Entrepreneurship is "the pursuit of opportunity beyond the resources you currently control."	Stevenson, 2004
A process by with individuals and groups identify and pursue entrepreneurial opportunities without being immediately constrained by the resources they currently control—where entrepreneurial opportunities are conditions in which new goods or services can satisfy a need in the market	Ireland et al., 2009
A field of business that seeks to understand how opportunities to create new products or services arise and are discovered or created by specific individuals, who then use various means to exploit or develop them	Baron and Shane, 2009
Entrepreneuring is the efforts to bring about new economic, social, institutional, and cultural environments through the actions of an individual or group of individuals	Rindova et al., 2009
Entrepreneurship refers primarily to an economic function that is carried out by individuals, entrepreneurs, acting independently or within organizations, to perceive and create new opportunities and to introduce their ideas into the market, under uncertainty, by making decisions about location, product design, resource use, institutions, and reward systems. The entrepreneurial activity and the entrepreneurial ventures are influenced by the socioeconomic environment and result ultimately in economic growth and human welfare.	Bo Carlsson, Pontus Braunerhjelm, Maureen McKelvey, Christer Olofsson, Lars Persson and Håkan Ylinenpää , 2013

Yet, the turning point for both the entrepreneurial activity and for entrepreneurship research was the decade of the 80s (Carlsson et al., 2013). The "twin oil crises" in the 1970s

created a new current of research on entrepreneurship which defined the field in two fundamentally different ways; the one re-appraised the role of small firms regarding *entrepreneurship as property or quality of the firm itself*. Entrepreneurial firms are typically thought of as small (Aldrich & Austen, 1986), fast- growing (Drucker, 1985), organic and network-based rather than bureaucratic (Birley, 1986).. On the other hand, *entrepreneurship has been defined as a behavioural characteristic of the founders, employees and managers* in the firm, not a characteristic of just the firm itself (Carsrud et al., 1987; Krackhardt, 1995). This stream focused on personal traits, heuristics and organizational births and deaths (Cooper, 2003), engaging psychology, behavioral science and sociology.

The growth of the field of entrepreneurship research had begun. Yet, there was still a lack of common understanding of the field. Scholars went on debating about a *"working definition of entrepreneurship"* (Bygrave, 1989). In 1990 Gartner conducted a Delphi study of academics, businessmen and politicians and analyzed 44 original definitions of entrepreneurship. He resulted to the view that entrepreneurship was a single phenomenon with multiple components whose importance would differ according to environmental context[7]. He further supported the need of a universal definition. The same year, Casson provided an overview of entrepreneurship research by then covering main topics of an economist's view such as innovation, risk and the entrepreneur and the firm (economic theory), firms, market entry, innovation, employment and regional growth (empirical evidence) and cultural issues (such as social mobility). In 1997, Shane published a study on the contributions to the development of the field of entrepreneurship within the relevant decade (since 1987). A year later Morris summarized the most popular perspectives on the nature of entrepreneurship and the 18 most prevalent key terms identified after analyzing seventy-five contemporary definitions of entrepreneurship (Tables 2.2 and 2.3).

Table 2.2: Seven Perspectives on the nature of entrepreneurship adapted by Morris, 1998

[7] According to his research these definitions formed two groups: the first and biggest one (79%) turned around specific features such as personal characteristics, innovation and growth attitudes, and the second (29%).turned around outcomes such as value creation and profits

Seven Perspectives on the nature of entrepreneurship	
Creation of Wealth	Entrepreneurship involves assuming the risks associated with the facilitation of production in exchange for profit.
Creation of Enterprise	Entrepreneurship entails the founding of a new business venture where none existed before.
Creation of Innovation	Entrepreneurship is concerned with unique combinations of resources that make existing methods or products obsolete.
Creation of Change	Entrepreneurship involves creating change by adjusting, adapting, and modifying one's personal repertoire, approaches, and skills to meet different opportunities available in the environment.
Creation of Jobs	Entrepreneurship is concerned with employing, managing, and developing the factors of production, including the labor force
Creation of Value	Entrepreneurship is a process of creating value for customers by exploiting untapped opportunities.
Creation of Growth	Entrepreneurship is defined as a strong and positive orientation toward growth in sales, income, assets, and employment.

Table 2.3: Key Terms Identified in Content Analysis of Seventy-Five Contemporary Definitions of Entrepreneurship (adapted by Morris, 1998)

	Term	Number of Appearances
1.	Starting/founding/creating	41
2.	New business/new venture	40
3.	Innovation/new products new market	39
4.	Pursuit of opportunity	31
5.	Risk-taking/risk management/uncertainty	25
6.	Profit-seeking/personal benefit	25
7.	New combinations of resources, means of production	22
8.	Management	22
9.	Marshalling resources	18
10	Value creation	13
11	Pursuit of growth	12
12	A process activity	12
13	Existing enterprise	12
14	Initiative-taking/proactiveness	12
15	Create change	12
16	Ownership	9
17	Responsibility/source of authority	8
18	Strategy formulation	6

Creation and innovation seem to be the most popular terms, while entrepreneurship is defined as risk-taking, pursuit of opportunity and profit-seeking focusing on the creation of change thus the modification of the existing activities in order to meet the different available market opportunities. The same concepts were used by the OECD, in an effort to define entrepreneurship which resulted in a published report under the title *Fostering Entrepreneurship* in 1998:

> "Entrepreneurship is central to the functioning of market economies. Entrepreneurs are agents of change and growth in a market economy and they can act to accelerate the generation, dissemination and application of innovative ideas. In doing so, they not only ensure that efficient use is made of resources, but also expand the boundaries of economic activity. Entrepreneurs not only seek out and identify potentially profitable economic opportunities but are also willing to take risks to see if their hunches are right. While not all entrepreneurs succeed, a country with a lot of entrepreneurial activity is likely to be constantly generating new or improved products and services." (OECD, 1998, p.12)

The field of entrepreneurship was growing rapidly gaining prominence among management scholars. With the dawn of 2000, Shane and Venkataraman (Jan. 2000, p.218) defined the field of entrepreneurship as:

> "… the scholarly examination of how, by whom, and with what effects opportunities to create future goods and services are discovered, evaluated and exploited. Consequently, the field involves the study of sources of opportunities; the processes of discovery, evaluation, and exploitation of opportunities; and the set of individuals who discover, evaluate, and exploit them. (Shane and Venkataraman 2000, p. 218).".

Following their reasoning, the key aspects of entrepreneurship are according to them:

- the sources of opportunities
- the processes of discovery, evaluation and exploitation of opportunities
- the set of individuals who discover, evaluate and exploit them.

Zahra and Dess (2001) added a fourth dimension: the *outcomes of exploiting entrepreneurial opportunities*, whether they are "positive or negative, immediate or long term, tangible or intangible".

Of course the term of entrepreneurial opportunities was not new. For Schumpeter (1934) opportunities exist in factor markets, as in the case of the discovery of new materials while for Drucker (1985) opportunities could arise by new information through the invention of new technologies, the exploitation of market inefficiencies and by the consequences of political, regulatory or demographic changes. Casson (1982) had defined entrepreneurial opportunities as those situations in which new goods, services, raw materials, and organizing methods can be introduced and sold at greater than their cost of production. The term received increased attention in the entrepreneurship literature (Kirzner, 1979; Shane & Venkataraman, 2000; Gaglio, 1997; Hills and Shrader, 1998; Ardichvili *et al*., 2003; Eckhardt and Shane, 2003; Sarasvathy *et al*., 2003; Shane and Venkataraman, 2000; all cited in Ihrig et al., 2006).

Taking all entrepreneurship definitions together, Davidsson (2004) notes that they broadly reflect two relatively distinct social realities; people become self-employed instead of working for somebody else under an employment contract. The second reality refers to 'entrepreneurship' as the creation of new economic activities and organisations ('Schumpeterian entrepreneurship') as well as the transformation of existing ones ('corporate entrepreneurship') where change is a major aim. This distinction is more clear within The Global Entrepreneurship Monitor research which differentiates between "necessity entrepreneurship," as a "need" to become an entrepreneur (often "self-employed") due to no better options, and "opportunity entrepreneurship," as an active choice to start a new enterprise based on the perception of the existence of unexploited or underexploited business opportunities. A natural consequence of such operational definitions of entrepreneurship is the production of **several measures of performance**, like survival, growth and profitability which act as indicators of entrepreneurship to a lesser or greater degree (Stam, 2009). In all cases however entrepreneurship is blended with innovation and change; the economic value of entrepreneurship depends on the economic value of the resulting innovation (Audretsch et al., 2001). Moreover, following Schumpeter's evolutionary concept of innovation, entrepreneurship is not termed as a permanent condition but as a significant economic phenomenon which excludes incremental innovation and drives the innovativeness and growth of industries (Schumpeter 1911 in Aegis Annex, 2008). Meanwhile, globalization, the development of knowledge economy and the increasing role of technology and knowledge (Javalgi et al., 2011) shift the attention to the changing nature of entrepreneurship within new contextual settings (Garavaglia and Grieco, 2005).

A number of researchers in recent years focus on the notion and **role of knowledge** in entrepreneurship developing in both theoretical and empirical ways the concept of knowledge-intensive entrepreneurship (e.g. Protogerou et al., 2012; Kanellos, 2013; Garavaglia and Grieco, 2005). Within this new stream, unique knowledge is assumed to be the most valuable asset of a firm for achieving competitive advantage (Liebeskind, 1996; Ihrig et al., 2006) producing economic benefits (Garavaglia and Grieco, 2005), while knowledge-intensive industries are considered at the core of growth in an emerging knowledge-driven economy (Smith, 2002; Robertson and Smith, 2008). The emerging phenomenon of knowledge-intensive entrepreneurship (KIE) will be discussed in more detail in the following chapter.

The domain of entrepreneurship research has evolved over time, with an increasing pace over the last two-three decades and a tendency of further broadening the concept, since it became a popular theme among scholars of different disciplines (Landström and Persson, 2010). However, even today, after a whole decade of the twenty-first century, there is no consensus about the very nature of entrepreneurship and the role of the entrepreneur. Besides the deeper discussions on central concepts and the delimitations of the research field (Landström, 2012), researchers still admit the complexity, heterogeneity and the multifaceted nature of entrepreneurship. Efforts on defining entrepreneurship still go on.

2.2.3 Schools of Thought on Entrepreneurship

Entrepreneurship literature has been categorized in several ways; the classical (e.g. Blanchflower and Meyer, 1991) and neoclassical theory (e.g. Kihlstrom and Laffont, 1979); the schools of the supply-side (Weber 1904, Shane 1993) and the demand-side perspective (White 1981, King & Levine 1993); the strands that focuses on individuals (e.g. Delmar 2000) and the one that focuses on structure (e.g. Martinelli 1994; Busenitz, Gomez and Spencer, 2000) to name some. Within the KEINS project Joseph Schumpeter's writings were adopted to create the two broadly accepted key starting arguments; the first point regarding the function and the object of entrepreneurship and the second regarding the agents that could play the role of entrepreneurship (KEINS, Final Version, 2004).

On the first aspect, Schumpeter (1934) is very clear:

> The carrying out of new combinations we call "enterprise"; the individuals whose function it is to carry them out we call "entrepreneurs." … [W]e call entrepreneurs not only those "independent" businessmen in an exchange economy who are usually so designated, but all who actually fulfill the function by which we define the concept, even if they are, as is becoming the rule, "dependent" employees of a company, like managers, members of boards of directors, and so forth, or even if their actual power to perform the entrepreneurial function has any other foundations, such as the control of a majority of shares (p.74).

On the second aspect, Schumpeter distinguishes between innovations carried by *new firms* which challenge the established incumbents (Schumpeter,1934) and innovations that usually progress along existing trajectories carried by *established incumbents* that do research and development (R&D) and continuously introduce new products or new processes (Schumpeter,1942).

It is quite impossible to summarize even specific strands of entrepreneurship literature in a few pages. In what follows, we review in short some different disciplines of entrepreneurship dwelling upon main elements that we believe to be important in order to reach the notion of *'knowledge-intensive entrepreneurship' which constitutes the core theme of the present thesis*[8].

2.2.3.1 The economics and managerial perspective

a. Mainstream Economics

"The theoretical firm is entrepreneurless – the Prince of Denmark has been expunged from the discussion of Hamlet"

(*William J. Baumol, 1968, p. 68)*

During the 60s and 70s neo-classical theory explained economic growth by accumulation of production factors and exogenous technological change (Wennekers and Thurik, 1999*)*. Neoclassical economics imposes strong emphasis on utility maximization, rationality, equilibrium and the neglect of fundamental uncertainty (Dequech, 2007; Hodgson, 1994). Many scholars have commended that there has been little to no room at all for the entrepreneurs and the entrepreneurial theory in theoretical mainstream economics (e.g. Kirzner 1997). Actually, the terms "entrepreneur" and "entrepreneurship" are *virtually nonexistent* in the leading graduate textbooks in micro, macro and industrial organization (Johansson, 2004). Furthermore, due to the lack of entrepreneurial tradition in England during the 19th century (Koolman, 1971) the English classical economists, such as Ricardo and Smith, fail to recognize the significance of the entrepreneur and the entrepreneurship.

Traditional neoclassical assumptions (otherwise the *Chicago* tradition), impose limitations on entrepreneurship such as by perfect competition, perfect information, and rational behavior (Glancey and McQuaid, 2000), or the absence of time lags between decision and outcome (Lydall, 1998). Yet, besides limitations, there have been a few attempts made to incorporate entrepreneurship into the neoclassical framework such as Knight's (1921) acceptance of uncertainty and Lucas's (1978) incorporation of entrepreneurship as a factor of production. Further, the Marshallian

[8] The description of theories is neither complete nor extensive and detailed. The brief outlines are offered as an orientation of theories with a significant interest. These short descriptions subsequently lack details and intricacies. Therefore, the interested reader probing deeper into the mentioned disciplines is advised to consult original references and/or relevant advanced textbooks.

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framework accepts change, market and firm dynamism and explosion to uncertainty, but unfortunately it limits the role of entrepreneurship with "a specific figure that acts as an entrepreneur to miss in this theory" (Garavaglia and Grieco, 2005).

During the last two decades of the twentieth century that the entrepreneur started to be treated explicitly in economic conventional models, both terms found some room within major strands of traditional economics. Among the first relevant efforts was the use of the "entrepreneurial ability" as a variable in the cost function (Jovanovic, 1982; Brock and Evans, 1985) and in the production function (Evans and Jovanovic, 1989; Holmes and Schmitz, 1990). However, even then, innovation is a term difficult to fit within the neo-classical production function (Solow, 1956) while technology has been treated as a residual and a "black hole in orthodox (neo-classical) economic theory" (Daneke, 1998, p 103). Moreover within neoclassical economics knowledge plays no role at all.

b. The Austrian School

Economics, in speaking of entrepreneurs, has in view not men, but a definite function. This function is inherent in every action...In embodying this function in an imaginary figure, we resort to a methodological makeshift

(Mises 1966, pp252-3; Kirzner 1973, p 39)

Unlike neo-classicals, Austrian theorists largely believe that restrictions in the economy are imposed by human entrepreneurial knowledge and not by objective phenomena or material factors of the outside world *(*Hayek, 1955; Lachmann, 1986; Machlup, 1982; Mises, 1998; Shackle, 1972). In the Austrian School, entrepreneurship, is considered as the driving force (for example in Hayek, 1968); and production as an intellectual, spiritual phenomenon (Mises 1996), while the main task of the entrepreneur is the location and creation of new information.

Within economics, the Austrian School has been the most systematic exponent of subjectivism which refers to preferences, knowledge, expectations and differences in mental states (e.g., Hayek, 1948; Mises, 1949). Kirzner defines entrepreneurs as individuals who perceive profit opportunities in disequilibrium conditions by improving on market inefficiencies or deficiencies, since markets constitute discovery processes (Kirzner, 1997, p 690). According to the Austrian view, market economies are in a continuous change and entrepreneurship creates more changes.

Grounding the theory of entrepreneurship in subjectivism, literature extended to entrepreneurial creativity and the creation of economically profitable opportunities because of the interaction not only within markets but also with technology and other stakeholders (Ardichvili et *al.*, 2003; Busenitz, 1996; Sorensen and Sorenson, 2003). The entrepreneur turns out to be innovator (Korr et *al.*, 2007) transforming information into conscious useful knowledge.

The Austrian School focuses on the ability to identify opportunities incorporating the role of the entrepreneur and the role of creativity and dispersed knowledge. However, they do not explicitly develop the concept of entrepreneurship as a source of change; they neither investigate skills and capabilities needed (Garavaglia and Grieco, 2005).

c. Schumpeterian Entrepreneurship

> *"The fundamental impulse that sets and keeps the capitalist engine in motion comes from the new consumer's goods, the new methods of production and transportation, the new markets, and the new forms of industrial organisation that capitalist enterprise creates".*
>
> *Schumpeter (1934, pp 137)*

The theoretical insight about the role of the entrepreneur as an innovator, inspirer and the implementer of the famous "creative destruction"[9] in a capitalist economy emerged forcefully out of the early-twentieth-century work of Joseph Schumpeter. According to his view in the Theory of Economic Development (Schumpeter, 1934), the entrepreneur is an agent of change, the one that creates instability, disequilibria, and economic development. Schumpeter defines entrepreneurship as the recognition and assertion of opportunities through innovation. Opportunities are determined by *"[…] the introduction of the new commodity, the new technology, the new source of supply, the new type of organization"* (Schumpeter, 1942) and include "*the technological change in the production of commodities already in use, the opening up of new markets or of new sources of supply"* (Schumpeter, 1934, p84). Such opportunities are able to disrupt the market and gain profits. According to Schumpeter *"[…] new combinations are, as a rule, embodied in new firms which generally do not arise out of the old ones but start producing beside them"* (Schumpeter, 1912). Entrepreneurs create and commercially exploit new knowledge, possess and further

[9] According to Reinert and Reinert (2006) the idea of "creative destruction" has been met in the work of thinkers such as Bakunin, Nietzsche and Karl Marx. The concept is traced back to Indian philosophy, from where the idea entered German philosophy.

develop vision, intuition and skills such as leadership and creativity which are of major significance in initiating 'creative destruction'.

Schumpeterian ideas inspired soon early followers who continued research based on the entrepreneur as innovative-path-breaker (e.g. Dahmén, 1950; Leibenstein, 1968; Baumol, 1968, 1990). However, the Schumpeterian theory left many questions unanswered; Chiles et *al.*, (2010) claim that Schumpeter "avoided discussing the role of entrepreneurs in creating opportunities, ignored entrepreneurs' subjective imaginations and limited innovation to periodic bursts and preexisting resources employed in other valued uses". Yet, he was the first to recognize the importance of innovation and change and the creative behaviour of the entrepreneur..

d. The Evolutionary Approach

Schumpeterian theory led to the development of evolutionary economics in the early 80s; economy is considered in a constant process of change, with "*economic activity almost always proceeding in a context that is not completely familiar to the actors, or perfectly understood by them*" (Nelson, 1995). In the name of change, according to the seminal work of Nelson and Winter (1982), the evolutionary economics approach confronts entrepreneurship as a series of search processes for new opportunities and ideas creation and exploitation. The view approaches and assigns active roles to concepts such as technological change, imitation and institutional factors; for example it relates policy issues to technical progress and market structure.

Evolutionary economics constitute an important approach which suggests firm-specific **capabilities** (Langlois, 1992, Foss, 1993, Teece et al., 1994) as a reason for the existence of firms.

e. More Recent Developments in Economics

In 1990, Harvard professor Michael Porter grants entrepreneurship[10] a crucial role placing it "*at the heart of national advantage"* (Porter, 1990, p. 125). He connects economic growth to competitive advantage and relates it to factors such as the firm's strategy, structure and rivalry. Later Wennekers et al. (1997) used Porter's model to study the relations among entrepreneurship, innovation and economic growth. Growth

[10] Referring to the competitiveness and economic development of nations, states, and regions

and wealth creation are also the main concerns of strategic management (Amit & Zott, 2001; Hitt & Ireland, 2000; Hitt, et al., 2003; Ireland, et al., 2003).

In 1998, Herbert & Brazeal in an effort to emphasize the role of top management against the individual contributor within the realm of corporate entrepreneurship used the term "strategic entrepreneuring" and introduced "strategic entrepreneurship"[11]: The term was subsequently heralded by Hitt & Ireland (2000) and a dedicated special issue on strategic entrepreneurship by the *Strategic Management Journal* in 2001 gave birth to the new field which received great attention the last ten years (see for example Hitt et al., 2002; Ireland et al., 2003; Kuratko & Audretsch, 2009; Ireland & Webb, 2009; Luke et al., 2011). Strategic Entrepreneurship demands the achievement of a balance between the opportunity-seeking behaviors of "entrepreneurship" and the advantage-seeking behaviors associated with "strategic management" which ensure stability and predictability (Hitt et *al.*, 2001; Venkataraman & Sarasvathy, 2001; Ireland et *al.*, 2003). In more recent works the concepts of knowledge, innovation and capabilities have further gained the attention of the relevant researchers.

> "Strategic entrepreneurship allows the firm to apply its knowledge and capabilities in the current environmental context while exploring for opportunities to exploit in the future by applying new knowledge and new and/or enhanced capabilities." (Hitt et *al.*, 2012)

The above described economic approaches are widely regarded as central to entrepreneurship research (Chiles et *al.*, 2007; McMullen & Shepherd, 2006; Shane, 2000); they emphasize and explain the shaping and the development of key issues that hold a central role in knowledge-intensive entrepreneurship and the capabilities view. Yet, the question on entrepreneurship remains and other disciplines besides economics tried to give their own aspect.

2.2.3.2. Other Perspectives

Industrial dynamics: a relatively young field (Carlsson, 1987) with roots in the seminal works of Alfred Marshall, Joseph Schumpeter and Edith Penrose and "the market structure and innovation" approach (Kamien and Schwarts, 1975). It explores the evolution of industries (thus how existing industries change) with a focus on entry, growth and exit dynamics of firms (Carlsson, 1987, 1989; Malerba, 2006, 2007).

[11] According to van Rensburg (2013) earlier linkages between strategy and entrepreneurship include Mintzberg (1973, entrepreneurial strategy making), Burgelman (1983a, inter-relationships between strategic management and Entrepreneurship), Day (1992, linkages between entrepreneurship, strategic management, and general management)

Within this framework, entrepreneurship is the process by which enterprises are founded and become viable (Santarelli and Vivarelli, 2006). The relevant literature has related entry into an industry to various aspects such as innovation, localization, clusters, competition, growth and productivity increase, where entrepreneurship holds a positive and dynamic position (e.g. Thurik, 2003; Baptista, Van Stel and Thurik, 2006; Malerba and McKelevey, 2010)[12]. The approach extends to issues such as the co-evolution of technology, the structure of the market, as well as the analysis of the knowledge base of industries and the structure and dynamics of innovation networks (Malerba, 2007).

A particular aspect of extensive analysis has been the examination of the *personal characteristics* such as pre-entry experience (see Storey, 1982; Reynolds *et al*., 2001; Stam, 2007; Klepper, 2009) and background (see Evans and Leighton, 1989; Reynolds *et al*., 2001), education and human capital (Becker, 1964; Colombo and Grilli, 2005; Bosma, 2012); family tradition (see for example Djankov *et al.* 2007), financial status, age, gender and motivations (Quatraro and Vivarelli, 2013).

Management Science Perspective: Management scholars are interested in the activities performed in entrepreneurship focusing on new firms, or as Gartner (1989) points *"what entrepreneurs do to come into existence"*. This body of thought exhibits strong similarities with many of the economic perspectives reviewed above (Garavaglia and Grieco, 2006). However, it focuses on entrepreneurship as a process (e.g. Hisrich, Peters and Sheperd, 2008) and allows greater attention to existing and mainly large corporate firms (e.g Dess *et al,* 2003).

Psychological perspective: Even since the 60s, attention has turned to a psychological view of entrepreneurship that attempted to explore the personal characteristics of entrepreneurs. The major focus was on motivation, behavior and cognitive aspects of the individual in order to develop ways of optimizing entrepreneurial success (Simons, Irwin and Drinnin, 1987). The effort started by the seminal work of McClelland (1961) which resulted that need for power, achievement and affiliation constitute the main psychological set (Brockhaus, 1982).

[12] We remind that it is beyond the scope of this thesis to fully account for the vast literature on entrepreneurship and its various sub-fields

A significant number of studies are devoted to general personality traits such as high-risk propensity (e.g. Tan & Pazarcık, 1984), high self confidence (Lambing and Kuehl (2000), creativity and imagination (Witt, 1998; Peterson & Seligman, 2004). Kuratko and Hodgetts (1998) presented an extensive list of such characteristics which they named Frequent Entrepreneurial Qualities (Table 2.4).

Table 2.4: Frequent Entrepreneurial Qualities as presented by Kuratko and Hodgetts (1998)

1. Self-confidence	22. Reliability
2. Constancy	23. Prevision
3. Being active and energetic	24. Honesty
4. Skill	25. Commonality
5. Risk taking	26. Being profit-minded
6. Dynamizm & Leadership	27. The Ability of Learning from mistakes
7. Optimism	28. Desire for Power
8. Ambition	29. Good personality
9. Versatility	30. Self-centeredness
10. Creativity	31. Courage
11. The ability of Manipulation	32. Imagination
12. The Ability to Communicate with people	33. Understanding/Sympathy
13. Initiative	34. The Tolerance against uncertainity
14. Flexibility	35. Agression
15. Intelligence	36. Satisfaction
16. Focusing on Clear Objectives	37. Advantage
17. Being competitive	38. Being promising
18. Independency	39. The Ability to rely on employees
19. Sensitivity to critical situations	40. Sensitivity
20. Efficiency	41. Integrity
21. Being Decisive	42. Maturity

Sociological perspective: entrepreneurship attracted the interest of sociologists in the 80s. They focused on the social stimulants of the entrepreneurial activity (Alizadch, 1999) as well as the connection of cultures to entrepreneurship (e.g. Aldrich & Waldinger 1990; Shane 1993). Hayton, George and Zahra (2002) provide a comprehensive review of empirical studies that have examined the association between national culture and entrepreneurship.

The sociological perspective relates entrepreneurship to the rise and decline of organizations (Low & Mac Millan, 1988; Berger, 1991); most new firms follow existing paths and survive by filling existing niches (Garavaglia and Grieco, 2006; Carroll, 1997). Among several aspects, explored, is the intensity of the relationships

between network members causing much discussion on strong and weak ties (Granovetter, 1974; 1985, 2005; Coleman, 1990) as well as dense and sparse networks (Uzzi, 1997; Obstfeld, 2005). Granovetter (1974) included family in strong ties and further emphasized the role of trust.

Another stream of early work connected social networks to innovation (Allen, 1977; Tushman and Scanlan, 1981; Ibarra, 1993) shifting attention to the social nature of innovation (Obstfeld, 2005). According to Chesbrough & Teece (1996), adopting an economic transaction cost perspective; networks cost less constituting a more efficient alternative to formal hierarchies.

2.2.4 Entrepreneurship in the Context of the Resource-based View

> *"In a Resource-based view, discerning appropriate inputs is ultimately a matter of entrepreneurial vision and intuition, the creative act underlying such vision is a subject that so far has not been a central focus of resource-based theory development"*
>
> *(Conner, 1991, p. 121)*

The resource-based view has become one of the most influential and cited strategic management frameworks aspiring to explain the internal sources of a firm's sustained competitive advantage. Within a resource-based view (RBV), organizations are considered as bundles of resources (Peteraf 1993; Eisenhardt and Schoonhoven 1996). Actually "*entrepreneurship and RBV adopt precisely the same unit of analysis—the resource*" (Alvarez and Busenitz, 2001). The concept of resources includes both tangible and intangible ones such as physical assets, capabilities, organizational processes, firm attributes, information and knowledge (Barney, 1991; Daft, 1983).

RBV's origins are found in the work of British economist Edith Penrose and her seminal publication "The theory of the growth of the firm" from 1959. Penrose relates competitive advantage to the ability of a firm to acquire, absorb, apply and control valuable, rare, inimitable, and non-substitutable resources and capabilities (Barney, 1991, 1994, 2002). RBV initiated in strategy content research in the mid-1980s by Wernerfelt (1984), Rumelt (1984) and Barney (1986), and further developed by many other writers (e.g., Dierickx and Cool 1989; Helfat (Castanias & Helfat, 1991; Helfat & Lieberman, 2002); Amit and Schoemaker 1993; Peteraf 1993; Foss, 2011). The theoretical and empirical development of the RBV has been analyzed in a number of

review studies such as Foss (Foss, 1997; Foss, Klein and Korr, 2007; Foss, 2011), Newbert (2007), and Lockett, Thompson, & Morgenstern (2009).

Entrepreneurship scholars increasingly used RBV to identify and explain persistent performance differences among firms (Alvarez & Barney, 2002; Mosakowski, 2002) and develop the concept of strategic entrepreneurship (e.g. Ireland, Hitt and Simon, 2003). It further contributed to the development of new field areas such as the "capabilities view of the firm" (Langlois, 1992), the notion of core competences (Hamel & Prahalad, 1994), dynamic capabilities (Helfat & Peteraf, 2003; Teece, Pisano, & Shuen, 1997; Teece, 2007), the knowledge-based view (KBV) (Grant, 1996; Kogut & Zander, 1992) and the novel theory on knowledge-intensive entrepreneurship (e.g. Malerba and McKelvey, 2010).

A strong linkage between RBV and entrepreneurship can initially be found in Schumpeter's definition of entrepreneurship as the creation of *new resource combinations* (Schumpeter 1934 in Foss et al., 2008). Elaine Mosakowski (1998) assigns "entrepreneurial resources" to single managers-entrepreneurs or to entrepreneurial teams[13]. Another basic condition of both sides (i.e. RBV and entrepreneurship) is resource heterogeneity. Resource based view focuses on the heterogeneity of resources as strategic assets appropriated under imperfect factor markets. In a parallel line, heterogeneous resources are also basic for entrepreneurship (Kirzner, 1997)[14]. Entrepreneurial opportunities exist primarily because different agents have different beliefs about the relative value of resources (Schumpeter, 1934; Kirzner, 1979; Shane & Venkataraman, 2000). Entrepreneurs will often have to modify the resource-base while pursuing the opportunity (Mosakowski, 1998).

The resource based view constitutes a means to further connect the phenomenon of entrepreneurship to strategic management[15] on an advanced theoretical and empirical basis. According to Alvarez (2003) it is entrepreneurship which should inform

[13] We should bring in mind that during the same year Herbert & Brazeal emphasized the role of top management against the individual contributor within the realm of corporate entrepreneurship introducing "strategic entrepreneurship", which according to Foss, 2011 is "a new research stream in the intersection of RBV and entreprneurship.

[14] However, we should mention that Kirzner's entrepreneurs do not own capital and thus are dissociated from the firm. Hence Kirzner's (1973) concept of entrepreneurship cannot be related to firm-level strategies and to the resource-based view of the firm.

[15] Shane and Venkataraman (2000, 2001) were against this integration of entrepreneurship research and strategic management research while many others supported it (McGrath and MacMillan, 2000; Hitt et al., 2001; Zahra and Dess, 2001; Ireland et al., 2003; Choi and Shepherd, 2004).

strategic management about these processes that can lead to competitive advantage. Concepts such as competitive advantage, resources and capabilities, although been formerly used in the existing views on entrepreneurship without any particular connection among them, they were interlinked, redefined and redirected.

2.2.5. The capabilities view

> *The term 'capabilities' floats in the literature like an iceberg in a foggy Arctic sea, one iceberg among many, not easily recognized as different from several icebergs nearby.*
> *Dosi, Nelson and Winter, 2000*

While in his 1991 article Barney included capabilities in resources, the very same year Grand (1991) differentiated the two concepts and two years later, in 1993, Amit and Schoemaker (1993) presented a clear distinction between resources and capabilities:

> "resources are stocks of available factors that are owned or controlled by the firm," … *Capabilities,* in contrast, refer to a firm's capacity to deploy *Resources,* usually in combination, using organizational processes, to affect a desired end". (Amit and Schoemaker, 1993 p 35))

In this respect, resources are tradable and non-specific to the firm, while capabilities are *"information-based, tangible or intangible processes that are firm-specific and developed over time through complex interactions among the firm's Resources* (Amit & Schoemaker, 1993). In 2002 Gruber and Harhoff put the differentiation between resources and capabilities on a very simple basis: resources are everything a firm "has" while capabilities are everything the organization "can do". Therefore, capabilities focus on resource combinations (Grant, 1991) using organizational processes, to achieve a desired specific end (Amit & Shoemaker, 1993; Grant, 1996; Prahalad & Hamel, 1990; Winter, 2000; Helfat et *al.*, 2007). Table 2.5 presents a list of some indicative capability definitions.

Indeed, the new approach shifted importance to capabilities (than resources) and stressed the interactions among resources, capabilities and competitive advantage; resources constitute the source for capabilities' development, which in turn lead to competitive advantage (Grant, 1991). Furthermore, competitive advantage can be obtained only if capabilities are unique, durable and difficult to imitate and trace (Amit and Schoemaker, 1993) and this configuration constitutes a strategic asset (Boccardeli, 2006).

Soon the new capabilities approach went well beyond the initial efforts such as Selznick's (1957) concept of 'distinctive competence' and concept definitions of

organizational routines (Nelson & Winter, 1982) to "core competencies" (Hamel & Prahalad, 1990), "core capability and rigidity" (Leonard-Barton 1992), "absorptive capacity" (Cohen & Levinthal, 1990), "architectural knowledge" (Henderson & Clark, 1990), "combinative capabilities" (Kogut & Zander, 1992), "architectural competence" (Henderson and Cockburn 1994), "integration capability" (Iansiti & Clark, 1994), "static – improvement – evolutionary capabilities" (Fujimoto, 1998), "relational capability" (Dyer and Singh, 1998), "operational capabilities" (Winter, 2003) and, finally, dynamic capabilities (Teece, Pisano & Shuen, 1997; Teece, 2007). There was also a further focus on specific capabilities such as "technological capabilities" (e.g. Dosi et al., 1992; Bell and Pavitt; 1993), "technical capabilities" (Tripsas, 1997) and "managerial capabilities" (e.g. Chandler 1992; Adner and Helfat, 2003) called "organizational capabilities" by Carlsson and Eliason (1994); competitive, allocative and transactional are some further categorizations of the last type of significant importance (e.g. Dosi, Teece and Winter, 1992; Weinstein and Azoulay, 1999).

Table 2.5: An indicative selection of Capability definitions (Including Capacities)

Authors	***Definitions***
Nelson and Winter (1982, p. 103)	Capability: 'the repertoires of organizations members' that are 'associated with the possession of particular collections' of resources
Barney (1991, p. 44)	Capabilities are those organizational characteristics that 'enable an organization to *conceive, choose and implement strategies*.'
Leonard-Barton (1992, p. 113)	Core capabilities: the knowledge set that distinguishes and provides a competitive advantage. Four dimensions: knowledge and skills; technical systems; managerial systems; values and norms.
Stalk, Evans, and Shulman (1992, p. 62)	A capability is a set of business processes strategically understood.
Amit and Schoemaker (1993, p. 35)	Capabilities refer to a firm's capacity to deploy resources, usually in combination, using organizational processes, *to effect a desired end*.
Collis (1994, p. 145)	Organizational capabilities: the socially complex routines that *determine the efficiency with which firms physically transform inputs into outputs*.
Grant (1996, p. 377)	Organizational capability: a firm's ability *to perform repeatedly a productive task* which relates either directly or indirectly to a firm's capacity for creating value through affecting the transformation of inputs into outputs.
Szulanski (1996, p. 28)	Organizational capability as best practice. Practice refers to the organization's routine use of knowledge and often has a tacit component, embedded partly in individual skills and partly in collaborative social arrangements.

Dosi, Nelson, and Winter (2000, p. 4)	Capabilities involve organizational activity and the exercise of capability is typically repetitious in substantial part. Routines are units or 'chunks' of organized activity with a repetitive character. Hence, it is basically well said that 'routines are the building blocks of capabilities'—although routines are not the *only* building blocks of capabilities.
Winter (2000, p. 983)	An organizational capability is a high-level routine (or collections of routine) that, together with its implementing input flows, *confers upon an organization's management a set of decision options for producing significant outputs of a particular type.*
Makadok (2001, p. 389)	A capability is a special type of resource – specifically, an organizationally embedded nontransferable firm-specific resource whose purpose is *to improve the productivity* of the other resources possessed by the firm.
Maritan (2001, p. 514)	A capability is defined as a firm's capacity to deploy its assets, tangible or intangible, *to perform* a task or activity to improve performance.
Helfat and Peteraf (2003, p. 999)	An organizational capability refers to the ability of an organization to perform a coordinated set of tasks, utilizing organizational resources, *for the purpose of achieving a particular end result*.
Special Forms of Capabilities	
Teece, Pisano, and Shuen (1997, p. 516)	*Dynamic capabilities*: firm's ability to integrate, build, and reconfigure internal and external competences *to address rapidly changing environments.*
Eisenhardt and Martin (2000, p. 1107)	*Dynamic capabilities* are the antecedent organizational and strategic routines by which managers alter their resource base—acquire resources, integrate them together, and recombine them—to *generate new value-creating strategies*.
Galunic and Eisenhardt (2001, p. 754)	*Dynamic capabilities* are the organizational and strategic processes by which managers manipulate resources into new productive assets in the context of changing markets.
Zollo and Winter (2002, p. 340)	A *dynamic capability* is a learned and stable pattern of collective activity through which the organization systematically generates and modifies its operating *routines in pursuit of improved effectiveness*.
Cohen and Levinthal (1990, p. 128)	*Absorptive capacity*: the ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends.
Zahra and George (2002, p. 186)	*Absorptive capacity*: a set of organizational routines and processes by which firms acquire, assimilate, transform, and exploit knowledge to produce a dynamic organizational capability.
Kogut and Zander (1992, p. 391)	*Combinative capabilities*: the intersection of the capability of the firm to exploit its knowledge and the unexplored potential of the technology.
Leonard-Barton (1992, p. 113)	*Core capabilities*: the knowledge set that distinguishes and *provides a competitive advantage.*
Henderson and Cockburn (1994, p. 66)	The '*architectural competence*' of an organization allows it *to make use of its component competencies:* to integrate them together in new and flexible ways and to develop new architectural and component competencies as they are required.

Many areas caught researchers' attention; the internal development of a firm's capability (e.g., Nelson and Winter, 1982; Zollo and Winter, 2002; Winter, 2000; Lichtenhaler, 2009 or Helfat and Peteraf's (2003) life-cycle model presented in figures 2.1 and 2.2), capabilities' strategic importance (Leonard, 1995; Tidd et al., 2001) the processes complexity (Prahalad and Hamel, 1990; Winter, 2002) and their micro-foundations (Gavetti, 2005; Felin, 2012).

For Helfat et al. (2007, p37 and p121) capability implies a potential for action; organizational capabilities perform coordinated sets of tasks based on organizational resources in order to achieve defined aims and results. They actualy enable the achievement of repeated performance of activities in contrast to *ad hoc* activities with no patterned behaviors (Dosi et *al.*, 2000; Winter, 2003; Helfat and Winter, 2011) and are assumed to lay the foundations for sustainable competitive advantage.

Prior research has recognized several levels of capabilities. Carlsson and Eliasson (1994) based partly on Chandler's work (1990) had distinguished three levels and namely for operation units, middle management level (for technical and functional competencies) and coordination and control capabilities for the top management level. Organizational capabilities were identified as the major source of sustainable competitive advantage. However, volatile markets, rapid changes and environmental ambiguity posed questions on the reliance on specific capabilities. In order to answer such questions, there followed a further distinction in operational and dynamic capabilities (Eisenhardt and Martin, 2000; Helfat and Peteraf, 2003; Helfat et al., 2007; Helfat and Winter, 2011). Operational (or zero-order) capabilities are associated with "*how we earn a living now*" (Winter, 2003, p 992) enabling activities on an "on-going basis" or a 'repetitive pattern of activity' according to Nelson and Winter (1982, p 97), with similar techniques for existing products, services and markets (Helfat and Winter, 2011; Felin, 2012). In contrast, dynamic capabilities are higher order capabilities[16], build, integrate, or reconfigure operational capabilities, thus govern their rate of change, enabling a firm to alter its ways of making a living (Helfat and Peteraf, 2003; Helfat and Winter, 2011; Felin, 2012). This dynamization effect (Schreyogg and Kliesch-Eberl, 2007) was the basis of the term and the subsequent framework as introduced by Teece, Pisano and Shuen (1997) and then further developed in a major strand of literature (see for example Eisenhardt and Martin, 2000; Zollo and Winter, 2002; Zott, 2003; Winter, 2003, 2007; Teece 2007; Helfat *et al*., 2007; Helfat and Peteraf, 2009; Easterby-Smith, Lyles, and Peteraf, 2009; Di Stefano, Peteraf, and Verona, 2010; Helfat and Winter, 2011; Protogerou, 2011; Protogerou et. *al*, 2012). This strand has been said to extend the applicability of the resource-based strategy to highly competitive and rapidly changing environments as we will see later.

[16] The term higher order or meta capabilities was suggested by Collis (1994) who defined them as "learning to learn" capabilities.

2.2.5. a Entrepreneurial capabilities

The entrepreneurship literature started developing the notion of entrepreneurial capabilities (ECs) in order to explain the resources and skills required for effective entrepreneurial activity and new firm creation mainly on the basis of the resource-based view (see, for example, Alvarez and Busenitz, 2001; Chell and Allman, 2003; Steffens and Burgers, 2009). By then, the entrepreneurship literature had been criticized for being too concentrated on the process of launching new business concepts neglecting the strategic element of it (Hitt & Ireland, 2000; Hitt et *al*., 2003; Boccardelli, 2006). Boccardelli (2006) claims that, "The resource-based view of the firm only tells why firms have success in the present context. It gives no clear understanding about how a firm through entrepreneurial action achieved their present fit*"*. In this line of view, entrepreneurial capabilities were defined as "'the ability to identify a new opportunity and develop the resource base needed to pursue the opportunity' (Arthurs and Busenitz, 2006, p 199) or according to Shackle (1970) to reshuffle those resources in an ongoing, reiterative conversation with their dynamic expectations of the future".

This new theoretical strand suggested that "entrepreneurial capabilities" can provide the resource foundations for competitive advantage. Theorists discussing the use of RBV into the examination of entrepreneurial actions (e.g. Alvarez and Busenitz, 2001; Alvarez and Barney, 2004) turned to the concept of entrepreneurial capabilities mostly after 2000. Since then, researchers have developed a significant number (a panspermy indeed!) of entrepreneurial capabilities such as opportunity recognition and resource organization or opportunity exploitation (Alvarez and Buzenitz, 2001), flexibility (Ebben and Johnson, 2005; Steffens and Burgers, 2009), unique marketing and technical expertise (Wikilund and Sheperd, 2003), agility and strategic resource management (Alvarez and Barney, 2002), while we should not omit Kirzner's (1973) alertness[17]. For Mosakowsi (1998) and Arthours and Busenitz (2006) the abilities to act with foresight, behave creatively, use intuition, employ heuristics, be alert to new opportunities and develop the resource base required to start or/and grow a new venture are major entrepreneurial capabilities. Foss et *al*. (2008) accept alertness and judgment as entrepreneurial capabilities. Boccardelli and Magnusson (2006) through

[17] Kirzner assumes that entrepreneurs are more alert to new opportunities and have a different approach to information

empirical work underline the importance of flexibility, experimentation and improvisation from the founding of the firm. Sun et *al.* (2011) name eight ECs identified by former research including opportunity identifying, interpersonal skills and organising.

Quite a few scholars focused attention on ***the evolution of ECs*** (e.g. Alvarez and Busenitz, 2001; Arthours and Busenitz, 2006; Beckman, 2006). Indicatively, Ireland et *al.* (2003) indicate that ECs are formed by the abilities of managers to strategically structure resource portfolios and bundle resources in unique ways. Research has further extended to the exploration of the entrepreneurial capabilities' ***contribution to firm performance*** (e.g. Kimberly, 1980; Eisenhardt & Martin, 2000; Barney & Arikan, 2001; Sirmon, Hitt & Ireland, 2003). Entrepreneurial capabilities were also connected to entrepreneurial leadership, thus the ability to guide the strategic management of resources by others in both opportunity and advantage seeking (e.g. Ireland, Hitt and Sirmon, 2003; Covin and Slevin, 2002). Another stream of literature has also turned attention to international entrepreneurship and entrepreneurial capabilities (e.g. Autio et *al.*, 2000; Sapienza et *al*., 2006; Weeravardena et *al.,* 2007).

2.2.5.b Two different but parallel approaches: bricolage and improvisation

Bricolage

"Houston… We have a problem…."[18]

> *"Homer's Odyssey provides a classical example of the potential benefits of bricolage: Odysseus is a paragon of bricolage. Unlike so many of today's managers, Odysseus never complains of inadequate resources. Making do with whatever resources are available to him, he is capable of redefining useless materials into useful ones and of redefining his objective in line with the resources available."*
>
> Gabriel (2003, p.623)

Recently a quite significant stream of literature focused on the application of bricolage theory in entrepreneurship research (e.g. Baker, Miner, & Easley, 2003; Baker & Nelson, 2005; Cunha, 2005; Steffens et *al.*, 2009; Salunke et *al.*, 2013). The

[18] Apollo 13 is so far considered the most cited example of organizational bricolage (Cunha, Cunha, & Kamoche, 1999). When an explosion threatened the survival of the three astronauts onboard in space, the unplanned solution was found due to bricolage: materials available on the spaceship (e.g. plastic bags, duct tape, etc.). These were pieced together creatively, leading to an unorthodox but effective solution to the problems caused by the explosion (Rerup, 2001).

idea of bricolage was originally introduced by the anthropologist Lévi-Strauss (1966). According to his sayings, he was inspired by artist Max Ernst's collages "which built personal myths out of images borrowed from another culture . . . making these images say more than when viewed by an innocent eye". He uses it in his book *The Savage Mind* (*La Pensée Sauvage*) while discussing the difference between mythical thought and science. According to Lévi-Strauss:

> "And in our own time the "bricoleur" is still someone who works with his hands and uses devious means compared to those of a craftsman. .. It has to use this repertoire, however, whatever the task in hand because it has nothing else at its disposal"
>
> (*The Savage Mind*, pp. 16-17)

Ciborra names bricolage as "ingenious reconciliation of existing organizational mechanisms and form, picked by management according to the subjective plans and interpretations" (Ciborra, 1996, p 104). The concept was used to describe entrepreneurial activities that led to the creation of new ventures seemingly out of nothing through various processes of recombination and transformation of existing resources (e.g. Ciborra, 1992; Baker, 2000; Garud and Karnoe, 2003; Baker et *al.,* 2003).

In their highly influential article, Baker and Nelson (2005, p 33) define bricolage as 'making do by applying combinations of the resources *at hand* to new problems and opportunities' highlighting the 'socially constructed nature of idiosyncratic firm resource environments'. This article established bricolage as a core process for the acquisition, reconfiguration, integration and exploitation of firm resources and at the same time set the foundations of a theory of entrepreneurial bricolage. Resources *at hand* can be material or immaterial, collected independently of any particular reason. They compose the "repertoire" which is at the center of Lévi-Strauss's idea of bricolage; bricolage starts with the constitution of a repertoire and finishes with the return of resources to the repertoire. The "repertoire" may refer to physical assets such as available materials (Garud and Karnoe, 2003), financial capital (Lee, Lee and Pennings, 2001), human capital (Brüderl, Preisendorfer, & Ziegler, 1992), technical assets (Stuart, Hoang, & Hybels, 1999) and social capital and networks for building new ventures (Baker, Miner and Easley 2000; Baker et *al.*, 2003).

Bricolage addresses successfully the critical situations where ventures are created in cases of resource scarcity (Baker and Nelson, 2005), inadequate social and other resource buffers (Wiklund, Baker and Shepherd, 2009), or even resource constraints due to technical sophistication ((Rothaermel and Deeds, 2006). Furthermore,

constraints can refer to time and labour (Cleaver, 2002), opportunities (Ardichvili, Cardozo and Ray, 2003), institutional and market factors (Baker and Nelson, 2005) and even the global financial crisis (Senyard et *al*., 2010). Within the bricolage framework, resource constraints serve as sources of creativity and innovation. Studying six consumer Internet ventures Fisher (2012) found that all engaged bricolage in creative ways and presented significant growth in their early stages of development. In the same line, Steffens, Senyard and Baker (2012) based on a sample of approximately 700 nascent and 700 young firms found that the high-level use of bricolage leads to the development of more advantageous strategic resource positions.

In more recent studies bricolage is involved in venture creation and business growth (e.g. Baker et *al.*, 2003), market creation (Baker & Nelson, 2005), ICT (Ciborra, 2002; Ferneley & Bell, 2006; Ali & Bailur, 2007), innovation literature (Ciborra, 1996; Garud & Karnoe, 2003), organization theory (Duymedjian & Rulings 2010), technology and strategic entrepreneurship (Berchicci & Hulsink, 2006). Quite recently some scholars related also bricolage to networking and social capital; resources at hand can refer to those available though pre-existing networks (Baker et *al*., 2003; Baker, 2007; Duymedjian and Ruling, 2010; Burgers et *al.*, 2013).

A very small number of researchers have recently (almost after 2010) started to view ***bricolage as capability*** (e.g. Duymedjian and Rüling, 2010; Gundry et al., 2011; Salunke et al., 2010). Jones et *al*. (2010) claim that bricolage is a dynamic capability that sustains the renewal and reconfiguration of the resource base. "Bricolage capability" is further used by Hirsch-Kreinsen (2013) to describe a specific capability observed in low-tech industries which enables the synthesis of knowledge from many fields for the achievement of long-term advantages. However there are some cases where "bricolage capability" is rather indifferently used with the term alone (i.e. bricolage) such as in the works of Makitalo-Keinonen,et *al*. (2011) and Teoh (2012).

Improvisation

No, improvising is wonderful. But, the thing is that you cannot improvise unless you know exactly what you're doing.
Christopher Walken (actor)

Besides bricolage, improvisation is another issue related to resources and entrepreneurship by many authors (e.g. Miner et *al*., 2001; Weick, 2002; Baker et *al.*, 2003; Baker and Nelson, 2005; Hmieleski and Corbett, 2006; Jones et *al*., 2010).

Improvisation is understood as the convergence of design and execution (Baker et *al.*, 2006; Moorman and Miner, 1998). Weick (1993, 2001) defined improvisation as the spontaneous and creative process of attempting to achieve an objective in a uniquely new way. It refers to conscious choices rather than random behaviors to depart from a planned strategy or a routine, entails spontaneity and real-time information, is process-oriented and represents teleological and evolutionary change (Crossan et *al.*, 2005; Vera & Crossan, 2005; Cunha & Cunha, 2003). There is a vast literature on improvisation and an impressive number of definitions (e.g. Bastien and Hostager, 1988; Weick, 1993, 1998; Moorman and Miner, 1995, 1998; Eisenhard and Tabrizi, 1995; Ciborra, 1996; Kamoche and Cuhna, 1997, 1998; Crossan, 1997; Barret, 1998; Vera and Crossan, 2005; Hmieleski and Corbett, 2006, 2008).

Cunha et *al.* (1999) and Leybourn (2007) provide enlightening and comprehensive reviews of the emerging 1990s improvisation literature. Building on early philosophical ideals from Ryle (1979), and more organizationally oriented work within Weick (1979), theory development in improvisation was divided into first, second, and third generation articles:

The *first-generation* authors grounded their studies exploring the phenomenon within jazz music[19] and theater, utilizing metaphorical approaches to transfer characteristics and adapt to organizations. Such improvisation is usually extemporaneous, unexpected and unplanned (Ciborra, 1999).

Second-generation moved away from arts to organizational contexts using grounding theory to build definitions and lay foundations for further research (Weick, 1993 and 1998; Kamoche and Cunha, 1997 and 1998; Moorman & Miner, 1998; Crossan & Sorrenti, 1997; Hatch, 1999; Crossan, 1998; Vera and Crossan, 2005).

The music metaphor further encouraged empirical evidence in business and organizations to be used in furthering the concept of organizational improvisation *(third stage)*. Improvisation now is categorized as collective versus individual,

[19] Although relative literature has connected mainly jazz with improvisation, improvisation was the major technique used by the aoidoi (classical singers and poets) in Ancient Greece. These performers gave public performances of memorized poetry, including such works as Homer using a technique between singing and speech. The ways and techniques of improvisation were taught by teachers or older aoidoi to students (future aoidoi). Rhapsodoi, the successors of aoidoi, did not improvise (Plato's Ion, Samara and Tsipousis, 2012).

product versus process, and behavioral versus cognitive (Moorman & Miner, 1998; Miner et *al.*, 2001).

Studying the suitable conditions for improvisation scholars included experimental culture, minimal structure, and a low procedural memory (Barrett, 1998; Weick, 1998; Eisenhardt & Tabrizi, 1995). However, a rich number of factors have been described as antecedents driving organisational improvisation; indicatively. the cognitive ability of the managers (Crossan and Sorrenti, 1997; Leybourne and Sadler-Smith, 2006), high-risk taking, self-confidence and experimental culture (Chelminski, 2007; Leybourne and Sadler-Smith, 2006), organisational structure (Cunha et *al*., 1999; Moorman and Miner, 1998) and information processing (Vera and Crossan, 2005) to name a few. In recent times, much attention has been also focused on the impact of environmental turbulence on improvisation, due to new technologies, changing preferences and competitive intensity (e.g. Moorman and Miner, 1998b; Cunha et *al.*, 2003, Vera and Crossan, 2005; Cunha and Cunha, 2006). Actually, there is a growing body of both theoretical and empirical research which addresses improvisation as an important organizational process (Crossan, 1998; Moorman and Miner, 1998a,b; Hatch, 1997, Weick, 1993b) especially in conditions of high uncertainty (e.g. Mintzberg and McHugh, 1985; Weick, 1987; Moorman and Miner, 1998a).

Entrepreneurship is one of the areas where improvisation is emerging as a useful and elemental factor especially in cases of opportunity exploitation and new-firms founding (Baker et *al.*, 2003; Baker and Nelson, 2005; Hmieleski and Corbett, 2003, 2006, 2008; Miner et *al*., 2001;Weick, 2002; Chen and Ma, 2005). Baker, Miner and Easley (2003) studied the nascent activities of 68 knowledge-based start-ups proving both theoretically and in practice that improvisation and bricolage should be added in the "vocabulary of entrepreneurial action".

Contrasting bricolage, improvisation has been confronted as a type of competence or capability (e.g. Crossan, 1998; Cunha et *al*., 1999; Brown & Eisenhardt, 1997; Weick, 1998). Besides the general belief that improvisation and routines are almost antonyms in management due to the repetition basis of the second ones, improvisational capabilities have also been claimed to imply a reconfiguration of routines and knowledge through an interaction of freedom and structure (Baker, 2003;

Vera & Crossan, 2007). Some authors even consider improvisation as a dynamic capability (Cunha et *al.,* 2007; Zahra, 2011) especially in early-phase entrepreneurship (Boccardelli and Magnusson, 2006). On the other hand, Pavlou and Sawy (2007) distinguish between dynamic and improvisational capabilities as two distinct means for adapting to turbulent environments.

An epilogue on entrepreneurial capabilities

The recent focus on entrepreneurial capabilities in entrepreneurship research has proved an important step forward in the exploration of the "hows" and "whys" of entrepreneurship; in other words the abilities and resources required for effective entrepreneurial activity (Foss et *al*., 2006). However, so far, most definitions and studies have viewed entrepreneurship from a strictly individual level of analysis producing a *panspermy* of properties arbitrarily named 'entrepreneurial capabilities'. Lanza and Passareli (2013) claim that research is far too limited concerning capabilities and entrepreneurial settings especially in the founding stage and the initial development of a firm. An important limitation is the concentration of efforts on large and well established organizations neglecting small firms. Regarding the last area, the majority of existing studies rest on personal skills, traits, and tacit knowledge of the entrepreneurs (e.g. Lant, 2003)

Especially since the new millennium, management scholars have begun to recognize the value of incorporating entrepreneurship into strategic management research, (e.g., Alvarez and Busenitz, 2001; Alvarez & Barney, 2004; Hitt, et *al*., 2001). Yet, up to date there are not any significant efforts to relate an integrated capabilities framework with the early stages of firm creation and development, (especially in low-tech sectors). The few efforts to touch upon capabilities creation turn to high tech sectors (e.g. Boccardelli and Magnusson, 2006; Zahra et *al.,* 2006). In their paper, Ethiraj et al. (2005) state the uncertainty about this subject: "Although there are a number of theoretical arguments about the characteristics of resources or capabilities that yield competitive advantage […] and what prevents their imitation […], we have limited understanding of where capabilities come from or what kinds of investment in money, time, and managerial effort is required in building them." Paradoxically strategists seem to neglect the process by which resources are discovered, turned from inputs

into heterogeneous outputs, and exploited in order to create a new business. Perhaps the only effort to present a coherent approach of the entrepreneurial capabilities is the one of Zahra (2011) who describes entrepreneurial capabilities as the entrepreneurial element of a firm's dynamic capabilities and explains their role to game changes that alter the competitive arena. Still it is only a theoretical approach which does not address or explain the vulnerable and resource-limited stages of start-ups.

2.2.5. c Dynamic Capabilities and their relation to entreprneurship

The dynamic capabilities perspective has emerged as a major stream in the field of strategy research over the past 20 years (e.g. Teece, 2007; Eisenhardt and Martin, 2000; Di Stefano et *al*., 2010). Since the seminal work of Teece, Pisano, and Shuen (1997) on dynamic capabilities, the topic has become one of the most active research areas in the field of strategic management research. It actually focuses on the competitive advantage that is provided by a certain resource constellation over time to fit changing business environments. Dynamic capabilities refer to the capacity of an organization to "purposefully extend, create, or modify its resource base, enabling the firm to achieve evolutionary fitness through adaptation to and/or shaping of the external environment" (Helfat et *al*., 2007). 'Creating' a resource includes obtaining new resources through acquisitions and alliances as well as through innovation and entrepreneurial activity. 'Extending' a firm's resource base may be promoting growth in an ongoing business. 'Modifying' a resource base includes any reaction to change, e.g. a response to external environment shifts.

Teece, Pisano and Shuen in their landmark article of 1997 proposed the dynamic capabilities framework which enables organizations to renew competencies and strategically manage the internal and external organizational skills, routines and resources required to maintain performance in the face of changing business conditions. According to literature, the Dynamic Capabilities framework can be understood as building on the RBV; answering the question on resources' origins, Teece et al. (1997) defined dynamic capabilities as "the firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments." Their definition was subsequently followed by several alternative conceptualizations (e.g. Eisenhardt and Martin, 2000; Zollo and Winter, 2002; Helfat et *al*., 2007; Teece, 2007); some were closer to RBV and others to evolutionary

economics. In his review article of 2007, Teece states "For analytical purposes, dynamic capabilities can be disaggregated into the capacity (1) to sense and shape opportunities and threats, (2) to seize opportunities, and (3) to maintain competitiveness through enhancing, combining, protecting, and, when necessary, reconfiguring the business enterprise's intangible and tangible assets". However, in spite Teece's explications, there is still a significant variation in terms of nature, role and context, while no concise or comprehensive definition of dynamic capabilities has been reached yet. Table 2.6 presents a brief, indicative overview of main definitions.

Table 2.6: Key Definitions of Dynamic Capabilities

Study	***Definition***
Leonard-Barton, (1992)	Dynamic capabilities thus reflect an organization's ability to achieve new and innovative forms of competitive advantage given path dependencies and market positions
Teece & Pisano (1994)	The result of a firm's individual history and therefore they have to be developed and cannot be bought
Teece, Pisano, & Shuen (1997)	The firm's ability to integrate, build and reconfigure internal and external competences to address rapidly changing environments.
Helfat (1997)	The subset of the competences/capabilities which allow the firm to create new products and processes and espond to changing market circumstances
Eisenhardt & Martin (2000)	Dynamic capabilities are 'The firm's processes that use resources – specifically the processes to integrate, reconfigure, gain and release resources – to match or even create market change. Dynamic capabilities thus are the organizational and strategic routines by which firms achieve new resources configurations as markets emerge, collide, split, evolve and die' (pp. 1107).
Zollo (2000)	A dynamic capability is a learned and stable pattern of collective activity through which the organization systematically generates and modifies its operating routines in pursuit of improved effectiveness
Zahra and George (2002)	Dynamic capabilities are essentially change-oriented capabilities that help firms redeploy and reconfigure their resource base to meet evolving customer demands and competitor strategies
Zollo & Winter (2002)	A dynamic capability is a learned and stable pattern of collective activity through which the organization systematically generates and modifies its operating routines in pursuit of improved effectiveness' (p. 340).
Winter (2003)	Dynamic capabilities 'are those that operate to extend, modify or create ordinary capabilities' (p. 991).
Zahra, Sapienza, & Davidsson (2006)	DCs are 'the abilities to reconfigure a firm's resources and routines in the manner envisioned and deemed appropriate by its principal decision-maker' (p. 918).
Helfat et al. (2007)	'the capacity of an organization to purposefully create, extend or modify its resource base'. (p.1)
Wang and Ahmed (2007	,Dynamic capabilities are 'a firm's behavioural orientation constantly to integrate, reconfigure, renew and recreate its resources and capabilities and, most importantly, upgrade and reconstruct its core capabilities in response to the changing environment to attain and sustain competitive advantage' (p. 35)
Teece (2007)	Dynamic capabilities can be disaggregated into the capacity (a) to sense and shape opportunities and threats, (b) to seize opportunities, and (c) to maintain competitiveness through enhancing, combining, protecting, and, when necessary, reconfiguring the business enterprise's intangible and tangible assets (p. 1319)

Augier and Teece (2009)	The ability to sense and then seize new opportunities, and to reconfigure and protect knowledge assets, competencies, and complementary assets with the aim of achieving a sustained competitive advantage.
Barreto (2010)	The firm's potential to systematically solve problems, formed by its propensity to sense opportunities and threats, to make timely and market-oriented decisions, and to change its resource base
Pavlou and El Saw y (2011)	Capabilities that help units extend, modify, and reconfigure their existing operational capabilities into new ones that better match the changing environment
Protogerou, Caloghirou, and Lioukas (2012)	Higher order capabilities that allow firms to exploit existing lower order capabilities and more importantly to identify and acquire new technological and/or marketing capabilities

Quite recently, Teece (2007) presented three clusters of activities and adjustments which he named micro-foundations of dynamic capabilities: sensing, seizing and reconfiguring. According to his terminology sensing refers to the identification and assessment of an opportunity ; seizing is the resource mobilization such as selection of business models investing in technology and brand management in order to address opportunities and capture value; and reconfiguring capabilities are useful in asset ‘‘orchestration’’ for a continued renewal. Reconfiguration can be accomplished through changing organizational structures, managing strategic fit and achieving incentive alignment.

The dynamic capabilities framework proved to be a fruitful field for both theoretical and empirical research and discussions on the types of processes that constitute a dynamic capability (e.g. R&D by Helfat, 1997), acquisitions (e.g. by Karim and Mitchel, 2000), product innovation (e.g. by Danneels, 2002) and absorptive capacity (e.g. by Zahra and George, 2002) among others). Considering their **role and nature,** dynamic capabilities have been mostly approached as **processes and routines** that focus on change regarding resources, processes, operating routines and capabilities (e.g. Eisenhardt and Martin, 2000; Zollo and Winter, 2002; Winter, 2003; Zahra et *al.*, 2006; Teece et *al*., 1997; Helfat et *al.*, 2007; Baretto, 2010). DCs are characterized as “higher level” capabilities since they change “ordinary” or “zero-level” capabilities. However there is much discussion on the role and nature; indicatively, according to Eisenhardt and Martin, although dynamic capabilities can be considered as valuable and rare at the same time they are equifinal (i.e. similar across firms in terms of their key attributes) and therefore are neither inimitable nor immobile. Therefore, dynamic capabilities cannot be themselves a source of sustainable competitive advantage (Protogerou et al., 2005).

An important issue which presents a significant variation in the relevant literature regards the kind of **external business environments** that are relevant to dynamic capabilities: researchers have not yet reached a consensus on the role and usefulness of DCs in environments of varying degrees of dynamism (Zahra et al., 2006; Barreto, 2010). There are those who clearly suggest that the nature of DCs make them synonymous with highly dynamic environments (e.g. Teece et *al.*, 1997; Zollo and Winter, 2002; Teece, 2007). A number of scholars acknowledge the applicability of the concept also in environments subject to lower rates of change (Protogerou et al., 2012; Protogerou, Caloghirou and Karagouni, 2014; Zollo and Winter, 2002; Eisenhardt and Martin 2000; Helfat et *al.*, 2007; Ambrosini et *al.,* 2009). Eisenhardt and Martin (2000) assigned DCs in "moderately dynamic" markets, where "change occurs frequently, but along predictable and linear paths." Finally, some simply choose not to include specific environmental characteristics in their line of research/argument (e.g. Makadok, 2001; Carpenter, Sanders, & Gregersen, 2001; Danneels, 2008; Karim, 2006).

The genesis and evolution of DCs constitutes also a debate issue. It has been mainly assigned to learning and learning mechanisms (e.g. Winter, 2000; Hitt, Ireland, Camp et *al.*, 2001; Zollo and Winter 2002; Zahra and Filatotchev, 2004). Eisenhardt and Martin (2000) suggested repeated practice, past mistakes, and experience as the main mechanisms, while Zahra et *al.* (2006) added several other mechanisms such as trial and error, improvisation and imitation especially for new ventures.

A core issue among scholars has also been the impact of dynamic capabilities on firm **performance**[20] (Protogerou et *al.,* 2012). Early proposals clearly adopted an almost tautological relationship with firm performance due to the assumption that DCs explain competitive advantage and private wealth creation (Teece et *al.*, 1997; Makadok, 2001; Zollo and Winter, 2002). Several empirical studies reported this direct relationship such as Garcı´a-Morales and Llorens-Montes, 2007; Kor and Mahoney, 2005; and Zhang, 2007. In contrast, several scholars (e.g. Eisenhardt and Martin, 2000; Helfat and Peteraf, 2003; Winter, 2003; Zott, 2003; Zahra et *al*., 2006; Easterby-Smith et *al.,* 2009, among others) question this direct link suggesting that competitive advantage does not stem from dynamic capabilities *per se.* Protogerou et

[20] Although it is beyond the scope of the present thesis, we should mention that there is significant variation regarding performance and its measures; relevant studies consider different types of performance such as economic, innovative, technology, environmental and international performance (for more see Protogerou et *al,* 2005, 2008, 2011, 2012 and Eriksson, 2013).

al. (2011, 2012) have empirically proved indirect links, with dynamic capabilities to be antecedents to functional competences which -in turn- impacted performance in significant ways for both higher and lower levels of environmental dynamism. Macpherson et *al.* (2004) link the outcomes of DCs to firm growth through the mediating factors of opportunity recognition and opportunity exploitation, and thus connecting DC indirectly to performance within an entrepreneurial framework. In sum, the indirect approach appears to dominate slightly in the empirical studies. Dynamic capabilities build and reconfigure resource positions (Eisenhardt and Martin, 2000), zero-order capabilities (Winter, 2003), operational routines (Zollo and Winter, 2002), operational capabilities (Helfat and Peteraf, 2003) or functional competencies (Protogerou et *al.*, 2012) and, through them, affect performance and competitive advantage.

Table 2.7 Traditional View and New View of Dynamic Capabilities
(adapted from Eisenhardt and Martin, 2000)

		Traditional View of Dynamic Capabilities	New View of Dynamic Capabilities
1	**Definition**	Routines to learn routines	Specific organisational and strategic processes (e.g. product development, strategic decision making) by which managers alter their resource base
2	**Heterogeneity**	Idiosyncratic (i.e. company specific)	Commonalities (i.e. best practice) with some idiosyncratic details
3	**Pattern**	Detailed, analytic routines	Depending on market dynamism, ranging from detailed, analytic routines to simple, experimental ones
4	**Outcome**	Predictable	Depending on market dynamism, predictable or unpredictable
5	**Competitive Advantage**	Sustained competitive advantage from principles of RBV as applied to dynamic capabilities	Competitive advantage from valuable, somewhat rare, equifinal, substitutable, and fungible dynamic capabilities

Till recently, all research efforts had been towards a very **precise type of firms** and namely, on multinationals (e.g. Teece, 2007; Zollo and Winter, 2002), FDIs (e.g. Pitelis and Teece, 2010) and more generally, large, well-established companies operating in high-tech sectors, single national contexts and especially large developed countries or, more often, sectoral contexts such as Ellonen et *al.* (2009) and Tikkanen (2010) among others. Such choices stemmed from the assumption that high-tech environments are characterized by rapid technological change while large firms

correspond to adequate organizational structures and own the required resources to develop and exercise dynamic routines (Danneels, 2002; Zahra et *al.*, 2006; Newey and Zahra, 2009; Boccardelli and Magnusson, 2006). Teece (2007) himself stated that his framework is suitable for multinational companies in international environments. However, there are a few studies referring to the size of companies (Kale & Singh, 2007, Salvato, 2003, Doeving & Gooderham, 2008). Caloghirou et *al.* (2004), for example, attempted a first approach of the size question, considering the impact of firm-specific assets and capabilities on both SMEs and large firms. Lately research has drawn attention on public sector organizations (e.g. Pablo et *al.*, 2007), new firms (e.g. Zahra et al., 2006), SMEs (Jantunen, 2005; Borch and Madsen, 2007; Rafailidis and Tselekidis, 2009; McKelvie and Davidsson, 2009; Foss et *al.*, 2010; Wang and Shi, 2011; Abro et *al.*, 2011; Salvato, 2003) and micro firms (Telussa et *al.*, 2006; Doeving & Gooderham, 2008).

A small but quite significant stream of empirical research starts shifting focus on the role of DCs in mature traditional industries in both cases of start-ups and established firms (Salvato et *al. ,* 2003; Borch and Madsen, 2007; Rafailidis and Tselekidis, 2009; Evers, 2011; Karagouni and Kalesi, 2011; Karagouni and Protogerou, 2013). These efforts address several issues, such as DCs development, the relationship between dynamic capabilities and firm performance, the role of DCs in achieving competitive advantage at the international level and their impact on innovative performance (Evers, 2011; Kuuluvainen, 2011; Quentier, 2011)[21].

Finally, there is a just arising interest in testing and confirming the applicability of the dynamic capabilities concept in multiple national contexts exhibiting different constraints and characteristics (Easterby-Smith et *al.* 2009). Protogerou and Karagouni (2012) found that DCs can be present in newly-established and mainly micro and small firms of the high, medium and low-tech industries as well, applying an empirical analysis to a large number of firms operating in ten European countries and thus confirmed the generalizability of their results in different national contexts.

Entrepreneurship and Dynamic Capabilities:

According to literature, dynamic capabilities used in entrepreneurial settings constitute a significant research question. Indicatively, Helfat and Peteraf (2003) had already claimed that an organization in the founding stage cannot have any DCs. In

[21] The subject will be developed in more detail in a relative subsequent chapter

their paper "Dynamic capabilities in Early–phase entrepreneurship", Bocardelli and Magnusson (2006) argue that resource-based theories have rarely considered the early stages of firm development; they suggest that earlier proposed DC frameworks need to be modified, by taking into account the single entrepreneur as a source of dynamic capabilities, and by introducing the concept of resource flexibility.

Most DC theorists actually drew a distinguishing line between entrepreneurial and dynamic capabilities highlighting the insufficiency of entrepreneurial capabilities after the first stages of a new venture and suggesting DC development as an important complement to the earlier foundation. However, only one year later, Helfat et *al.* (2007) recognized that "Creating, adapting to and exploiting change is inherently entrepreneurial" and Teece (2010), added *creative managerial and entrepreneurial acts* in his famous micro-foundations, calling for studying 'entrepreneurial management' to understand how sensing and seizing opportunities arise (Felin et *al.*, 2012). Drawing back on the work of Penrose (1959), Zahra et *al.* (2006) ascribe the creation and use of DCs to the entrepreneur, the entrepreneurial team, or the firm's senior management's *perception* of opportunities, *willingness* for changes and *ability* to implement them. Teece (2007) also recognizes the power of human beings and that *no all are processes*: "In regimes of rapid technological innovation, it is clear that making investment choices requires special skills not ubiquitously distributed amongst management teams".

In 2008 Augier and Teece (2008) accept the conjunction of managers and entrepreneurs underlying that entrepreneurial management is no more an oxymoron: *The manager/entrepreneur must articulate goals, help evaluate opportunities, set culture, build trust, and play a critical role in the key strategic decisions. Clearly, the role of the entrepreneur and the manager overlap to a considerable extent. Especially in the case of new or expanding firms, the entrepreneur does not face an abstract capital market. ..[They are] much closer to Schumpeter's entrepreneur than to the entrepreneur of current neoclassical theory.*

In 2012, Teece, father of the dynamic capabilities framework, establishes entrepreneurial managerial capitalism, providing more tight connections among dynamic capabilities and entrepreneurship.

> Entrepreneurial managerial capitalism involves calibrating opportunities and diagnosing threats, directing (and redirecting) resources according to a policy or plan of action, and possibly also reshaping organizational structures and systems so that they create and address technological opportunities and competitive threats …. Although some elements of dynamic capabilities may be

> embedded in the organization, the capability for evaluating and prescribing changes to the configuration of assets (both within and external to the organization) rests on the shoulders of top management.

He actually connects his three micro-foundations to entrepreneurship

> Entrepreneurship is about sensing and understanding opportunities *(A/N[22] sensing),* getting things started *(A/N seizing)*, and finding new and better ways of putting things together *(A/N reconfiguring)*.
>
> *Teece, 2012*

It is evident that the interest of researchers on the interrelation of DCs and entrepreneurship which started in the mid 2000s is growing quite rapidly (Eriksson, 2013). It is also quite interesting that a considerable amount of literature concentrates on suggestions with no empirical or even –sometimes- theoretical grounding. For example, Sapienza et *al.* (2006) assume that SMEs and new ventures need unique and dynamic capabilities in order to survive grow and reap the benefit of their innovation. Newbert (2005), based on a study of 817 US nascent entrepreneurs, sees firm formation process as a dynamic capability, defined as the "organizational and strategic routines by which firms achieve new resource combinations". For Telussa et *al.* (2006) new firms start usually as micro or small ones, encountering resource weaknesses and therefore need dynamic capabilities to reconfigure their resource base as needed ; yet, this assumption is still empirically unexplored.

Works further explore the role of DCs in new firms' survival and performance in international markets (Sapienza et *al.*, 2006; Sapienza et *al.*, 2010; Jantunen et *al.,* 2005) or regarding family businesses (Chirico and Nordqvist, 2011). Drnevitch et *al.* (2008) examine the positive and negative contributions of capabilities to relative firm performance as well as the effects of environmental dynamism. Wu (2005) explores dynamic capabilities and performance in a dynamic environment using data from 244 Taiwanese information technology firms and Hong et *al.* (2010) explore the relationship between a firm's entrepreneurial orientation, its reconfiguring capabilities and its performance using survey data on about 500 firms in Central China.

Findings are quite interesting and add to theory on both DCs creation and development and their direct or indirect impacts on new ventures (e.g. Stam et *al.,* 2007). For example Boccardelli and Magnusson (2006) referring to the high-tech sector of mobile internet argue that "dynamic capabilities can exist already at the

[22] A/N abbreviation for Author's Note

outset of a venture, then however residing primarily in the few individuals constituting the entrepreneurial team and not always throughout the organization".

While the majority of existing empirical studies seem to focus on high-tech sectors, a few researchers choose to explore DC-new venture relationships in **traditional sectors**. For example, Telussa et *al.* (2006) uses a sample of mostly low and medium-tech firms to explore the association between dynamic capabilities and new firm growth. Ren et *al.* (2010) explore how 127 new cutlery firms within a cluster applied the DCs framework to convert their resources into performance. Questioning the origins of dynamic capabilities in new ventures of traditional sectors (up to 10 years old), Karagouni (2011) proposed that entrepreneurial capabilities such as bricolage and improvisation are important antecedents of dynamic capabilities. Francesco Chirico (2007) contacts a comparative research among Italian and Swiss companies of the beverage sector to offer new insights through the DC lens on their knowledge-based origins and their impact on entrepreneurial performance of family business.

In recent years, there has been a sharp rise in research papers, special issues, dedicated book units and workshops throughout the world on dynamic capabilities. However, regarding newly-founded firms and entrepreneurship so far, there is plenty room for further exploration and development. More specifically, there is little to no research on whether dynamic capabilities exist, assist, are vital or are absent during venture creation. Furthermore, empirical investigation is rather limited and mainly based on case studies with most arguments pending empirical confirmation. Pablo et *al*. (2007, p 690) emphasize that 'while the dynamic capabilities framework is drawing support and increased validity by researchers, empirical studies of dynamic capabilities remain relatively rare'. That is even more evident in cases of new firms belonging to low-tech sectors especially for the sensitive period of venture creation. Perhaps Protogerou, Caloghirou and Karagouni (2013) is one of the few efforts to answer the question of whether young entrepreneurial ventures in low-tech sectors develop dynamic capabilities and how such capabilities may benefit these firms' performance, using rich quantitative and qualitative data.

The need to rethink the dynamic capabilities framework is further amplified when the concepts and notions of knowledge intensive entrepreneurship and traditional industry are also engaged.

2.2.5.2. d Dynamic Entrepreneurial Capabilities

According to literature, the dynamic capabilities perspective includes the capacity to *create* a resource base and not just to modify and extend it, providing a sound conceptual framework for understanding competitive dynamics (Helfat, 2007). Based on the fact that DCs help firms not only react to, but also create market changes, Zucchella and Scabini (2007) compare dynamic and entrepreneurial capabilities in their thorough study on international entrepreneurship. The authors conclude that the latter concept is broader including individual-level capabilities necessary to take initiatives within the firms. These tendencies although not clearly stated, have prepared a more unrefined view of dynamic capabilities, where new terms have been so far proposed such as dynamic managerial capabilities (Adner and Helfat, 2003) and dynamic marketing capabilities (Bruni and Verona, 2009). Therefore, instead of the distinguishing lines between entrepreneurial and dynamic capabilities (e.g. Arthurs and Busenitz, 2006) it was quite obvious that more research was needed in the area that regards the relationships of the two categories of capabilities as well as their genesis (Ambrosini and Bowman, 2009).

Very recently (almost after 2010), a very small number of scholars try to examine the relationship between firms' entrepreneurial capabilities and more precisely in cases of opportunity recognition and exploitation and their dynamic capabilities (e.g. Aramand and Dave, 2012). In order to find out the ways of DC development during the process of venture creation, Corner and Wu (2012) concentrate on the resource issue (following Helfat et *al.*, 2007) and define dynamic entrepreneurial capabilities (DECs) as *the capacities that entrepreneurs use to identify, amass, integrate and reconfigure the resources needed in the creation of new ventures.* Contacting a single case study in China, the authors define two DECs which seem to be required to change the venture over time through reconfiguring resources and crucial for new venture's survival; *prospecting problems* and *revealing technology.* The authors claim that their findings illuminate the genesis of DCs and illustrate their idiosyncratic nature.

Quite the same time, Lanza and Passarelli (2013, 2014) view DECs in a quite different way; *dynamic entrepreneurial capabilities are peculiar higher order capabilities in small business settings, usually with limited resources, which enable product innovation and technological change*. They "enact, develop, refine, and routinize specific entrepreneurial features such as personal skills and psychological

traits, usually based on tacit knowledge and emotional features of individuals into firm-based processes, organizationally embedded and structured in a quasi-repetitive and patterned fashion". The authors adopt a "corporate entrepreneurship" context exploring a case of major technological change in an established small company of the glass industry. However, they do not describe their DECs or give any dimensions. It seems that, for them, DECs reflect the ability of SMEs to enact, integrate and transform the so-called (by them) substantive entrepreneurial capabilities (i.e. distributed entrepreneurial insights, entrepreneurial heuristics and entrepreneurial flexibility) into patterned firm-based processes.

According to our best of knowledge these were the first efforts to define "Dynamic Entrepreneurial Capabilities" without being able to know which one was actually presented first[23]. Both efforts are based on limited empirical research (one case study), reflect rather very specific cases and thus cannot be applied in general. Furthermore, in both works, DECs lack precise definitions, measures and dimensions, while there is not a coherent explanation of DC genesis. However, they are the very first efforts to connect entrepreneurial to dynamic capabilities and explain their genesis and impact on venturing. Furthermore, Augier and Teece (2009) provided a conceptual lens that focuses on the importance of the "**entrepreneurial" dynamic capabilities** of top managers, while Teece (2012) discusses the differences among dynamic capabilities and "enterprise-level dynamic capabilities". The author states the difference between entrepreneurial action and routine and admits that not all strategic actions can be replicated or fully routinized.

> Creative managerial and entrepreneurial acts (e.g. creating new markets) are, by their nature, strategic and non-routine, even though there may be underlying principles that guide the choices. Enterprise-level dynamic capabilities, in other words, consist of more than an aggregation of routines. Routines identify how projects are run, but not necessarily how projects are identified, prioritized, and selected. For example, strategizing and asset orchestration (identifying complementarities, buying or building missing assets and then aligning them) can only be routinized in a limited sense. Many strategic actions and transformations require actions that one may never replicate.
>
> *Teece, 2012*

The term "dynamic entrepreneurial capabilities" or "entrepreneurial dynamic capabilities" has been also used in some papers in a rather indifferent way (e.g. Agbim, 2013; Corner and Kearins, 2013; Gabrielsson, Gabrielsson, & Dimitratos, 2014; Kearney and Morris, 2015; Lee and Slater, 2007; Batjargal, 2000; Chirico,

[23] Both views were presented in conferences before (e.g. Lanza and Passarelli's view in 2009)

2008, 2010). On the other hand Katzy, Dissel and Blindow (2003) identified *incubating* and *grafting* as two dynamic capabilities supporting the entrepreneurial venturing process. Likewise, Woldesenbet et *al*., (2012) examined the capabilities that allow 18 small firms to operate as suppliers to large organizations in the public and private sectors. The authors viewed entrepreneurial capabilities as micro-foundations for dynamic capabilities involving processes and routines. However, neither study engaged in this debate of DECs.

In the same line with Katzy et *al.* (2003), Zahra (2011) tried to highlight the entrepreneurial capability as a new category of dynamic capability, placing its operation at the intersection of managers' and entrepreneurs' mindset. Zahra defines EC as the ability and the means to sense, choose, shape and synchronize internal and external conditions for the enterprises' exploration and exploitation. He goes on proposing several sub-capabilities and dimensions of ECs. The author develops a purely theoretical view claiming that it is the first attempt to distinguish entrepreneurial capabilities as distinctive (dynamic) capabilities.

Even today it is generally accepted that the debate about dynamic capabilities has reached a point where theoretical arguments should be further complemented by relevant empirical work; this is necessary for dynamic entrepreneurial capabilities too. Furthermore it seems quite necessary to distinguish between dynamic and entrepreneurial capabilities as well as find any potential relationships among them; a task not easy to accomplish as evident by relevant literature so far. Yet, there are certain lines to walk on; as Casson (2000) put it, "rule making is entrepreneurial, but rule implementation is routine". Therefore hints and indications for certain connections and relationships among ECs and DCs (thus DECs) exist and wait to be explored, specified and defined.

2.3. Knolwedge-intensive entrepreneurship

If money is your only hope for independence, you will never have it. The only real security that a man can have in this world is a reserve of knowledge, experience and ability.
Henry Ford (Automobile Manufacturer)

2.3.1. Introduction

In recent years knowledge-intensive industries are considered at the core of growth in an emerging knowledge-driven economy (e.g. Robertson and Smith, 2008). The concept of 'knowledge economy' emerges when unique knowledge is assumed to be the most valuable asset of a firm for achieving competitive advantage (e.g. Ihrig et *al.*, 2006) in all categories and sizes of individuals firms and industries. In this context, "knowledge-intensive entrepreneurship (KIE) can be understood as a necessary mechanism mediating between the creation of knowledge and innovation and its transformation into economic activity, i.e. KIE represents a core interface between two interdependent systems: the knowledge generation and knowledge diffusion system, on the one hand, and the productive system, on the other"(Caloghirou, Protogerou and Tsakanikas, 2014).

KIE is related to the establishment of new ventures or the expansion of existing ones, based on the dynamic creation and application of new knowledge and entails the Shumpeterian perspective of the the introduction of new innovative activities (Malerba and McKelvey, 2010). Known as knowledge-based entrepreneurship in the beginning of the new millennium, KIE started becoming a more concrete field in the end of its first decade; efforts for deeper exploration and conceptualation of the AEGIS project indicated a quite interesting field of entrepreneurship research.

Initially, KIE researchers had drawn the attention on firms or start-ups in new technology-based high-tech sectors. Qualitative and quantitative studies on activities such as information and communication technologies-related industries, pharmaceuticals and biotechnology have evolved in order to explore several issues regarding the KIE phenomenon (Caloghirou et al., 2012). However, KIE exploration seems to be still in its infancy; for example, new firm formation remains a rather under-researched topic (not only within KIE, but the entrepreneurship literature in general according to Newbert, 2005). This is especially true regarding the so-called low-tech industries, otherwise characterized as traditional or mature, which do not usually enjoy the privilege of radical R&D-based innovation.

This chapter reviews the existing literature on the phenomenon of knowledge-intensive entreprenurhsip, the KIE-models developed so far and the role and relationship of knowledge, innovation in KIE. It also deals with the evolution and the characteristics of knowledge-intensive entrepreneurship regarding nascent and

corporate venturing covering the whole spectrum of relevant activities; i.e. from founding to competitive advantage created.

All issues that are developed in this chapter within the spectrum of KIE are such vast topics in the field of entrepreneurship that they cannot be discussed in great detail in this thesis; they are epitomized till the point that they are useful to build the right fabric for the thesis' framework development that will follow in Unit Three (3).

2.3.2. Knowledge-based entrepreneurship

Ever since antiquity many thinkers have tried to identify the role of ***"knowledge"*** *next to the role of the* ***"entrepreneur".*** As already seen in a previous section, Thales (6 c. B.C.) proved with a practical case study that knowledge is perfectly consistent with and needed for practical entrepreneurial issues. Xenophon in his famous "Economist" (Oikonomikos, 4 c. B.C.) mentions leadership, knowledge and organization as the main factors of productivity, while he questions the organization of knowledge. The (Pre) Socratians have tried to shed light on the cognitive "black box" of knowledge exploring its essence, properties and perceiving modes.

However, knowledge is described as power only in 1597 by Francis Bacon (Denton, 1998). As narrated in a former chapter, knowledge plays no role at all within neoclassical economics while it does within the Austrian School with Kirzner's definition of the entrepreneur to highlight the limitations of neo-classical economics regarding knowledge. The endogenous growth theory puts further emphasis on the endogenous role of knowledge, incorporating it in static and dynamic models (Romer, 1990; Lucas, 1988; Krugman, 1991).

Actually, knowledge became of great importance apparently after the Second World War; by then there was a shift of focus from traditional factors such as land and capital to intellectual capital and the gradual abandonment of the primary sector. Later, the further shift *"from the industrial age into the information age*" (Bohn, 1998), placed knowledge within the main interests of several authors such as Drucker (1993) who in his Post-*Capitalist Society* (1993) argued that "knowledge is the only meaningful resource today*"*. Since the beginning of the 90s an increasing number of scholars (e.g., Prahalad and Hamel 1990; Nonaka 1991; Henderson and Cockburn 1994; Nonaka 1994; Kogut and Zander 1996) claim that knowledge and the ability to create and apply it are the most important sources of competitive advantage.

Knowledge remains still a highly complex and elusive concept. A major part of its definition efforts concentrates on distinguishing the concepts from data and information (Nonaka and Takeuchi, 1995; Shankar et *al.*, 2003; Becerra-Fernandez et al., 2004). According to Boisot:

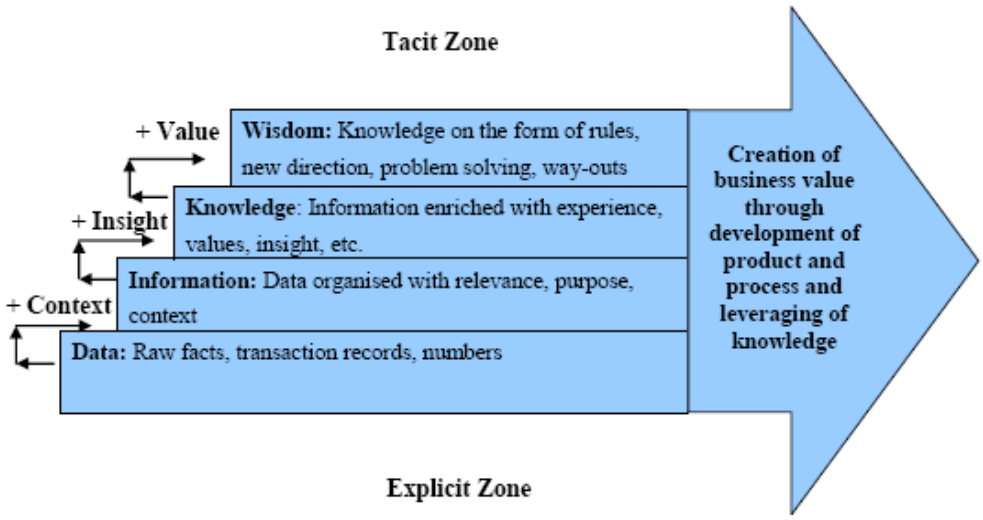
- Data – a *property of things* (discrimination between physical states)
- Information – that subset of the data residing in things that activates an agent – it is filtered from the data by the agent's perceptual or conceptual apparatus
- Knowledge – a *property of agents* predisposing them to act in particular circumstances.

In effect, *knowledge* builds on *information* that is extracted from *data*

(Boisot,1998, p.12).

Knowledge has further been **categorized in different ways**. Indicatively, Lundvall & Johnston (1994) propose four different kinds of knowledge. *"Know-what"* refers to knowledge about 'facts' and is usually called 'information'. *"Know-why"* is related to scientific knowledge often derived by universities and is extremely important for technological progress. *"Know-how"* concerns firm-level skills, and capabilities of carrying out activities in the economic area while *"know-who"* regards social relationships and networking in order to access and use knowledge. Karlsson et *al.* (2004) classified knowledge regarding its origin; *Scientific knowledge*, i.e., scientific principles as a basis for technological knowledge development, e*ntrepreneurial knowledge* that regards business-relevant knowledge about products, organization, markets, customers, etc and t*echnological knowledge* which encompasses both implicit and explicit blueprints.

Figure 2.1: Creation of knowledge-based business value



Source: Shankar et al, 2003, p. 192

Among the several types of categorization, tacit (or embodied) and explicit (or codified) knowledge seem to be the most discussable types of knowledge (e.g. Nonaka 1994; Orlikowski, 2002; Venkitachalam and Busch, 2012). Explicit knowledge can be documented, categorized and transmitted to others as information, while tacit knowledge[24] cannot be easily shared since it draws on the accumulated experience and learning of a person. Nonaka & Takeuchi (1995) provided a quite interesting definition of knowledge as '*a dynamic human process of justifying personal belief towards the "truth"*[25] and argued that tacit knowledge is the major "bottom part of the iceberg of individual knowledge' and explicit knowledge is just the visible top.

Nonaka (perhaps influenced by Polanyi's (1958) work) was the first to view the firm as a knowledge creating entity (Nonaka, 1994; Nonaka & Takeuchi, 1995; Nonaka et *al*, 2000) opening new knowledge-based perspectives in other strands such as the innovation management and organizational learning literature. According to Nonaka et *al*. (2000), firm's capability to create and utilize knowledge constitutes its most ***important source of competitive advantage***, and therefore firms should be able to create new knowledge continuously embodying it into products, services and systems. About the same period (1996), in his seminal work "Toward Knowledge-Based Theory of the Firm", Robert Grant developed the **knowledge-based view** both as a theory of organization and strategy, which has become a widely accepted knowledge-based perspective in the strategy field. According to Grant, knowledge is the single most critical resource for developing and sustaining competitive advantage by firms. Galbraith (1998) adds by describing the knowledge sector as an 'atmosphere' where innovation is important and the successful innovators have the potential of getting huge gains. The Knowledge – Based View (KBV) found a wide application in the areas of strategy and entrepreneurship, since it emphasized the strategic importance of knowledge as a source of competitive advantage for firms (Grant, 1996; Kogut & Zander, 1992; Tsai & Li, 2007). Kogut & Zander (1996) introduce *combinative capabilities* which enable the continuous recombination of knowledge bases and the application of this knowledge to new market opportunities. Grant (1996, 1996a) connects KBV with *organizational capabilities* viewing integration of expert knowledge to perform certain productive tasks as the essence of them; for him

[24] The idea of a "tacit dimension of knowledge" has been introduced by Polanyi (1958)
[25] "Knowledge is justified true belief" (Plato, Theaetetus)

organizational capabilities are responsible for the repeated performance of productive tasks in order to create value.

The emergence of the role and significance of technology in the economy, the increasing role of information and communication technologies and globalization are said to be the driving forces underling the changing nature of entrepreneurship within new contextual settings (Audretsch and Thurik 2001). In 1997, Hatzichronoglou classifies the OECD countries' industrial sectors and manufactures by level of technology using the ratio of R&D expenditure to value added and to production as sole criterion. However, he admits that other factors could also play a significant part such as scientific and technical personnel, technology embodied in patents, licenses and know-how, strategic technical co-operation between companies and the quick turnover of equipment. By then knowledge rests only in high technology industries which expand most strongly in international trade and their dynamism helps to improve performance in other sectors (spillover).

In 1999 OECD names knowledge-base industries the *high and medium-high technology manufacturing industries and services such as finance, insurance and communication* (OECD, 1999) using the amounts spent on R&D to distinguish between basic R&D, which is responsible for knowledge generation, and non-basic R&D. Respectively, knowledge economy measurements at national level equals the amount of GDP committed to basic research of higher education and public research (OECD, 1999). Although the organization has acknowledged the importance of knowledge as the driver of productivity and economic growth (OECD, 1996), sectoral categorization has remained quite unchanged (cf. OECD, 2005). However the R&D intensity indicator includes besides in-house R&D expenditures for R&D staff, further R&D costs and investments, out-house expenditures for, e.g., R&D tasks assigned to other companies and organisations (OECD, 2002:108).

The notions of knowledge and knowledge economy have appeared to be essential while forming the concept of **knowledge-based entrepreneurship** (KBE) by a number of scholars in recent years (Kanellos, 2013; Stam and Garnsey, 2007; Bishop, 2006; Witt and Zellner, 2005; Garavaglia and Grieco, 2005; Johansson, 2005). In "Hand in Hand with Entrepreneurship" (2005), a paper for KEINS project in an effort to categorize entrepreneurship, Garavaglia and Griego regarded as "knowledge-based" the type of entrepreneurship that combines the "creative" and "science-based" category. In this way the distinguished KBE from "ordinary entrepreneurship" which

relied on a mere combination of existing pieces of knowledge and "skills-based" when particular and specific entrepreneurs' skills were involved. Later, the term was connected with new firms with high knowledge intensity in their activities, which transform knowledge into innovation (Kanellos, 2013; Witt and Zellner, 2005; Johansson, 2005). Creation of new knowledge provides more entrepreneurial opportunities and is the core of value creation. Firms' assets consist more on knowledge than on physical capital and innovation becomes a "life-or-death matter" (Baumol, 2002).

Knowledge-based entrepreneurial activity relies almost exclusively on R&D and patents of new technologies (e.g. Witt and Zellner, 2005; Garavaglia and Grieco, 2005). In such cases, knowledge-based entrepreneurship was mainly represented by new start-ups (preferably run by former scientists) or innovation-based corporate entrepreneurship in high-technology sectors and mainly the ICT sector or academic entrepreneurship such as academic spin offs (Malerba and Zirulia, 2007; Malerba and McKelvey, 2010). This type of knowledge-based entrepreneurship was found to impact economic performance (e.g. Audretsch and Keilbach in Malerba, 2010), venture survival and growth (e.g. Audretsch and Keilbach, 2008; Carree and Thurik, 2008; Delmar, Wennberg and Hellerstedt, 2011; Mamede and Fernandes, 2012). Scholars also explore academic spin offs and patenting in terms of patent intensity, academic networks (e.g. Lissoni, Llerena, McKelvey and Sanditov, 2007) or effectiveness of scientific R&D (e.g. Salvador, 2011; Cantner and Kösters, 2012).

A quite popular strand of literature drew attention on the characteristics of KBE as well as features, traits and micro-dynamics of knowledge-based entrepreneurs such as experience and education level, networking and factors of success and failure (e.g. Mamede and Fernandes, 2012; Kanelos, 2013; Klepper and Sleeper, 2005; Szalavetz, 2007). According to Burger and Helmchen (2008), not only must the entrepreneurs be "knowledge-based" in the sense of innovating, but they must also be entrepreneurial in the organization of the new activity, entrepreneurial in the marketing mix and business model elaboration. The authors proposed to label "knowledge-based" entrepreneurs those entrepreneurs who meet at least two of the following conditions: (i) create new combinations (ii) create new knowledge (iii) employ knowledge developed originally in science.

A European FP6 research project called KEINS (Knowledge-Based Entrepreneurship: Innovation, Networks and Systems) attempted to explore the knowledge-based

entrepreneurship concept in depth, investigating relationships between KBE and innovation in relation to networks of alliances, information, finance and social ties and assessing KBE in different sectoral and national systems of innovation in both Western and Eastern Europe. The key to knowledge-based entrepreneurial firm for KEINS was the management of knowledge flows within the technological system (internal *and* external to the firm). KIE was related to knowledge generated by investments in R&D, embodied in high level of human capital and skills and measured by patents. KEINS looked at three types of KBE and namely start-up entrepreneurship, corporate entrepreneurship and academic entrepreneurship. The project focused on only high-technology sectors, emphasizing the role of science and technology driven entrepreneurship in growth.

2.3.3 Knowledge-intensive entrepreneurship

2.3.3.1 Defining Knowledge Intensive Entrepreneurship

Knowledge Intensive Entrepreneurship (KIE) appeared in literature with the dawn of the new millennium, in an accelerating manner[26], used interchangeably with the term of Knowledge-based entrepreneurship and no further specific definition (e.g. Madsen, Neergaard and Ulhøi, 2003; Mueler, 2007, Acs et *al*., 2007; Andrijevskaja, Mets and Varblane, 2006; Gabrielsson, Landström, and Brunsnes, 2006; Senyard et *al.*, 2008). KIE regarded again technology or science-based entrepreneurship with high R&D intensity. Indicatively, in the EC's (2006) Science *and Technology in Europe* report, knowledge-intensive sectors included only post and telecommunication, computer services and R&D.

However, there were certain efforts to relate KIE to a more general concept of knowledge; e.g. Autio et *al.* (2000) explain "a firm's knowledge intensity" by defining it as the extent to which a firm depends on the knowledge inherent in its activities and outputs as a source of competitive advantage. Furthermore, among the few exceptions regarding the KIE term was the work of Groen (2005); he defined KIE processes as the ones through which the entrepreneur based on relatively new (mostly

[26] Indicatively in Google Scholar KIE appears 51 times between 2000-2005, 317 times between 2006-2010 and 240 times during 2011-2013 (expecting a number over 4000 within the five years 2011-2015)

academically derived) knowledge or technology, sees opportunities, develops them to business concepts and exploits them.

An interesting approach before 2010 was the work of Brännback et *al.* (2003) on the nature and characteristics of KIE in biotechnology industries. The authors specify their preference in using *high knowledge intensity versus low knowledge intensity* as more appropriate than *high technology versus low technology*. In order to emphasize *knowledge* as a basis for technological innovation and new firm development, the authors define the term *knowledge intensive entrepreneurship* (KIE) as entrepreneurial activity in industries *where rapid advances in knowledge* are a key to understanding new venture creation, competitive advantage, and ultimately market. They further specify the type of knowledge intensive entrepreneurial firms; they are small, fast growing, organic, and *network-based firms,* with rapid and effective management of intensive knowledge assets and constantly developing context knowledge. However they also refer to ICT and biotechnology as KIE sectors.

A more precise KIE definition was given by Malerba and McKelvey (2010), developed in a very large EU-funded research project[27]. In this context KIE is associated with four basic characteristics and namely it concerns

- new firms (new ventures);
- that are innovative;
- engaging in activities that are knowledge intensive; and which
- are not to be found solely in high-tech industries i.e. they may well be active in industries with medium or low-tech characteristics.

According to this definition, KIE is a mechanism of translating knowledge to innovation and regards only new firms of diverse sectors. KIE ventures are responses to innovative opportunities, which can emerge from knowledge in the form of new technology, new markets or even new ways of internal or external resources exploitation. KI venture creation must be innovative in economic terms with significant dimensions of knowledge intensiveness in their activity (Malerba and McKelvey, 2010). Malerba (2010) states that knowledge intensive entrepreneurship regards the launch of new activities and organizations that intensively use existing

[27] Advancing Knowledge-Intensive Entrepreneurship and Innovation for Economic Growth and Social Well-being in Europe (AEGIS), project co-funded by the European Commission under the Theme 8 "Socio-Economic Sciences and Humanities" of the 7th Framework Programme.

scientific and technological knowledge or that intensively create new scientific and technological knowledge for commercial purposes or for bringing products to markets. The resulting innovation by KIE should go beyond the existing sectoral or product field-specific knowledge base by creating new knowledge, new ways of problem solving or new processes, products as well as new markets not applied or unknown in the industry before

Building on this definition Hirsch-Kreinsen and Schwinge (2010) specify that in KIE:

- Knowledge is the core of all entrepreneurial activities which are based on the integration and coordination of different knowledge assets and the creation of new knowledge. This characteristic differentiates KIE from KBE; there is a constant need for the development of knowledge bases through the creation of new knowledge or a recombination of existing knowledge.
- Innovative activities impact in significant ways existing economic and technological structures since they are not only new to the firm-specific knowledge but also new to the sectoral knowledge base or technology field.

The authors further place corporate venturing next to start-ups and spin-off under the KIE umbrella.

MacKelvey and Larssen (2013) adopt Malerba's definition and describe KIE as a series of decisions; agents "have to always balance new ideas and ways of doing things against existing routines". For them KIE is both a start-up venture but also defines an entrepreneurship phenomenon and the relevant processes. These processes are highly dynamic with strong feedback loops between individuals, company and society. Entrepreneurial management depends on networking and access to resources. The authors distinguish three types of knowledge relevant to KIE;

a) scientific, technological and creative knowledge
b) market knowledge related to markets, customers and users and
c) business knowledge as related to how to manage and structure firm processes.

Therefore, according to the above definitions, knowledge-intensive entrepreneurship is considered as a type of high potential entrepreneurship based on the dynamic application of new knowledge. Actually, it can be understood as a necessary mechanism mediating between the creation of knowledge and innovation and its transformation into economic activity, i.e. KIE represents a core interface between

two interdependent systems: the knowledge generation and knowledge diffusion system, on the one hand, and the productive system, on the other. (cf. Malerba, 2010; Malerba and McKelvey, 2010; Hirsch-Kreinsen and Schwinge, 2011). KIE ventures pursue innovative opportunities by purposefully and systematically utilizing knowledge in their operational activities across the whole spectrum of industries; knowledge intensive does not equate with high-tech manufacturing (Delmar and Wennberg, 2010; McKelvey and Lassen, 2013). Furthermore market success matters for KIE while technological assets are but one class of resources and capabilities needed for the successful commercialization of innovation. The rapidly increasing interest on knowledge-intensiveness indicates the important role that KI ventures can play in sectoral, local and national innovation systems by operating as problems solvers, knowledge brokers, knowledge-intensive service providers, or specialized suppliers (Protogerou, Caloghirou, Tsakanikas, 2013).

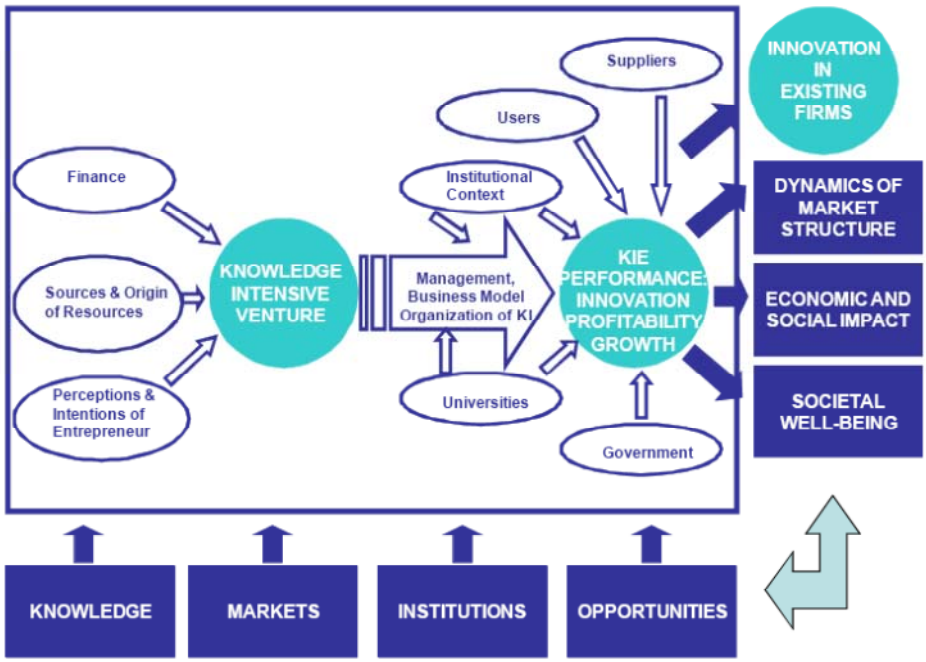
2.3.3.2 KIE frameworks and models

Malerba (2010) was probably among the first to try to distinguish KIE from the two quite related views of entrepreneurship: i.e. new technology based firms (NTBF) and entrepreneurship in high technology industries. The NTBF model suggested by Autio covers the functional role of new, technology-based firms in the "process by which generic scientific knowledge is transformed to application specific technological knowledge" (Autio, 1997, p. 266). NTBFs can utilize generic research to develop basic technologies, application specific technologies or basic technologies to specific needs and tasks. This niche orientation led to two groups of NTBFs; the *science-based* firms that develop sophisticated products of a broader application, and *engineering-based* firms for specific customer needs (Madsen, 2003; Malerba, 2010). Malerba (2010) claims that while NTBF focuses upon the technical assets, KIE turns to the translation of science and technology assets into economic value and the impact of innovation systems. On the other hand, the high-tech literature focuses upon only specific sectors, such as ICT, Biotechnology and Nanotechnology while KIE covers the whole spectrum of economic activities; however sectoral conditions impact arising opportunities of venturing and firm growth.

Within the AEGIS project, Malerba and McKelvey (2010) developed a model of knowledge intensive entrepreneurship (Figure 2.2) that brings together elements of how new ventures interact with their societal-economic context, opportunities and the

broader innovation system. According to the authors, specific pre-firm assets (finance, resources and entrepreneurial perceptions) are translated into firm performance and growth through internal management, organization and networking. The innovation system which highly affects the new venture's birth and evolvement is constituted by knowledge, markets, institutions and opportunities. KIE is actually embedded in innovation systems such as sectoral, national, regional and local ones (Malerba and McKelvey, 2010). KIE's impact regards innovation in existing firms, dynamics of market structure, economic and social impact as well as societal well-being.

Figure 2.2: The Model of Knowledge Intensive Entrepreneurship ("KIE model", ***(source: Malerba and Mc Kelvey, 2010)***



Malerba and McKelvey's (2010) "KIE model" formed the basis for decoding KIE and answer questions about type of KIE organizations, as well as how and why to link knowledge-intensive firms to broader economic and societal processes. Within the AEGIS project, taxonomies were developed while knowledge-intensive entrepreneurship was found to be:

a. strongly related to innovation.

b. sector specific.

c. not only associated with high-tech sectors but also with traditional sectors, where in many segments a rich knowledge base exists (following Smith, 2000).

d. undertaken by highly skilled individuals or groups of individuals as well as by existing organizations (spin-offs, spin-outs, corporate entrepreneurship).

e. related to networks.

f. very much dependent on the national/regional system of innovation as well on the particular configuration of the country's socioeconomic model.

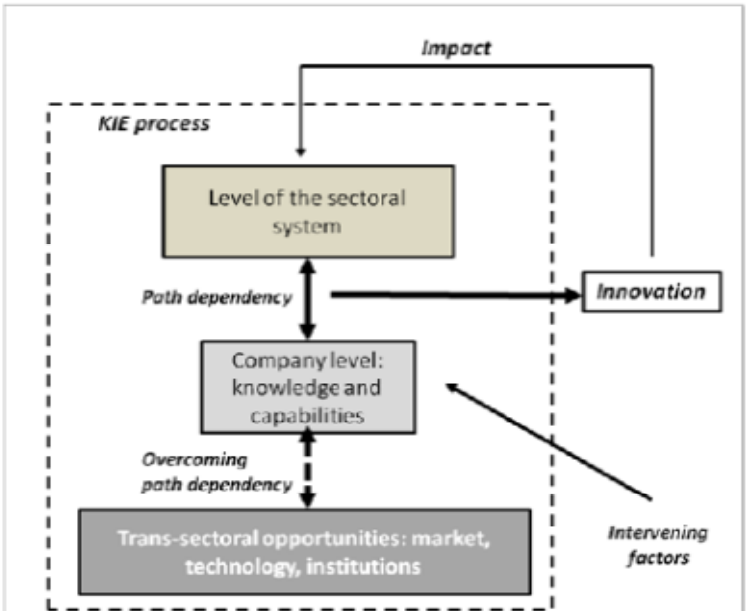
g. inextricably linked to the ability of companies to develop dynamic capabilities

h. embodied in firms that can change the industrial landscape but equally in firms that operate as knowledge brokers, problem solvers, specialized suppliers and knowledge-intensive services.

i. embodied within the social networks where knowledge is shared within 'interdisciplinary communities made up of a heterogeneous range of members' (OECD, 2004: 36)

Shifting focus on low-tech (LT) industries, Hirsch-Kreinsen and Schwinge claim that the ability of transcending the sectoral context is crucial for KIE in mature traditional industries. Knowledge generation in LT companies can be linked to knowledge beyond internal sources, derived widely from other organizations, institutions and stakeholders of relevant or non relevant sectors. As levels of R&D are very low in much of the low-tech economy, the use of distributed knowledge is the main source of new ideas and techniques. Firms "have to build up relationships with actors, resources and opportunities from outside the sector". In order to explore KIE and its contribution in low-tech industries, Hirsch-Kreinsen and Schwinge (2012) presented an LT KIE model (Fig. 2.3). The authors focus on the interdependencies between the level of trans-sectoral knowledge and company-specific capabilities for innovation to be produced and KIE to be developed.

Figure 2.3: KIE model in LT (Hirsch-Kreinsen and Schwinge, 2012)



In order to contact case study research, Lassen and McKelvey (2012) formed a suitable framework (Figure 2.4) composed of inputs and outputs of KIE as well as KIE management patterns.

Studying the three models it is evident that they are interlinked but they have quite different foci up to some degree. Lassen and McKelvey's (2012) model was rather process- oriented trying to explain how and why KIE ventures are able to manage and develop (Ljungberg, McKelvey and Lassen, 2012).

The authors refined the model further, presenting the "KIE creation model" (McKelvey and Lassen, 2013) and shifting attention to the key decision-points and processes (Figure 2.5). The new model endeavors to enable the understanding of entrepreneurship as an uncertain but structured and defined which involves individuals, venture and societal influences covering all sectors and types of KIE. McKelvey and Lassen (2013) focus on the specific role of different types of knowledge and the opportunities created and designed through interactions with the ecosystem. The authors recognize three types of knowledge relevant to KIE and namely (1) scientific, technological and creative knowledge which enables the creation of new ideas and opportunities; (2) market knowledge including customers and users; and (3) business knowledge for internal firm processes.

Figure 2.4 : Lassen and McKelvey (2012) model of KIE ventures

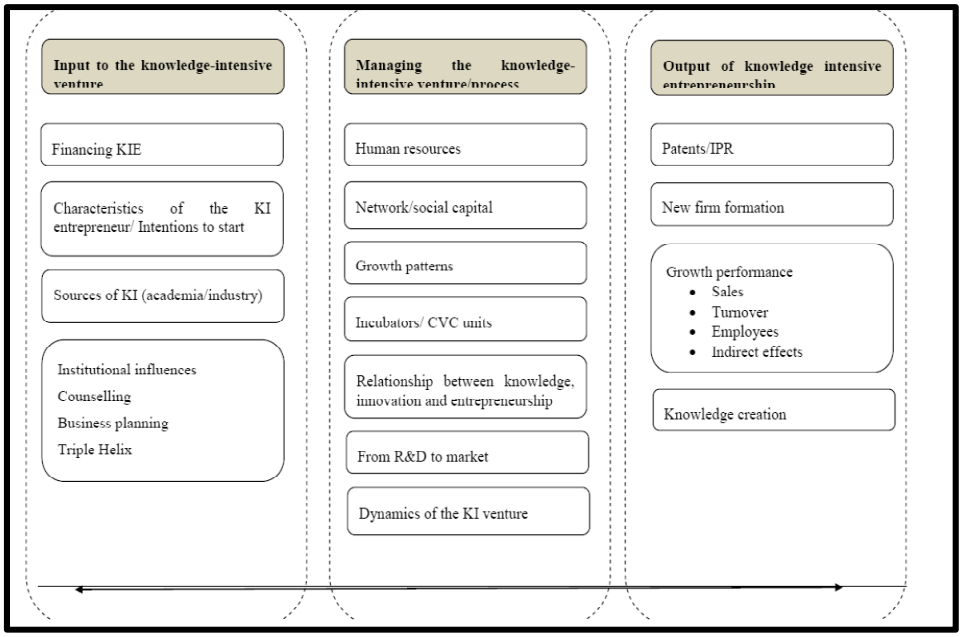
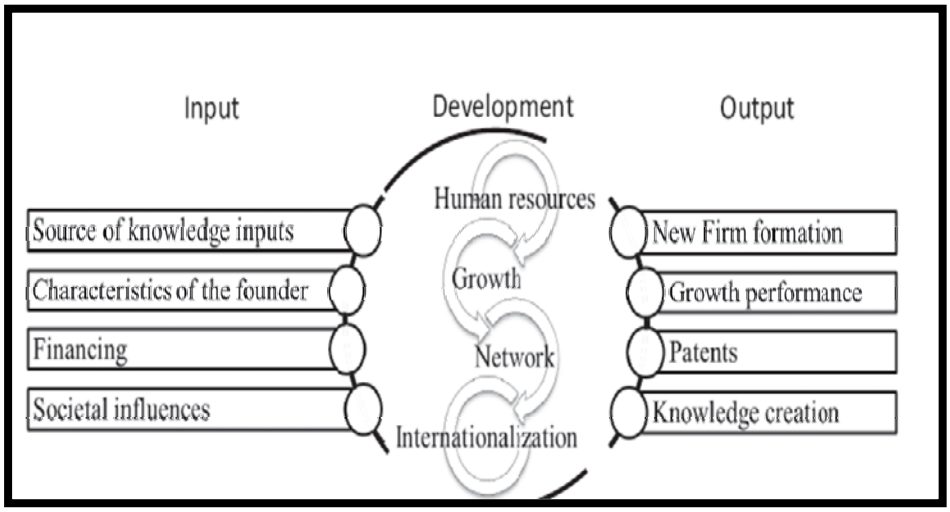


Figure2.5: McKelvey and Lassen (2013) "KIE creation model"



It is quite evident that the exploration of the KIE phenomenon is still in its infancy, regarding its multifaceted nature. For example, the above KIE models recognize but do not attempt to explain the nature of the isolating mechanisms that enable entrepreneurial activity and the creation of an initial competitive advantage for the survival and further growth of a new venture. An interesting approach seems to be the Hirsch-Kreinsen and Schwinge model for low-tech industries which refers to the need of certain firm-level or individual-level capabilities in order to produce innovation.

> Referring to conceptual considerations on the innovativeness of low-tech companies (cf. Bender and Laestadius, 2005), it needs to be stressed that such reflective competences of firms depend heavily on specific *capabilities*, a term provided by the well-known "resource based approaches" of innovation research. The core finding of this approach is that innovativeness, and therefore also

> KIE processes, may be analysed in terms of capabilities for orchestrating and mobilizing knowledge and other resources at the disposal of actors and firms (cf. Teece and Pisano, 1994).
>
> *(Hirsch-Kreinsen and Schwinge, 2011)*

However, the model refers mostly to capabilities related to knowledge acquisition and mainly innovation.

KIE models so far have focused mainly on the mechanisms of knowledge and innovation regarding capabilities; they seem to have neglected the entrepreneurial side of the issue. Several writers have lately offered insights on the important links between knowledge creation and its commercialization particularly at the early stages of a new venture. While the notion that the nature of firms' pre-entry capabilities determines the direction of expansion as firms survive and grow is not new (Nelson and Winter, 1982, Grant, 1991; Penrose, 1995), the capabilities perspective seems to be missing; the quotation of Zahra et *al.* (2006) is still popular; "…research has not provided a compelling explanation for the ability of some new and established companies to create, define, discover and exploit entrepreneurial opportunities". Furthermore, while there is a growing empirical literature on the existence of dynamic capabilities in KI firms and organizations of all sizes and sectors, KIE models have not attempted to incorporate the DCnotion in the early stages of venturing.

2.3.3.3 Knowledge intensive entrepreneurship and innovation

> *"The term, then, (i.e. entrepreneurship) refers not to an enterprise's size or age but to a certain kind of activity. At the heart of that activity is innovation".*
>
> *Drucker, 1985*

The relationship between KIE and innovation seems to be by definition straightforward (see KIE definitions above). Moreover, an important stream of entrepreneurship literature suggests that innovation and entrepreneurship are almost a tautology (e.g. Shane and Venkataraman, 2000, Casson, 2003; Acs, 2006; Audretsch et al. 2006) following Schumpeter's (1934) view on entrepreneurship. Several scholars have dealt with a number of issues; for example, an important issue regards the ways of value identification and innovation genesis in order to capture the deriving economic benefits. A growing number of researchers suggest that **different forms of collaboration** enable firms to engage in innovation (e.g. Chesbrough, 2003a; Lichtenthaler and Ernst, 2009). Another key notion is the **innovation type** produced within KIE or otherwise "the innovation opportunity" as Malerba and

McKelvey (2010) put it. This appears to be tightly connected to **knowledge and its different types** as well as the abilities of performers to combine and use it (e.g. Henderson and Cockburn, 1994; Verona and Ravasi, 2003; Protogerou et *al.*, 2008).

A) Innovation and its typologies

"Innovation has become the industrial religion of the late 20th century. Business sees it as the key to increase profits and market shares. Governments automatically reach for it when trying to fix the economy. Around the world, the rhetoric of innovation has replaced the post-war language of welfare economics...yet there is still much confusion over what it is and how to make it happen."

(Economist, 1999)

Innovation is a multi-dimensional phenomenon which is both complex and context-specific. Consequently, the relevant literature is both vast and diverse. This review is not aimed to present a thorough summary of current knowledge on innovation, but it seeks to point out certain key issues related to the subject of the present thesis.

Schumpeter defined innovation broadly as a discontinuously occurring implementation of new combinations of means of production and the setting up of a new production function (Schumpeter, 1939, 1947). This definition included five specific cases leading to a new production function: (1) the introduction of a new good (product innovation), (2) the introduction of a new method of production (production innovation), (3) the opening of a new market (marketing innovation), (4) the conquest of a new source of supply of new materials, and (5) the carrying out of a new organization of any industry (organizational innovation) (Schumpeter, 1936).

For several years innovation has been treated as the successful implementation of creative ideas (Stein, 1974; Woodman, Sawyer & Griffith, 1993) becoming "the industrial religion of the late 20th century" (Economist, 1999). About the late nineties **the notion started increasingly to be related with precise firms' capabilities** and more precisely with the ability to acquire external information, knowledge and technologies. A significant strand of literature, mostly related to the economics of innovation and technological change, focused attention on **research and development** (R&D) as the main source of firm-level innovation (e.g. Freeman 1994; De Jong and Vermeulen, 2007) using standard R&D-related measurements. Accordingly, the majority of surveys regarding the area of innovation followed the "Frascati Manual" developed by the OECD (OECD, 1963) which used R&D as the

main criterion for innovation. Even the development of the Oslo Manual (OECD, 1992; 1997; 2005) did not manage to move away of the R&D based concept besides the efforts made to describe a wider range of firms' innovation behaviour (Salazar and Holbrook, 2004; Barge-Gil, Nieto and Santamaría, 2012).

Innovation literature turned soon to the **notion of knowledge** and its combinations (e,g. Leheyda et *al.,* 2008). Bender (2004) further argued that innovation is not only a process of creative destruction, but frequently one of a recombination of knowledge, artefacts and actors. Researchers have gone even further claiming that the resources and capabilities required by a firm in order to innovate, are not usually related to the generation of new knowledge, but to the exploitation of existing knowledge (e.g. Kline and Rosenberg 1986; Bender and Laestadius 2005; Barge-Gil et *al.*, 2012).

Soon innovative performances of firms were connected to **various types of co-operations** and the inclusion of a variety of stakeholders such as customers and suppliers, competitors, universities, and public research organizations (e.g. Veugelers, 1997; Fritsch and Lukas, 2001; Chesbrough, 2003b). This attitude was called **"open innovation"** reflecting the view that valuable ideas can be born outside the firm (Dahlander and Gan, 2010). The most known definition of open innovation is attributed to Chesbrough (2003a) according which "open innovation is a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as firms look to advance their technology".

Table 2.8: Selective Definitions of Innovation through half a century of innovation exploration (1965-2015)

Authors	***Definitions***
Thompson (1965: 2)	"Innovation is the generation, acceptance and implementation of new ideas, processes products or services".
Gabor (1970)	". . . process that turns an invention . . . into a marketable product"
OECD (1981:15-16)	"Innovation consists of all those scientific, technical, commercial and financial steps necessary for the successful development and marketing of new or improved manufactured products, the commercial use of new or improved processes or equipment or the introduction of a new approach to a social service. R&D is only one of these steps."
Freeman (1982)	"an *innovation* in the economic sense is accomplished only with the first *commercial* transaction involving the new product, process, system or device…" "Industrial innovation includes the technical, design, manufacturing, management and commercial activities involved in the marketing of a new (or improved) product or the first commercial use of a new (or improved) process or equipment"
Edwards and Gordon, (1984: 1)	Innovation is "a process that begins with an idea, proceeds with the development of an invention, and results in the introduction of a new product, process or service to the marketplace"
Drucker (1985, 1986)	"Innovation is the specific tool of entrepreneurs, the means by which they

	exploit change as an opportunity for a different business or service." "Innovation is not explicitly the improvement or technical modification of a product…. creation of new value and new satisfaction for the customer."
Bird (1989: 39)	Innovation is therefore more than invention; it also involves the commercialization of ideas, implementation, and the modification of existing products, systems and resources
Damanpour (1991)	a continuous and cyclical process involving the stages of awareness, appraisal, adoption, diffusion and implementation.
EC(1995:2)	"In brief, innovation is: • the renewal and enlargement of the range of products and services and the associated markets; • the establishment of new methods of production, supply and distribution; • the introduction of changes in management, work organisation, and the working conditions and skills of the workforce."
Woolgar (1998: 444)	"Innovation is a social process that entails a change in a network of social relations. Innovation is thus about changes in some or all of an existing set of identities, expectations, beliefs and language."
UK DTI (2004)	"Innovation is the successful exploitation of new ideas"
Albury (2005)	"Successful innovation is the creation and implementation of new processes, products, services and methods of delivery which result in significant improvements in outcomes, efficiency, effectiveness or quality"
OECD (2005: 46)	"the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations".
Chesbrough (2006: 1)	the use of purposive inflows and outflows of knowledge to accelerate internal innovation and expand the markets for external use of innovation
Hartley (2006)	"the successful development, implementation and use of new or structurally improved products, processes, services or organisational forms"
Crossan and Apaydin (2010)	Innovation is: production or adoption, assimilation, and exploitation of a value-added novelty in economic and social spheres; renewal and enlargement of products, services, and markets; development of new methods of production; and establishment of new management systems. It is both a process and an outcome
Raynor (2011: 168)	"…a change that breaks trade-offs."
Kahn (2012: 454)	"A new idea, method, or device. The act of creating a new product or process, which includes invention and the work required to bring an idea or concept to final form."
Kumar (2013:1)	"…a viable offering that is new to a specific context and time, creating user and provider value"
Rothaermel (2013: 172)	"The commercialization of any new product, process, or idea, or the modification and recombination of existing ones."
Plsek (2014: 12)	"…directed creativity implemented."

The Oslo Manual (OECD, 2005) supported the definition of "open innovation", which was further emphasized by other authors such as Hirsch-Kreinsen (2008). The author, studying innovation within low-tech sectors claimed that innovations can be the result of incremental product development, customer-oriented innovations or the optimisation of process technologies. However, it should be mentioned that open innovation is not new. Even since the 1980s, many authors have commented on the incremental shift from a closed model regarding innovation to a model according which firms across industries started increasingly to rely on the acquisition of external

technologies to complement their technology portfolios (von Hippel, 1988; Lichtenthaler, 2008b; Spithoven et *al*., 2010).

The concept of open innovation was split up into two main types; *inbound and outbound* (Chesbrough and Crowther, 2006). In the case of inbound open innovation, agents explore and integrate external knowledge for technology development and technology exploitation. Ideas on R&D results that are external to the firm stem from **collaborations and networks** with suppliers (Brown and Eisenhardt, 1995; Cousins *et al*., 2011), customers (Joshi and Sharma, 2004) and other external actors such as universities, research institutes and governments (e.g. Griliches, 1995; Caloghirou et *al.*, 2000; Shane, 2005) through technology in-licensing, acquisition or joint development. Recently, the use of such collaborations into the innovation process has expanded to the specific context of new ventures, which present distinctive characteristics from large established firms (e.g. Song and Di Benedetto, 2008).

In the case of outbound open innovation, companies look for exploiting their technology capabilities by utilizing not only internal but also external paths of commercialization (Chesbrough 2003; Chesbrough and Crowther 2006). Therefore, they seek external organisations that are better suited to commercialize (part of) their given technology e.g. in terms of intellectual property or brand out-licensing. Outbound open innovation includes the spin-off of new ventures based on prior product or technology development (Chesbrough, Vanhaverbeke, and West 2006; Lichtenthaler 2008b, 2011; Van De Vrande et al. 2009).

Innovations have been classified by the type, the degree of novelty and the nature (e.g. Terziovski, 2007; Tidd et *al.*, 1998). By definition it is quite apparent that innovation can be classified at least into two broad categories according the type; product innovation and process innovation. Actually, there are essentially four types of innovation identified in the Oslo Manual (OECD 2005) for measuring innovation[28]:

• *Product innovation* refers to the introduction of a good or service that is new or significantly improved with respect to its characteristics or intended uses and is successful in the market. Significant improvements may consider technical specifications, components and materials, user friendliness etc.

[28] The innovation classification scheme applied in the OECD-initiated large cross-European innovation surveys (CIS) is based on the Schumpeterian types of innovation, which are further refined into a larger number of categories and definitions of innovation activities.

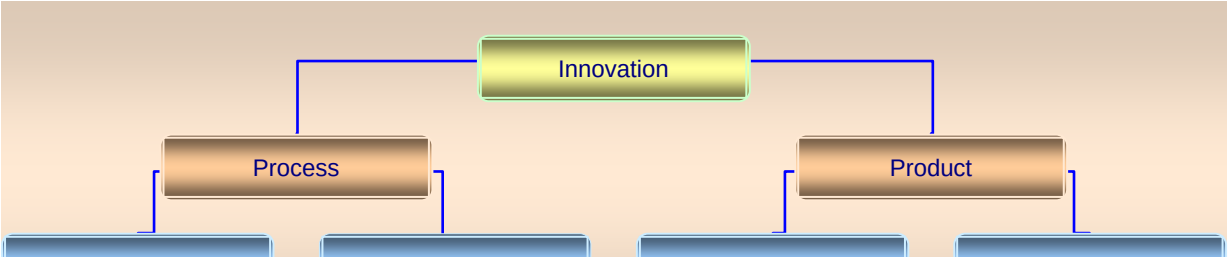
• *Process innovation* is the implementation of a new or significantly improved production or delivery method. It may be a technological or organisational innovation. The first type includes the creation or adoption of a new or improved manufacturing or distribution process, significant changes in production technologies, techniques, equipment and/or software, automation and flexible high-tech processes that for example can offer tailor-made products in a mass production system. The second type can range from a new method of managing material or information flows between subsequent steps of a value-adding process to new methods of social service. The two types of innovations are not necessarily mutually exclusive. Process innovation may lead on to novel products and *vice versa*.

• A *marketing innovation* is the implementation of a new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing.

• An *organizational innovation* is the implementation of a new organizational method in the firm's business practices, workplace organization or external relations. Organisational innovations have been treated in different ways (see Lam, 2005, for a detailed discussion). Regarding the technological side of an organization, they have been related to the adoption of new production management systems or concepts, such as continuous flow production systems, flexible manufacturing systems, computer-aided product development, manufacturing systems and JIT production management concepts. Organisational innovation in a firm's external relations comprises structural, personnel, and cultural innovations; it involves the implementation of new ways of organising relations with other firms or public institutions, such as the establishment of new types of collaboration with research organisations and customers, or new methods in supply chain management and the outsourcing or subcontracting of business activities (e.g. Wang and Ahmed, 2004).

The above list is however by no means exhaustive, since literature is continuously enriched by new classes of innovation such as customer experience innovation (e.g. Davis et *al.*, 2010; Deck, 2007), business model innovation (Comes and Berniker, 2010; Chesbrough, 2010), IT innovation (Andersson et *al*., 2008).

Figure 2.6: Edquist's Taxonomy of innovation *(Source: Edquist, 2001)*



In terms of **nature,** Jacobs and Snijders (2008) assign innovations along an axis from incremental to radical. The OECD goes further by defining novelty on three levels: new to the world, new to the market, and new to the firm. More precisely,

Radical innovations represent discontinuous events of technological change which, may even transform an industry and give rise of new industries and services. Although radical innovation pertains mainly to new products development, it can also apply to business, operations and project management models, as well as manufacturing and other processes.

Incremental innovations [29]represent small-scale modifications to existing systems of products and processes. Rebecca M. Henderson and Kim B. Clark in the influential "Architectural Innovation: The Reconfiguration of Existing Product Technologies and the Failure of Established Firms" (1990), observed from several studies the following:

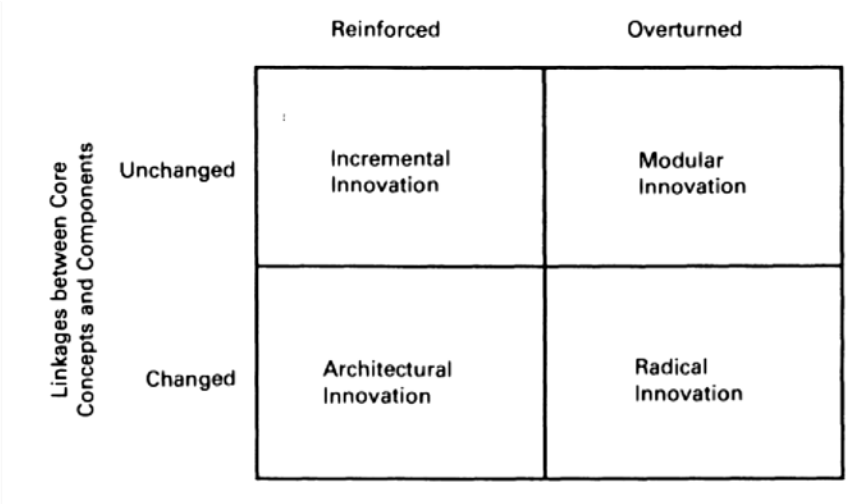
1. Incremental innovation improves the existing product in a minor way, maximizes the established design, and helps maintain the market and technology leadership
2. It strengthens the dominance of an established company.
3. It refines and extends an established design.

A significant strand of researchers focused in describing the nature of innovation; indicative efforts are the theory of *disruptive innovation* by Bower and Christensen (1995); *systemic innovation* by Teece (1986) and later Freeman and Perez (1988) and Albury and Mulgan (2003) which led to the concept of *techno-economic paradigm*s; the *"architectural*[30] *innovation"* type by Henderson and Clark (1990).

Figure 2.7: Henderson and Clark's (1990) framework for defining innovation.

[29] For a detailed analysis on the types of innovation please refer to Rebecca M. Henderson and Kim B. Clark "Architectural Innovation: The Reconfiguration of Existing Product Technologies and the Failure of Established Firms" in the *Administrative Science Quarterly*, 1990

[30]Actually it was Professor Michael L. Tushman of the Massachusetts Institute of Technology and Harvard Business School who coined the term "architectural."



Innovations are also classified according the **degree of novelty** (as mentioned above). The category of *'new to the firm'* innovation reflects minimum entry level for an innovation. The innovation must include modifications and improvements extending or substituting certain items (Kaufmann and Tödtling, 2000). "*New to the market*" innovation refers mainly to products which are new to the firm and the market (Kaufmann and Tödtling, 2001). "New to the market" does not necessarily imply a technological novelty; novelty can be traced in new functions, qualities, services, and appearance, not available in another market place at the moment of entrance. It can also refer to marketing and organisational changes (Palmberg 2001, Rametsteiner 2000). Innovation is called *"new to the world"* when the firm is the first to introduce it for all markets and industries, domestic and international. It is mainly related to radical or breakthrough innovation (e.g. Buddelmeyer et *al.*, 2010).

The literature underpinning the phenomenon of innovation has further attempted to explain how **the innovation process works**. In accordance both the theoretical approaches and the empirical research on innovation patterns identified two main modes or ideal types of innovation, always in tension in firms, sectors and national innovation systems (Jensen et *al.*, 2006 in Koeller, 2008; Jensen et *al.,* 2007) distinguish between:

- **STI-mode:** Science, Technology, and Innovation based, placing the main emphasis on promoting R&D and creating access to explicit codified knowledge. It adapts mainly to the linear model of innovation (Fagerberg, 2005; Cappellin, 2009): basic research, applied research, development, production, marketing and diffusion.

- **DUI-mode:** Doing, Using, and Interacting mode is mainly based on learning by doing, using and interacting. It relies on tacit knowledge and tries to build structures and relationships which enhance and utilize learning by doing, using and interacting (Jensen, 2004).

The two types are not mutually exclusive: most innovative firms combine both strategies, trying to reconcile formal processes of explicit and codified knowledge production with learning processes from informal interaction within and between organisations, resulting in competence-building with tacit elements.

Altogether, although it is definitely true that R&D is a way to generate very relevant conditions for, and inputs into innovation processes, it is also evident that **innovation is by no means always rooted in scientific research**; this issue going back to works of Dosi (1988) and Gibbons et *al.* (1994) among others. There is a plethora of non-science-based innovations. Jacobson and Heanue (2005) stated that "learning and innovation can take place without research and development (R&D), for example through acquisition of tacit and practical knowledge[31], and through formal and informal diffusion between firms". Bender (2004) in his study of innovation in low-tech industries in eleven European countries found that innovation is based to a large extent on the synthesising competence of actors, that is, on their ability to tap distributed competence and knowledge, to reframe them, and to recombine them creatively. This may be scientific knowledge, design competence, or expertise in logistics, it may be codified knowledge or knowledge which is incorporated in humans or in technical artefacts. That is to say, scientific research and knowledge is only one source of innovation. Table 2.9 presents the evolution of the various models up-to-date providing a brief description of each

Table 2.9: Innovation Process Models

Model/Author	Generation	Characteristics
Technology-Push Varjonen (2006)	First (1950s - mid 1960s)	Simple *linear sequential process* Emphasis on R&D and science. Innovation is pushed by technology and science. The linear model assumes that the market is a ready sink for the output of R&D
Market-Pull Varjonen (2006)	Second (late 1960s -	The era of corporate growth. Simple linear sequential process. Emphasis on marketing. Innovation is pulled by

[31] „The term ''practical knowledge'' stands for a complex bundle of different knowledge elements that comprises both explicit, codified and formalized elements as well as, above all, implicit elements such as accumulated experience and well established and proven and tested routines for solving technical problems" (Hirsch-Kreinsen and Jacobson, 2008)

	early 1970s)	market needs.
Coupling Model Rothwell (1995)	Third (mid 1970s - early 1980s)	Recognizes interaction between different elements and feedback loops between them. Innovation is a result of simultaneous coupling of knowledge within all three functions: R&D, manufacturing and marketing (Rothwell and Zegveld, 1985). Yet, the dynamics of the process depicted are still very *sequential*.
Interactive Model Rothwell (1995)	Fourth (mid 1980s - 1990s)	Combination of push and pull models, integration within firm. Innovation process is viewed as parallel activities across orga-nizational functions. A key element of competition in the 1980s was time to market. Many Japanese firms were able to maintain their competitive advantage by the use of this model.
Network Model Trott, (2008)	Fifth (mid 1990s - 2000s)	The *systems integration and networking process (SIN).* Recognizes influence of external environment and the effective communication with external environment. Innovation processes resemble that of *networking processes:* Innovation happens within a network of internal and external stakeholders.
Open Innovation (Docherty, 2006)	Sixth	Innovation processes does not take place only within the firm boundaries. Internal and external ideas as well as internal and external paths to market can be combined to advance the development of new tech-nologies or introduction of innovative products, services and processes.

(Sources: Du Preez and Louw, 200; and Varjonen, 2006)

In general, innovation can be carried out along multiple dimensions: technological, managerial, organisational, industrial and so on. Some of them can be measured; others even hardly estimated. Regarding the dimensions of innovation which can be measured, some authors (e.g. Flor and Oltra, 2004) classify indicators distinguishing whether they are based on inputs or on outputs of the innovation process. More precisely, Research and Development (R&D) budget, existence of formalized R&D, educational background of staff, etc. are based on inputs (Massa and Testa, 2008) while number of patents (Deyle and Grupp, 2005; Jaffe and Trajtenberg, 2002), perceived innovation effectiveness (Kivimaki et al., 2000) information disseminated in literature (Sorenson and Fleming, 2004), the absolute amount of sales of innovative products (Negassi, 2004), the actual number of innovations (Brower and Kleinknecht, 1996), or the increase in market share (Mascitelli, 2000) are based on outputs.

It is important to mention that innovation has been often used interchangeably with the term **innovativeness** (see for example Van De Ven 1986 or Deshpande *et al* 1993; Gudmundson *et al.,* 2003). In 1998, Hurley and Hult (1998) seeking to clarify the two issues defined innovation as "the number of innovations successfully implemented"

and innovativeness as "associated with cultures that emphasize learning, development, and participative decision making" (1998:42) underlining the notion of openness to new ideas as an aspect of a firm's culture. In an effort to embrace a dynamic conceptualization of firm innovativeness, Gilbert (2007) proposed that innovativeness "encompasses the concepts of newness in systems, processes, products and services, behavioral change, environmental adaptation, and learning and knowledge development; all which occurs in context over time".

Evidence of firm innovativeness may take several forms. Besides the R&D expenses, highly educated personnel (Hage, 1980) and greater reliance on technically trained specialists (Miller and Friesen, 1982), the number of new product or service introductions (e.g. Danneels and Kleinschmidt, 2001; Garcia and Calantone, 2002), the frequency of changes in services or product lines (Covin & Slevin, 1989; Miller & Friesen, 1982), the achievement of competencies in the latest technologies and production methods and the development of advanced manufacturing processes (Lumpkin and Dess, 1996). Innovativeness has been further measured with the tendencies of discarding old beliefs, exploring new alternatives and rewarding experimentation (e.g. Karagozoglu and Brown, 1988). Garcia and Calantone (2002) have identified 15 different constructs to distinguish between different types of innovativeness; product /service innovativeness, radicalness, newess to firms / markets/ of technology/ customer, product/market fit, synergy, product uniqueness/ type/ complexity, technical content, complexity and marketing task similarity. Scholars have used combinations of the above to investigate innovativeness. Senyard et al. (2014) adapted the relevant measure of Dahlqvist and Wiklund (2011) to the new firm context and expanded it to cover four dimensions of innovativeness of new firms: (1) product/service innovativeness; (2) process innovativeness; (3) marketing methods innovativeness; and (4) target market selection innovativeness.

In all cases, however, innovativeness regards a firm's innovative activities which result in better **firm performance** compared to companies that do not innovate. A number of empirical studies have been conducted on the relationship between innovation and performance (e.g. Kotha & Swamidass, 2000; Kemp et al., 2003; Choi & Lee, 2008; Tsai & Tsai, 2010). Research, over the last 50 years, has consistently linked innovation with business success (Nonaka and Takeuchi, 1995). Entrepreneurship and innovation are complementary in enhancing business performance (Zhao, 2005). Innovation has been attributed as a major contributory

factor in firms' growth (Mansfield, 1968, 1971; O'Gorman, 1997), competitiveness (Dosi, 1988), differentiation (Pavitt, 1991; Kotler, 1999) and export performance (Levebvre and Levebvre, 2002).

C) Knowledge-Intensive Entrepreneurship and Innovation

By definition KIE refers to firms that are innovative and are involved in a process that translates knowledge into innovation. Radosevic et *al.* (2010) even argue that a better term for "Knowledge-intensive entrepreneurship" would be "Innovative Entrepreneurship" as innovation makes a distinction between ordinary entrepreneurship and KIE.

The concept of was very early treated as a strategic choice and a determinant of firm performance. Entrepreneurs have long been portrayed as "innovators" (Schumpeter, 1965), that is, as "catalysts of change who continuously do things that have not been done before and who do not fit established patterns" (Schwartz and Malach-Pines, 2007). Assigning the role of innovator to the entrepreneur implies that successful entrepreneurs adopt and implement competitive strategies such as introducing new products and services, new methods of production, opening new markets, or even reorganizing an entire industry (Bird, 1989).

Innovation has been related to new venture survival. According to relevant statistics, at least in developed countries, about 50-80 % of all new start-ups do not survive more than five years. As Guenter Faltin comments in his paper on "Competencies for Innovative Entrepreneurship" (1999), *Compared to entrepreneurial ventures, Russian roulette looks like a better prospect: five of six shots let you survive, but in entrepreneurship four of five shots will destroy you Most probably the innovative element of your business idea is your most crucial partner for survival*.

Actually, there is a quite considerable amount of literature investigating the entrepreneurship-innovation theme. Indicatively, an unrestricted search of the Web of Knowledge using the keyword 'entrepreneur' by Crossan and Apaydin (2009) yielded almost 13,000 papers, of which 10 per cent were linked to innovation which was added as a keyword. Entrepreneurship and innovation are intrinsically related as both involve the processes of discovery, evaluation, and exploitation of opportunities (entrepreneurship) and novelties (innovation).

The triplet knowledge - innovation – entrepreneurship seems to be so far better approached by the analysis of knowledge-intensive entrepreneurship; entrepreneurs transform new, knowledge-based ideas into economic activity, while entrepreneurship itself is also a 'major engine of growth and transformation of technologies' (Malerba, 2010). In the area of their 'core' competences firms 'function as knowledge processors giving full priority to the creation of resources' (Malerba, 2010).

In the context of the AIGIS project, the resulting innovation by KIE is knowledge-based, going beyond the existing sectoral or product field-specific knowledge base by creating new knowledge, new ways of problem solving or new processes, products as well as new markets not applied or unknown in the industry before. KIE is characterized by a two-way nexus between entrepreneurship and innovation and is usually embedded in open systems composed of heterogeneous actors and networks of various types (Radosevic et *al.*, 2012; Lee, Hwang, & Choi, 2012). This is due to the fact that the external knowledge needed for innovation cannot be acquired by a single source (Robertson and Smith, 2008); on the contrary it is the outcome of a careful selection of knowledge sources dispersed across different environments and technologies, transcending sometimes even sectoral boarders (Hirsch-Kreinsen and Schwinge, 2010; Rothaermel *et al*., 2006).

Therefore, in a knowledge-intensive scenario, the development of **collaborations** constitutes a major capability in order to engage in innovation (Landström *et al.*, 1997) and sustain innovation performance (Collins, 2006; Elango & Chen, 2012). Collaborations can be with any type or organization such as universities or research institutes (Griliches, 1995; Caloghirou *et al.*, 2000), suppliers and customers (von Hippel, 1988; Dyer, 1991; Brown and Eisenhardt, 1995; Joshi and Sharma, 2004; Cousins *et al*., 2011), or any type of networks, alliances or joint ventures with other firms holding relevant knowledge (Chiesa and Manzini, 1998).

According to recent literature on KIE and innovation (see for example Radosevic et *al.*, 2012; Radosevic and Yoruk, 2012; Edquist et *al.*, 2012), KIE takes place in a systems context and an obvious link between entrepreneurship and innovation is the fact that activity "Creating and changing organizations" is a key activity in **Systems of Innovation (SI).** These scholars have adopted the definition of SI by Edquist

(1997) [32] according which a system of innovation includes "all important economic, social, political, organizational, institutional and other factors that influence the development, diffusion and use of innovations" (Edquist, 1997: 14; Edquist 2005; Edquist and Hommen, 2008). Accordingly, they argue that KIE is a *systemic* feature of innovation system; new knowledge, innovation and entrepreneurship are inseparable elements of a dynamic IS.

Within SIs, firms are part of an environment that is characterized by distributed knowledge. The creation of new knowledge can take place inside the existing value-chain of a firm or outside of it, in private laboratories and universities: the latter case is associated to a higher probability of exploiting the opportunities through new firm formation[33]. The installation and operation of new equipment can be also knowledge-creating with several mechanisms at work, which explain why new and small firms in combination with large organisations may drive innovation and ultimately economic growth. These mechanisms are knowledge spillovers, decentralization, experimentation, and competition (Mueller & Thomas, 2000). Research cooperation includes cooperative research, contract research, or joint research ventures. Then there is the purchase of licences to use protected knowledge.

Within this framework, new types of knowledge (scientific, technological, practical, marketing etc) constitute important sources of entrepreneurial opportunities for KIE.

Technological opportunities are related to the contribution of external knowledge sources to the innovation activities of firms (Arvanitis/Hollenstein 1994; Becker and Peters, 2000) and the expansion of innovative capabilities impacting the research efficiency, R&D and the quality of new technologies (Cohen/Levinthal 1989; Klevorick et al. 1995). They are essential (Dosi 1988; Griliches 1995; Radosivic et al., 2012), exogenous to the economic system (Schumpeter, 1934) and often temporary (Katila and Mang, 2003). Each industry has its own specific technological and knowledge bases, learning patterns, actor networks and institutions (norms, standards, established practices and routines) that shape specific modes of innovation. Sector-specific differences in technological opportunities operate as one of the determinants of differences in technological regimes (Breschi et al., 2000).

[32] Based on Freeman's (1987) definition of National System of Innovation (NSI) : "the network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies" Freeman (1987: 1)

[33] Among the institutional factors that have been considered in the entrepreneurship literature is the role of technology transfer offices or university incentives that may encourage start-ups (e.g. Krabel and Mueller, 2009).

Market opportunities are based on the idea of information asymmetry (Shane and Venkataraman 2000; Kirzner 1997). They vary along key dimensions such as life-cycle stage, market size, and industry structure (cf. Lien and Klein, 2009). However in all cases, agents need first to identify a market opportunity set before deciding on a commercialization path to follow with their technological resources.

Institutional opportunities as referred to National Systems of Innovation regard institutions, norms and rules (formal and informal) that affect (directly or indirectly) the innovation process. Main institutional factors can be grouped in four categories and namely, *Regulatory, Financial, Infrastructural and Perceptual.* They are by nature dynamic and subject to rapid evolution and change over the lifetime of firms.

2.3.3.4 Knowledge intensive entrepreneurship and venturing

The KIE definition (Malerba and McKelvey, 2010) focuses on special forms of venture creation. KIE seems to be a significant mechanism through which new entries in the markets, in the form of new firms or diversification of existing firms, bring new ideas, products, services and processes (e.g. Radoceviz et al., 2010; Chaminade and Edquist, 2006). An important issue of exploring KIE concerns therefore the investigation of factors that provide an overall picture of the various distinct types of knowledge-intensive ventures; these can refer to founders and their competitive behavior, firm, and contextual characteristics, initial conditions at founding, and kinds and levels of performance achieved[34]. A specific condition in all KIE cases regards the fact that new business ventures incorporate always different levels of knowledge intensity in their activities.

a) Venture creation

Venture creation is at the heart of entrepreneurship (Chandler, 1990; Gartner, 1990). New ventures have been defined as the end results of the entire process of the creation and realization of new businesses (from conception to adolescence as Reynolds, 2000 mentions) which develop and market products and/or services to meet latent market needs for the purposes of profit and growth (Gartner, 1985; Normann, 1977). Venturing is "the process that takes place between the intention to start a business and

[34] The literature review is not intended to be exhaustive. Topics are discussed for the purposes of the present thesis.

making the first sale" (Gatewood, Shaver, and Gartner 1995, p. 380). Founding conditions have a fundamental impact on the shaping of firms' identity and strategies and tend to persist over time (Geronski, Mata and Portugal, 2003) since they have long-reaching implications beyond founding (Eisenhardt & Schoonhoven, 1990). Furthermore, this explains partly why significant differences among firms exist; they are inherent and historically determined (Winter, 2006).

New ventures can be of various forms according to their relationship with existing firms in industry (Helfat and Lieberman, 2002). They can be:

- *New-to-the-world businesses*, founded firms from scratch (Verheul et al., 2005), initiated and controlled by one or more individuals acting in their own self-interest with no prior employment or financial relationship to established firms in the industry. Then we refer to "nascent entrepreneurship" (e.g Vesper, 1980, Reynolds & White, 1992). Independent companies which are founded by employees of incumbent firms of the same sector have been relatively called *spin-offs or spawn* which attract the attention recently (e.g. Klepper, 2002; Chatterji, 2009).

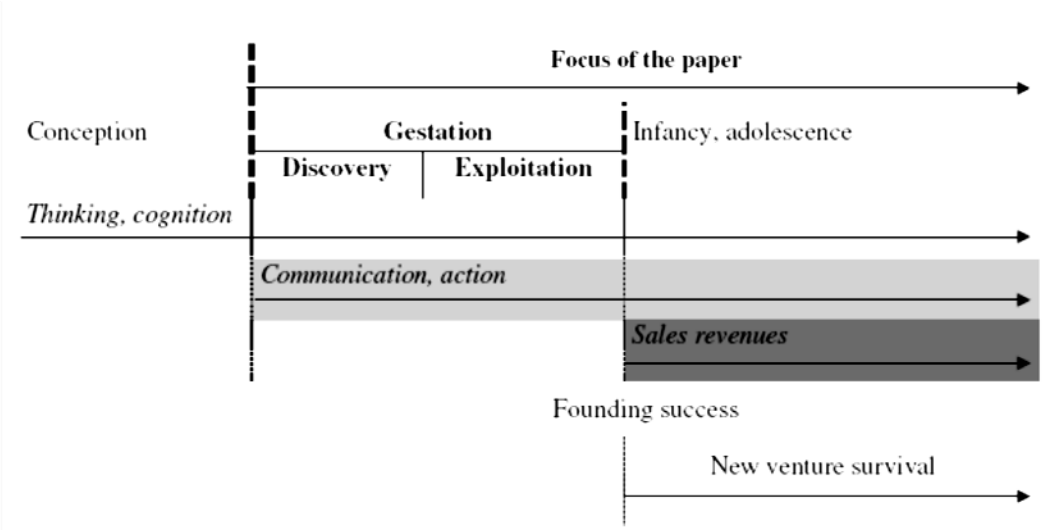
  Nascent entrepreneurship has been explored in the form of decision making starting from the communication of startup intentions and ending with a viable operational business (e.g. Aldrich, 1999). Such decisions could concern for example customers, products or services, resources, technologies, and methods of organization (Chrisman et al, 1998, Gartner, 1985; Katz & Gartner, 1988) and bear a significant impact on the new venture's as well as long-lasting performance (Eisenhardt & Schoonhoven, 1990; Park & Bae, 2004).
- *corporate ventures* initiated as self-contained organizational units outside or within the boundaries of established companies (external or internal corporate venturing) in order to pursue opportunities without regard to the resources they currently control (e.g. Dess et al., 1999; Zahra et al., 2000). It can refer to the development of a new corporate activity that may or may not include the creation of organizational bodies or to the strategic renewal i.e. changes in strategy and/or in the structure of the organization, (Sharma and Chrisman, 1999) and a firm transformation by revitalizing its operations and reordering its core capabilities (Ruiz-Navarro, 1998). Thus, through corporate entrepreneurship firms create new business and transform themselves by innovating and changing their business domain or processes (Guth and Ginsberg, 1999; Sharma & Chrisman, 1999). When diversifying entrants i.e. established firms enter new or established markets through acquisitions, joint

ventures or internal growth (cf. MacMillan et al., 1986; Burgelman & Sayles, 1986; Katz & Gartner, 1988), then the phenomenon has been called *joint corporate venturing*.

b) Personal, firm and contextual characteristics

The transition from venture creation to an early survival and continuation of the new firm has been attributed mainly to individual characteristics of the founders, the resources, the process and the environmental conditions (e.g. Gartner, 1985[35]; Ardichvili & Gasparishvili, 2003; Davidsson, 2006; Kessler et al., 2012).

Figure 2.8: Start-up process as presented by Kessler et al. (2012)



Personality traits: The belief that firms are extensions of their entrepreneurs has led many researchers to examine the character traits of the entrepreneur that are most likely to influence survival and growth. A long and continuing tradition argues on the importance of the entrepreneur, entrepreneurial skills and values for the venture's creation and performance (Baumol, 1968; Schumpeter, 1934; McClelland, 1961) or the types and quality of the entrepreneur's behaviors and decisions (Carsrud & Johnson, 1989; Gartner, 1988; Hofer & Sandberg, 1987).

More precisely, a bulk of literature confirms the impact of personality traits on business survival and business success (e.g. Baum et al., 2001; Brockhaus, 1980;

[35] Gartner (1985) defines the creation of a new venture as an interaction among four dimensions: personal characteristics of the entrepreneur (individual), competitive entry strategies (organization), push and pull factors (environment), and the actions taken by the entrepreneur to bring the enterprise into existence process.

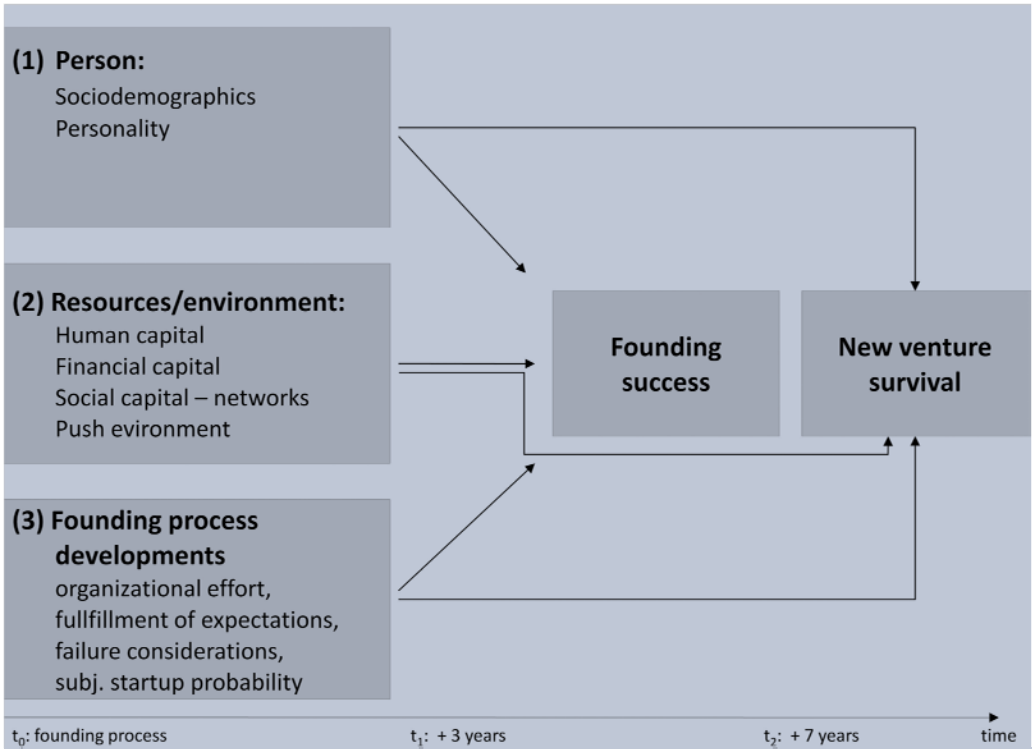
Gartner, 1989; Lee & Tsang, 2001; Zhao and Seibert, 2006). Research in this area is divided in two streams (Kessler et al., 2012); one aims to confirm general traits, like the well-known "big five personality dimensions" (e.g. Zao et al., 2006), while the other suggests the impact of specific personality traits related to specific demands, such like the three "classic" specific personality traits: internal locus of control (e.g., Brockhaus, 1980), need for achievement (e.g., McClelland, 1987), and risk-taking propensity (e.g., Stewart and Roth, 2001). In this vein, a plethora of personality traits have been considered and examined regarding their impact (direct or indirect) on the growth of the firms among which **educational background** (e.g. Sapienza & Grimm, 1997), age (e.g. Evans and Leighton, 1990) and prior experience (industry related or not) and background (Baum et al., 2001; Eisenhardt & Schoonhoven, 1990; Thompson, 2002) have been considered among the most significant ones. In its general form, the educational attainment of founders relates to the knowledge gained during formal education. The factor has gained new insight within the area of knowledge-based entrepreneurship due to the exceptional role of knowledge (e.g Baptista and Mendonça, 2010; Colombo and Grilli,(2010).

Intellectual capital together with founders' **background experience** will provide competencies that influence the entrepreneurial decisions impacting the success of venture creation. Industry experience regards previous work in the industry in which the new venture will operate and provides information about industry rules and norms, customer and supplier networks, and employment practices. A number of studies suggest that an entrepreneur's industry experience has a beneficial impact on new venture's survival (Taylor, 1999; Van Praag, 2003) and performance (e.g Cooper et al., 1988). Cooper et al. (1994) argued that prior experience plays a major role in developing tacit knowledge needed for making business decisions. Empirical literature explored and found the positive effect of founders' industry experience on firm survival and performance such as firm profits and firm employment (e.g. Holmes and Schmitz, 1996; Taylor, 1999; Bosma, van Praag, Thurik and de Wit, 2004). A specific type of experience regards prior founding experience which can offer information about activities like opportunity identification and resource acquirement (e.g. Shane and Stuart, 2002; Delmar and Shane, 2006).

We should however mention that an important stream of relevant literature claims that the vast majority of new ventures are founded and led by **teams**, rather than by

individuals (e.g. Beckman, 2006; Cooney,2005; Carland & Carland, 2012; Eisenhardt and Schoonhoven, 1990; West, 2007). Klotz et al. (2014) reviewing prior work on new venture teams, have provided an exhaustive list of new venture team studies. The authors describe new venture teams as *the groups of individuals that are chiefly responsible for the strategic decision making and ongoing operations of a new venture*. Aldrich et al. (2004) further add that most teams have only two members. The prior experience of new venture team has received the bulk of research attention (Amason et al., 2006; Beckman, 2006), with prior success (Nelson, 2003), the educational level and the educational prestige (Dalton, & Cannella, 2006) to follow.. Another strand regarded the impact of completeness and heterogeneity of these teams on new venture performance (Hmieleski and Ensley, 2007; Picot et al., 1994). Resource-based theorists suggest that teams are better than individuals since they can provide diversity and skills abundance (Kor and Mahoney, 2000; Watson et al., 2003) to cover the initial limited access to an extensive array of resources.

Figure 2.9: Research model of Kessler et al. (2012) for new venture creation



Human capital regarding expertise and highly skilled working force is more crucial for a start-up than a mature firm according to Cardon (2003). It also encloses

entrepreneurial traits and more precisely education, professional experience (*generic*) and capabilities that founders can directly apply in the newly-founded firm. Exceptional entrepreneurs can access highly valuable resources easier and faster than common ones (e.g. Ucbasaran et al., 2003) Knowledge as an intangible resource (Hall, 1992) is embedded in the members of the business which should be highly specialized (e.g. Stuart and Sorenson 2003) and is a major source of competitive advantage (e.g. Prahalad and Hamel 1990; Nonaka 1994; Kogut and Zander 1996; Grant 1996) and innovation (e.g. Nonaka et al., 2000). The importance of highly specialised human capital resources has been further stretched in order to exploit knowledge-based entrepreneurial opportunities in the area of technology-based new ventures (e.g., Ensley, Pearson, and Amason 2002; Stuart and Sorenson 2003).

Social capital[36] has been treated as a useful resource mainly through external networks in order to facilitate the discovery of opportunities, identify and access scarce resources (Adler and Kwon, 2002; Aldrich et al., 1998; Baron and Hannan, 1994; Putnam, 2000) as well as to diffuse critical information. Anderson and Jack (2002) credit the actual term "social capital" to Jacobs (1969) and describe it as the glue that binds and the lubricant that eases economic relations. Social networks can be based on strong or weak ties regarding friendships (e.g. Bruderl and Preisendorfer, 1998; Paxton, 1999), family (e.g Aldrich et al.1998; Sorenson et al., 2009), business contacts and acquaintances from former occupations (e.g. Newell et al., 2004). Lately, suppliers of both raw materials and machinery have been added to networks since they can work closely with new entrepreneurs bringing complementary skills and abilities (e.g. Ayers *et al.*, 1997; Jassawalla and Sashittal, 1998).

Table 2.10: Types of resources for new venturing

Human capital	Social Capital	Financial capital	Knowledge
age	Entrepr. Milieu	own	Tacit –codified
education	networks	family	Different types (e.g. Scientific technological, practical)
experience	Former business	partners	Different areas (e.g. management, market, R&D)
		loans	
		subsidies	

[36] Social capital may be defined as "the social stock of trust, norms and networks that facilitate coordinated actions" (Cohen, 1999, p. 218, referring to Putnam)

Financial capital is a highly important resource that new ventures initially require during the founding process (Schoonhoven, Eisenhardt, and Lyman, 1990; Stuart and Sorenson 2003) as well as the first years of their life (Cooper et al., 1994; Lee et al., 2001) since it influences sales and employment growth. Relevant studies have related the initial financial capital to new venture survival and performance (e.g. Cooper and Gimeno-Gascon, 1992; Batjargal, 2003). On the contrary inadequate financial resources are often related to emerging businesses failure (e.g. Chandler and Hanks, 1998; McQueen 1989). Due to rather natural finance constraints, entrepreneurs encounter severe problems with respect to funding (Horwitch and Prahalad 1976) and usually depend on external financing (Evans and Jovanovic 1989; Sapienza and Timmons 1989). Empirical evidence indicates that entrepreneurs tend to rely primarily on personal sources of funding for venturing such as personal savings, assistance from family and friends, or personal bank loans (Madsen et al., 2008). Chandler and Hanks (1998) have found that the initial capital provided by the founder depends on the type of industry and on founders' perceptions of opportunities recognition. General funds consist of government loans and grants, funds from business angels or venture capital firms, and seed funding (Shepherd, 1999).
Financial resources are more critical to new ventures in dynamic markets and volatile environments (Newbert 2005). Technology-based companies are especially subject to high risk and require substantial capital resources to finance R&D. Sternberg and Lückgen (2005) have found that private investors such as venture capitalists or business angels are highly important in cases of technology-based ventures.

Knowledge constitutes a particular type of resource in new venturing especially regarding KIE[37]. It has been described such as a rare, inimitable and non-tradable kind of asset (Barney, 1991) which if combined in creative ways it may yield entrepreneurial activities (Hagedoorn, 1996). Boulding (1966: p. 9) notes that: "the acquisition of knowledge is itself part of the process [of entrepreneurial discovery]". Literature has been long concerned about this valuable asset; it was first examined as the understanding of how to start up new organizations, how to manage people and processes and how to attain growth and competitive position associated with the opportunity (e.g. Alvarez and Barney, 2007; Mintzberg, 1994; Shane, 2000; West and

[37] Although the issue has been discussed in the beginning of the Unit, we refer to it again in order to provide a complete picture of the types of resources

Noil, 2009). Investigation extended to understanding how to stage technology and new product development (e.g. Wiklund and Shepherd 2003) relate to innovation (e.g. Caloghirou et *al.*, 2004; Zander and Kogut 1995; Nonaka, Toyama, and Nagata, 2000) and competitive advantage (e.g., Prahalad and Hamel 1990; Nelson 1991; Henderson and Cockburn 1994; Nonaka 1994; Kogut and Zander 1996).

Wiklund and Shepherd (2003) investigate three types of knowledge which derive from different sources; knowledge about the industry, knowledge about the type of business, and knowledge about starting up new ventures. Agarwal, *et al.* (2004) added market knowledge which regards information concerning opportunities or needs in the market that are not yet fulfilled by current competitors, or knowledge about regulatory and marketing processes. The accumulation of such knowledge resources at its inception sets a pre-condition for the new venture's sustainability. New types of knowledge were first mentioned when scholars turned to explore knowledge-based cases and more precisely technology-based. Then scientific and technical knowledge becomes a core resource for new venturing (e.g. Karlsson et *al.*, 2004; Garavaglia and Grienco, 2005) leading to the concept of knowledge-based entrepreneurship.

Under the knowledge-based view, knowledge sources become the most valuable assets in all cases; large organizations as much as small and micro firms, which are however knowledge-intensive, draw on many knowledge sources besides R&D in order to innovate (e.g. Shan, 2000; Freel, 2003). Therefore, knowledge producing activities are spread across a number of different functional areas and existing knowledge is exploited through networks and links to other knowledge producers.

Environment: "New ventures do not operate in vacuum" (Caloghirou et al., 2012, D1.1.3). Furthermore, entrepreneurship can only be meaningfully analyzed within a well-defined institutional context (Henrekson, 2007; Aldrich and Fiol, 1994). Therefore, there is always a role for the environment (primarily economic and institutional) in fostering entrepreneurial firms. Russell, (1999) proved that a dynamic environment offers high incentives for firms to pursue corporate entrepreneurship since their competitive advantages are constantly outdated, while a hostile or competitive market provides a strong incentive for firms to innovate because their advantages are not protected. Also, heterogeneity (Zahra et al., 1999), that is, the presence of diversified markets encourages entrepreneurial innovation.

Venturing always faces obstacles such as barriers to entrepreneurial entry, government bureaucracy, lack of qualified resources, lack of environment, industry data, customers' preferences and/or organizational rigidities. Stinchcombe (1965) referred to such special difficulties that new firms face in obtaining critical resources as 'liabilities of newness' which pose threats or obstacles to the new firms' success if they are not managed adequately. Obstacles can take many different forms and depend partly on the institutional and political conditions in the different national economies. They can impede the entrepreneurial commercialization of new technologies (Henrekson and Rosenberg, 2001) just as much as they can impede any other entrepreneurial activity.

Many times newly established ventures are in a vulnerable market position since they lack industry and environmental knowledge and do not have strong ties with customer and suppliers (Caloghirou et al., 2012). In the case of knowledge-based entrepreneurship, additional obstacles result from the peculiarities of knowledge and its mode of transfer (Witt and Zellner, 2005). The technology and/ or the market environment changes rapidly while competitive intensity, due to market dynamism, causes high ambiguity for price competition and competitors' reactions.

The **institutional environment** sometimes strengthens and sometimes reduces the incentives for entrepreneurship (Nystrom, 2008). Policy measures supporting entrepreneurial opportunities are also a vast topic in the field of entrepreneurship and it is not the intention of the present thesis to refer to them in an exhaustive way. However, they play a significant role to KIE as well as entrepreneurship in general. Impediments to entrepreneurship – such as taxes, regulations, government restrictions, administrative burdens and other unfavourable conditions – tend to dry up the supply of entrepreneurs with negative impacts on the startup, survival, growth and general viability of businesses within a European context (e.g. Rees and Shah, 1994; Poutziouris et al., 2000). According to Audretsch and Keilbach (2008) a high tax burden reduces the propensity to start up a new business, and hence the region's entrepreneurship capital. A reference at extreme situations, which however are common in real life, societies of high levels of corruption and where bureaucracies are inefficient, cannot produce a significant number of new firms (Mauro 1995)

On the other hand, favourable conditions tend to spawn entrepreneurs (Herbig et al., 1994). Formal rules such as regular law and regulations, the definition and

enforcement of property rights and contract laws are rather fundamental for economic activities (e.g. Henrekson, 2007. All scholars agree that favourable environments assist the removal of barriers for both innovation and entrepreneurial activity and are important stimulants to new business development (e.g. Witt and Zellner, 2005).

Within the environmental context a stream of literature considers the ***geographic location*** as a compelling factor influencing new venture creation and growth. Geographic location has been reported to influence firm patenting performance, enhance the ability to attract alliance or private equity partners as well as (e.g. Folta et al., 2006) heighten demand for products (Chung & Kalnins, 2001) and affect new ventures internationalization (Westhead, Wright, & Ucbasaran, 2001).

Table 2.11: The environmental framework

Economic Factors	Political Factors	Industry Factors	Demographic Factors	Cultural Factors
Stable Economic Conditions	Rule of Law & Property Rights	R&D Intensity, Technological Development	Population Growth	Social Acceptance of Entrepreneurship
Economic Growth	Macroeconomic Policies	Locus of Innovation	Population Density & Urbanization	Attitudes toward failure & bankruptcy
Wage Rates	Licensing & Bankruptcy	Strength of Patents	Immigration & Population Mobility	Competitiveness
Income Disparity	Deregulation	Market Size	Educational Infrastructure	Bureaucracy & Corruption
Capital Availability	Resource Policies	Market Growth		Tradition
Taxation	Sectoral Policies	Market Segmentation		Social Capital
	Decentralization of Power	Industry Structure		Power Distance (PDI)
		Industry Age		Uncertainty Avoidance (UAI)
		Dominant Design		Masculinity (MAS)
		Industry Concentration		Individualism (IDV)
		Profitability		
		Cost of Inputs		
		Capital Intensity		
		Advertising Intensity		
		Firm Size		

Adapted by Fuduric (2008) *(Sources: Hofstede et al., 2004; Lorentzen, 2007; Shane, 2003; Storey, 1999; Verheul et al., 2001)*

Another point of interest is the fact that since the late 80s new venture internationalization has become an issue of observation for new venture scholars[38]

[38] Mainly in high technology industries (Autio et al., 2000; McDougall et al., 1994; Zahra et al., 2000)

(Gilbert et al., 2006; McDougall et al., 1994), denoting its significance for a venture's ultimate survival and growth. Within this framework there is a number of factors examined that make early internationalization possible, including the knowledge-intensity of the venture's resources, potential for cross-border operation, and resource access and mobilization across national borders (Sapienza et al., 2006). Therefore, country, economic and industry conditions as well as institutional infrastructure such as special incentives and guarantees for foreign investment encouragement might significantly influence prospects for survival and/or growth (Busenitz, Gomez, & Spencer, 2000). Conversely, certain tariffs, laws, or cultural customs may preclude an entering company from realizing growth.

Today, the world becomes increasingly globalized with a growing interconnectivity of financial markets and various institutional factors, which were previously deliberated within national governments, to become universal. Therefore, the concept of environmental context and its impact on new venture creation, survival and growth broadens enough to take now transnational and global dimensions.

c) New venture performance

"The growth and survival prospects of new firms will depend on their ability to learn about their environment, and to link changes in their strategy choices to the changing configuration of that environment".
Geroski (1995)

Firm performance measures are defined as metrics employed to quantify the efficiency and/or effectiveness of actions (Tangen, 2003), and have always remained a problematic issue in business research (Fahy et al., 2000). Accordingly, there are many methods by which the performance of a venture might be measured (Dollinger, 1984), and it is beyond the scope of the present thesis to debate the relative merits of these approaches. However, we should mention that the literature has not provided yet any unitary definition of performance measurement in general.

Performance measures used are of a financial nature such as return on equity (ROE), return on assets (ROA) or return on investment (ROI) and operating income as well as non-financial nature, such as quality issues, number of complaints and delivery time (Anthony et al., 2001; Wu, 2006).

However, empirical literature focused on the post-entry performance of firms pays major attention in investigating the survival, growth and early exit of newborn firms

(among the early studies, see, for instance: Reid, 1991; Baldwin and Rafiquzzaman, 1995). Following the general views on firm performance, new venture performance has been measured by using several variables such as speed of first product to market (e.g. Knockaert et al, 2011; Schoonhoven et al., 1990), raise of external capital (Shane and Stuart, 2002) and innovativeness (Barney et al., 1996; Perry-Smith & Coff, 2011). Yet, the most used ones have been so far **survival and growth** (e.g. Brush and Vanderwerf, 1992; Ensley et al., 2006; Baum et al., 2001; Baum and Locke, 2004; Hmieleski and Corbett, 2006).

New venture survival has been defined as the existence of the venture over certain period of time after the actual start of the business (Kessler et al., 2012) or "the opposite of failure" taking into consideration that a venture fails when it ceases to exist as an economic entity (Chrisman et al., 1998). Barney (1986a) regarded survival as an absolute measure of venture performance that depends on the ability of the venture to continue to operate as a self-sustaining economic entity (Barney, 1986a).
However, a significant question regards the period of time that secures survival. According to Bartelsman et al. (2005) who worked on data for 10 OECD countries, about 20–40% of entering firms fail within the first 2 years of life, while only 40–50% survive beyond the seventh year (OECD, 2003). The U.S. Small Business Administration (SBA) estimates that four in five ventures fail within the first five years (Headd, 2010). Audretsch et al. (1999a) studied 1570 new Italian manufacturing firms and tracked a final survival rate after 6 years of activity equal to 59.1%. Dahl and Sorenson (2012) show that 52% of new Danish ventures with a least one employee do not survive for 4 years. According to Chandra (2007) one third of new firms do not survive the third year and about 60 per cent do not survive the seventh year. Several other studies on different countries and different sectors reveal that more than 50% of new firms exit the market within the first five years of activity (e.g. Dunne, Roberts and Samuelson, 1988 and 1989; Reid 1991; Geroski, 1995; Audretsch and Mahmood, 1995; Audretsch, Santarelli and Vivarelli, 1999a). Another view which confirms the above choice regards a stream of literature exploring the length of time it takes for a new venture to mature. Scholars argue that although this time will vary depending on its industry, resources, strategy, etc., it seems reasonable to assume a three- to- five years period after creation as the earliest one (e.g. Biggadike, 1979;

Kazanjian & Drazin, 1990). Therefore the five years period is rather universally accepted and frequently used as a suitable criterion (Ensley et al., 2006).
The Survival indicator is then accepted as a clear indication of whether a new firm can adapt to its external environment even at some minimally satisfactory level. Survival is a necessary condition for organizational growth (Helfat et al., 2007). However, survival does not tell us much about how well a firm is surviving while **firm growth** presupposes survival and relies on a considerable number of alternative objective and accurate measures. On the other hand, survival does not guarantee growth and not all growth is automatically profitable (Markman and Gartner, 2002). A review of the relevant literature suggests that the most important measures of new venture growth are in terms of sales, employment and market share (Delmar, 1997; Coad, 2009; Gilbert et al., 2006) thus in aspects of its cash flow, net income, customer base, sales, employment or market share (Murphy, Trailer, & Hill, 1996).

Sales growth and *multi-year sales trend* data can provide evidence of how revenues of a venture change over time and of sustainable growth respectively (Ireland et al., 2003; Helfat et al., 2007). As such, sales are the most commonly used indicator of new venture growth (Murphy et al., 1996; Weinzimmer et al., 1998). When sales growth occurs, a venture is supplied with revenues that can be reinvested into resource expansion or capability development. *Employment growth* is appropriate for new ventures where assets and employees often grow before any sales occur (e.g. Hanks et al., 1993). *Market share growth* provides another indication of the acceptance of the venture's products or services in the market. However, it can be evaluated only based on the industry or at the level of a given product category which constitutes a drawback compared to the other two measures.

Another point of interest is the *role of innovation* for firms' survival and growth since KIE's definition connects new firm formation with innovation. In new venture's growth literature innovation emerges in general as a firm's growth driver (cf. Aghion and Howitt, 1992; Freel, 2000; Coad and Rao, 2008) and specifically as a positive predictor of survival and an "above-the-average post-entry performance of newborn firms" (Vivarelli, 2013). However, some studies find a weak link (Bottazzi et al., 2001; Coad and Rao, 2008) while some others fail to find any influence of innovation on growth at all (e.g. Almus et al., 1999; Freel and Robson, 2004). In the same vein

innovation, knowledge and performance seem to have a rather significant relation according to the main findings of the survey conducted among 4,004 firms across ten European countries under the AEGIS project.

d) Competitive advantage

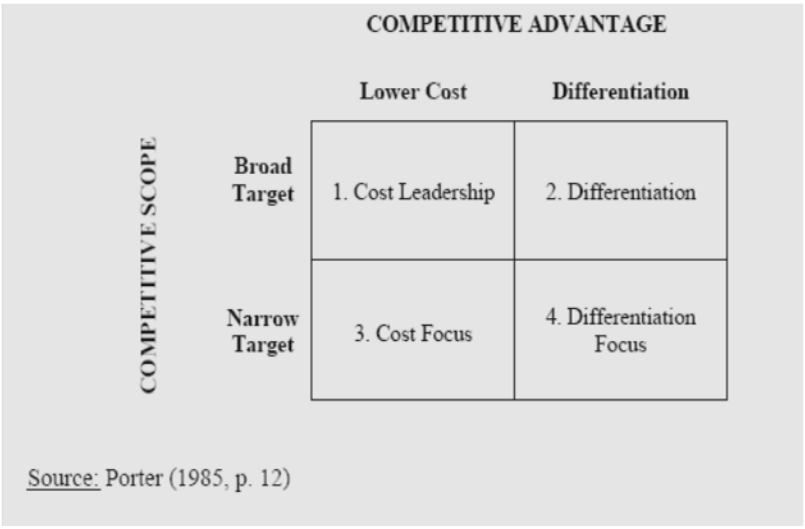
Performance is correlated with the notion of Competitive Advantage (CA) (Porter 1985), a concept introduced by Chamberlin (1933) and linked to competencies by Selznick (1957). CA was described as the unique position an organization develops vis-à-vis its competitors through its patterns of resource deployment (Hofer and Schender, 1978). Day (1984) and Porter (1985) regarded CA as the objective of strategy which is sustained when other firms are unable to duplicate the benefits of this strategy providing the term of "sustainable competitive advantage" (SCA). However, the concepts will be better defined in a clearer way only during the 90s, with Barney (1991) to state "A firm is said to have a sustained competitive advantage when it is implementing a value creating strategy not simultaneously being implemented by any current or potential competitors and when these other firms are unable to duplicate the benefits of this strategy". Hoffman (2000), based on Barney's (1991) work, to define it as "the prolonged benefit of implementing some unique value-creating strategy not simultaneously being implemented by any current or potential competitors along with the inability to duplicate the benefits of this strategy" CA and SCA has been mostly examined within the field of strategic management (e.g. Barney 1991; 1995; 2001; Hoffman 2000; Peteraf, 1993; Porter 1985; Priem & Butler 2001; Rumelt, 1984). Scholars have tried to examine sources and origins as well as the content and types of strategies of achieving SCA.

Evolving from the RBV, the dynamic capability view and the Knowledge-based View of the firm are considered as two extended forms of this theory tightly connected with SCA within the field of strategic management. According to the KIE approach, knowledge is considered the key or strategic asset to hold the potential of SCA, while managing knowledge-based resources has become the key for gaining SCA and sustained superior performance. The AEGIS project confirmed further the relation of SCA with knowledge-intensiveness. Indicatively, Radosevic and Mikhailov (2012) explored the CA of 60 knowledge-intensive firms of the software and machine tool sectors. In the same vein, Protogerou and Karagouni (2012) use the large dataset of the AEGIS survey work in order to empirically test the applicability of the DC

concept in Knowledge-intensive, newly-established firms of all sectors. The authors provide evidence that DCs are of significant importance for creating and sustaining competitive advantage.

While, according to Porter and his theory's fans, CA means having low costs, differentiation advantage, or a successful focus strategy (Figure 2.10), competitive advantage has been manifested in many dimensions, such as innovativeness, market position, mass customization, and difficulty in duplicating (e.g. Barney, 2007). In empirical research this has been translated into product/service novelty, product/service quality, product customization and cost competitiveness. While, most CA research has mainly focused on established companies, there is some limited research regarding the links between CA and new venture performance (e.g. Chen, 1996; Zahra et al., 2002). Sánchez and Menguzzato (2006) measured the start-up competitive advantage by four items: speed in responding to the market; production efficiency; product quality; and, innovation speed.

Figure 2.10: Porter's generic strategies



Source: Porter (1985, p. 12)

However, according to our knowledge, it seems that the literature so far has not paid further attention on the significance of the **initial competitive advantage** a new venture builds in order to survive and prosper. Although there are a considerable number of studies in multiple fields of interest where "initial competitive advantage" or "start-up competitive advantage" is mentioned, the term is always accepted as known, in no need of definition or further explanation. The two terms have been used

in discussions on the significance of resources and the importance of the founding team (e.g. Autio et al., 2009; Davidsson *et al.*, 2003; Lazonick, 1990; Prasad et al., 2013; Sánchez and Menguzzato 2006; Vanhoutte et al., 2010), analysis of the role of joint ventures (e.g. Espinosa and Suanes, 2011) and emerging market multinationals (e.g. Williamos et al., 2013), the role of intellectual property strategies for new venturing (e.g. Ho et al, 2010; Scitchmer and Green, 1990) and types of innovation in new ventures (e.g. Dunning, 1988; Kotabe, 1990; Jones, 1988; Leonie Baldacchino, 2009; O'Neill, 1983); Wu et al., 2009). Russell (1989) claimed that creativity and innovative spirit give the new-born entrepreneurial organisation its initial competitive advantage. George Yip, professor of management at Cambridge University, identifies international success as depending upon two factors: a firm's initial competitive advantage and the effectiveness of its internationalization process (in Grant, 1999). Halbheer et al., (2007) ask themselves if initial competitive advantages are self-reinforcing focusing on the examination of initial cost advantage.
However, in general, the word "initial" has been mostly used in describing phenomena related to new venturing as in terms like initial capital, initial resources, initial innovation etc but with no specific definitions in any case.

2.4. Production Technologies

2.4.1. Technology and technological knowledge

> *By virtue of his nature as a toolmaker, man is therefore a technologist from the beginning, and the history of technology encompasses the whole evolution of man.*
> (Britannica, p. 452)

The term alone is a combination of the Greek téchne, "art and craft", with logos, "word, speech", meant in Greece a discourse on both fine and applied arts and was clearly distinguished by science. In 1969, Bernal prefers the word technique in his Science in History defining it as "an individually acquired and socially secured way of doing something'. The author also makes sure to distinguish it from science: "a science is a way of understanding how to do it in order to do it further." (Bernal, 1969, p. 47) replicating Skolimowski's (1966) famous quote: "Science concerns itself with *what is,* technology with *what is to be."*

In 1972, Rosenberg defined technology as "those tools, devices, and knowledge that mediate between inputs and outputs (process technology) and/or that create new products or services (product technology)" (Rosenberg, 1972). Ten years later, he attempts a broader definition of technology as "knowledge of techniques, method, and designs that work and, that work in certain ways and with certain consequences, *even when one cannot explain exactly why*" (Rosenberg, 1982, p. 143). According to the Encyclopaedia Britannica, "Technology may be defined as the systematic study of techniques for making and doing things. […] In the early 20th Century, technology included a growing range of means, processes, and ideas in addition to tools and machines‟ (p. 451). Britannica continues by claiming that in the second half of this century technology is defined by terms like "The means or activity by which man seeks to change or manipulate his environment" (Ibid. p. 451).

The development of needed technologies entails "an act of discovery, a speculation on the future, but also the creation of a new path through the distributed efforts of many" (Berglud, 2010). Idea implementation rests on combinations of activities which range from pure novelty to modest adaptation but in their essence "they reflect the pragmatic nature of most expressions of technological knowledge" (Pavitt, 1984). Many scholars equate the attainments in technological evolution with prior work in science. Technology refers then, according to relevant definitions, to processes of applying the findings of science and other forms of enquiry to applied situations and can represent a major source of competitive advantage and growth for manufacturing firms (Dosi and Grazzi, 2009; Dussauge et *al.,* 1994). Scientific knowledge and new technologies are indeed indispensable in many innovation cases. However, it should be made clear that technology is not science, nor is technology dependent on science as emphatically stated since the early work on the issue (e.g. Skolimowski, 1966).

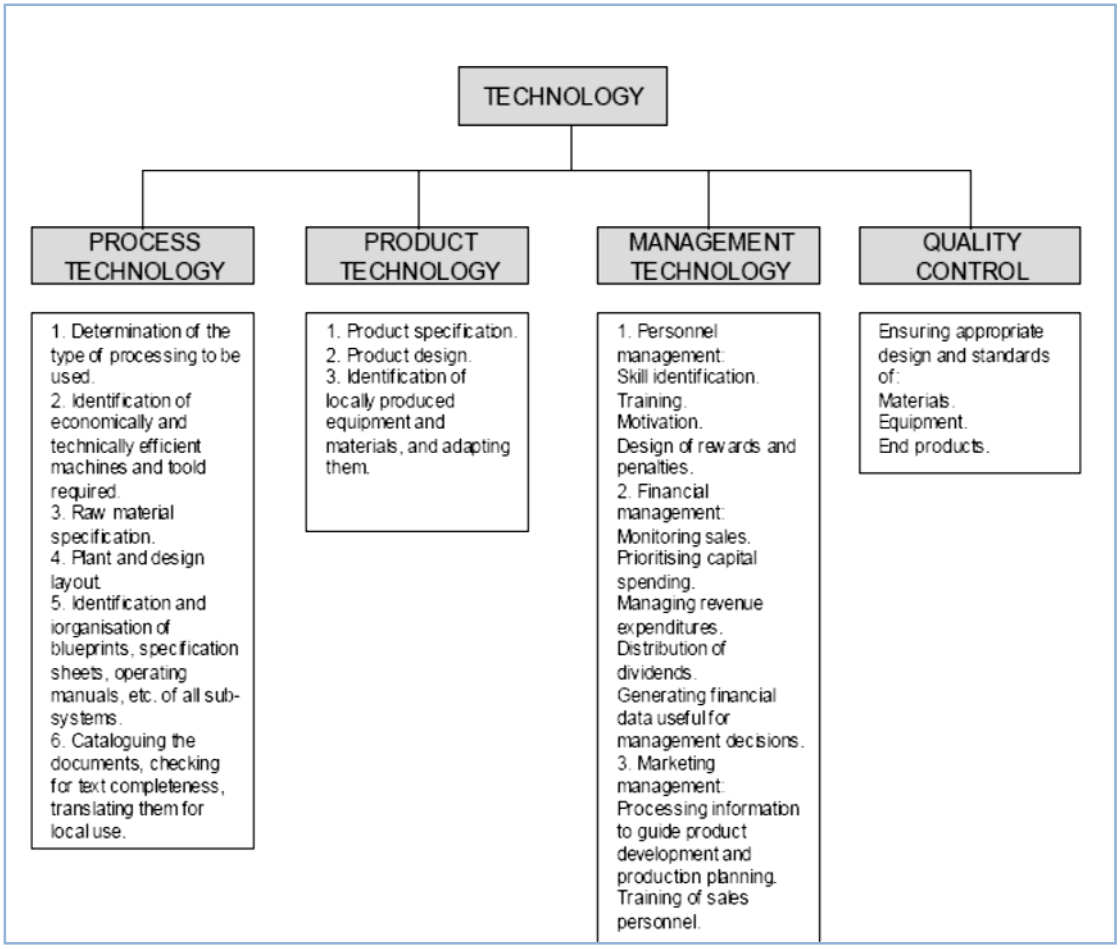
According to Dosi and Grazzi (2009) "technology is a set of pieces of knowledge ultimately comprising selected physical and chemical principles, know-how, methods, experiences of successes and failures, and also, of course, physical devices and equipment technologies". The authors confront the concept of technology as a kind of "recipe" which entails a design for a final product and a set of procedures in order to achieve it parallelizing it with a cake recipe and link it with the notion of knowledge.

Dosi and Grazzi (2010) claim that "in the most general terms, a technology … most often entails procedures regarding how to achieve the ends concerned, particular bits of knowledge, artifacts and specific physical inputs necessary to yield the desired

outcomes". The procedures of realizing a pioneering, novel or unconventional and usually knowledge-intensive idea draw upon specific elements of knowledge, partly of the existing know-how variety and partly of a more theoretical and creative variety.

Layton (1971) had viewed technology as a spectrum, with ideas at one end, techniques and things at the other with knowledge to be the intermediate link. This is referred as ***technological knowledge***; thus knowledge generated through thinking and action involved in creating adaptive systems. New theoretical knowledge is a source of invention and innovation and can constitute the base for new technology. A definition generally accepted today regards technological knowledge as knowledge of how to produce goods and services (Bohn, 1994) and according to a more updated definition **"knowledge associated with products, technologies, and/or processes"** (Burgers et al., 2008). According to Henderson and Clark (1990) technological knowledge is composed of *knowledge of the components* and *architectural knowledge* i.e. the linkage between the components. Most often knowledge internally generated by the firms is complemented by knowledge emanating from external institutions such as universities and public laboratories and from other industrial actors such as suppliers and customers (see the discussion in Dosi, 1988; Freeman, 1994; Klevorick et al., 1995). More and more firms now acquire a substantial part of their technologies from external sources (Lichtenthaler & Ernst, 2007).

Figure 2.11: Definition of technology



(Source: UNCTC, 1988)

Technological knowledge is tacit; as Pavitt puts it with regards to technological knowledge:

> *"Most technology is specific, complex . . . [and] cumulative in its development. It is specific to firms where most technological activity is carried out, and it is specific to products and processes, since most of the expenditures is not on research, but on development and production engineering, after which knowledge is also accumulated through experience in production and use on what has come to be known as 'learning by doing' and 'learning by using'.*
>
> *(Pavitt, 1987, p. 9)*

Therefore, technological knowledge concerning methods, processes, arrangements and products is created, replicated, modified or co-produced. No matter the way, it is a painstaking and often quite expensive business (Mansfield et al., 1981).

In sum, technology includes not only process technology (the narrow and traditional view of technology) but product technology together with financial and marketing technologies and quality control as Shamsavari, Adikibi and Taha (2002) claim adapting UNCTC's chart (Figure 2.11). Grant (1996) has also claimed that besides process technology which reflects the technical aspects of production and the types of specialized knowledge required for the process, organizational design is further included regarding the division of tasks between individuals and departments.

Technology and technology relationships have been connected to innovation and strategy (e.g. Arnold and Thuriaux, 1997; Parthasarthy and Sethi, 1992). According to Grant et al., (1991) ''optimal'' technology for a business is contingent upon the firm's strategic goals, its available resources, and the nature of its product–market environment. Innovation is a fundamentally economic process, in which technology may play a greater or a lesser role. Many studies have integrated innovations with market and technology dimensions (e.g. Danneels, 2002; Abernathy & Clark, 1985; Garcia & Calantone, 2002; Van de Ven, 1986; Brown & Eisenhardt, 1997; Renko et al., 2009). Furthermore, innovation may incorporate product and process innovation attributes besides other forms and types (please refer to relevant chapter). Innovation in the production process can mean new activities introduced into a firm's production or service operations which may range from introducing new machinery to adopting new methods of organizing production in order to achieve lower costs, higher quality or innovative products (Reichstein and Salter, 2006; Utterback and Abernathy, 1975).

Process innovation has been mainly associated with flexible, advanced manufacturing technology (e.g. Raymond and St-Pierre, 2005) and information technology (e.g. Zhang, 2006). Stowsky (1992) observes that, "innovations in the equipment sector have sparked- and continue to spark- key technological advances. Consequently, for both chipmakers (and indeed final product industries), the manufacturing know-how gained through managing the process of equipment development constitutes an increasingly crucial source of strategic competitive advantage". The revolution in production engineering and management over the past twenty years which has introduced 'Japanese' methods and 'soft technologies' such as continuous improvement and lean production can be interpreted as a move towards an innovative reintegrating the engineering and managerial aspects of technology. ERP systems, mass customization and Pilkington's innovative float glass production

process are impressive paradigms of process innovations which have helped companies achieve significant competitive advantages. Regarding R&D and NPD in general, innovative products incorporate new technology and often require the development of new production lines and even new machinery and, *vice versa*, a new production process allows the production of new goods (e.g. Smolny, 2003). The literature on technological knowledge has offered plenty of insights into the detailed mechanisms through which innovative search occurs, on the sources of knowledge on which it draws (e.g. Dosi and Grazzi, 2006), the investments needed (e.g. Smolny, 2003) and on their inter-sectoral differences. (e.g. Dosi *et al*., 2005; Freeman, 1994).
The process of technological knowledge accumulations appears is a rather dynamic process for the selection, acquisition and diffusion of new (technical) knowledge. The accumulated technological knowledge constitutes then the ***technological resources*** of the firms. A specific strand of literature has focused on the role of technological resources as prominent factors that influence innovation performance (e.g. Raymond and St-Pierre, 2005) together with profitability, productivity and competitiveness in the framework of constant technological change (Pack and Westphal, 1986). According to literature, technological resources further have a significant influence on the internationalization of firms (Rodriguez & Rodriguez, 2005; Tsang et al., 2008). Empirically, this has been investigated by a significant number of scholars such as Tseng, Tansuhaj, Hallagan, and McCullough (2007), and Kafouros et al. (2008).

Besides technological assets, technological know-how, unique and valuable tacit knowledge, and managerial capabilities have been considered as fundamental for the development of innovation and the creation of competitive advantage (e.g. Carlsson, 1989; Raymond and St-Pierre, 2005). Therefore, technological resources are not themselves sources of sustained competitive advantage; firms need also unique capabilities to exploit them in a creative and entrepreneurial manner and thus they have to develop ***technological capabilities.*** Several scholars focused then on the concept of technological capabilities and technological opportunities and their role on firms' survival, performance and competitive advantage (e.g. Malerba and Marengo, 1995; Helfat 1997; Torkkeli and Tuominen, 2002) Cantwell and Fai (1999, p. 333) conclude ''while on the surface innovation is commonly observed through the market phenomena of the emergence of new products and the diversification of existing products, the underlying capability to change what markets receive is provided by the

corporate capability to create and refine to a viable point new products and processes, which rests on the cumulative generation of technological competence in firms.''

Thinking in the same way, Arnold and Thuriaux (1997) claim that economists tend to describe innovation as "a new combination of the factors of production" according to the Schumpeterian perspective. This can involve using results of scientific or technological research, but it can also involve much more mundane things such as laying out the machines on the factory floor in a better order, changing the design of the product packaging or copying ideas from a producer in a distant market in order to create a local advantage. Furthermore, according to Keith Smith in his paper *What is the 'knowledge economy'? Knowledge-intensive industries and distributed knowledge bases* (2000) "knowledge cannot be incorporated into production except via investment, and the function of investment is often to implement new knowledge in production technology". Much of the knowledge intensity enters then as embodied knowledge incorporated into machinery, equipment, methods, techniques and production processes or as intermediate inputs such as components and materials[39]. Activities such as design / customization, the installation and preparation of equipment and trial production are knowledge generating activities.

Quite similar industrial activities seek knowledge in different areas and demand different "pieces of knowledge". For example, the knowledge and skills required to make glass using the float-glass method are quite different from those required to master other glassmaking technologies. The introduction of CNC machinery created a significant demand for new skills and capabilities regarding engineering, production processes, ICT and organization.

Production technologies hold a critical role in this value-generating cycle. They are actually responsible for the successful application of the work of researchers and industrial practice and the development of new products and processes in order to offer commercial products covering technologies for an extremely varied range.

2.4.2. Production technologies

[39] "Embodied flows involve knowledge incorporated in to machinery and equipment" (Hirch-Kreinsen, 2006).

"The conception, design, and production of whatever artifact, however, involve (often very long) sequences of cognitive and physical acts. In the example of a car, one goes from the activities of design to the development of a prototype all the way to the actual production"

Dosi and Grazi (2006)

Production is still an essential aspect of economic activity and has a major impact on technological change and innovation. Relevant analysis encompasses fundamental concepts and aspects as time, technical change, knowledge, organizational issues, input and output characteristics. The production process refers to the operational way in which inputs are combined and transformed into output, only once this process has been organized. Production process's organization and mechanisms have been called ***production technology*** by Woodward (1965) and Lin and Germain (2004) and have been treated as contextual variables of organizational design in general. Organization and technology are two sides of the same coin: time, knowledge, product characteristics, division of labor, control and decision rights and incentives interact together in ways that are still overlooked. For Suarez, Cusumano and Fine (1991) production technologies reflect the capital intensity of the production process and the characteristics of this capital. Therefore, production technologies may cover:

a) technological know-how, technologies and manufacturing
b) technological capabilities
c) processes and methods
d) models
e) R&D,
f) materials
g) design and,
e) production management systems.

Wu and Sun (2010) limit the term to technologies on the production of certain industries or even enterprises. According to the EAR[40], production technologies are also limited to rather a sort of "technological hardware" comprising of "all production stages, such as: product engineering, manufacture, integration, assembly (mounting), inspection, testing, and quality assurance". No matter the definition, production technologies and more generally, the management of new technologies are lately receiving increasing attention in strategic management research (Greve, 2009) either

[40] Export Administration Regulations

as important factor of innovative efforts and firm performance (e.g. Danneels, 2002; Abernathy & Clark, 1985; Garcia & Calantone, 2002) or as core elements of technological capabilities (e.g. Lee et al., 1997; Westphal et al., 1985; Sampath and Oyeyinka, 2008; Lall, 1992) as it will be soon after discussed.

The set-up of production technology occurs in parallel with organization creation for most types of ventures. Organization creation refers to the building of the physical structure as well as organizational processes that surround production technology at the core (Thompson 1967). Production technology as well as product development consume resources, often delay product introduction, and add to uncertainty and risk (Saple et al., 2005). After the commitment to physical creation, entrepreneurs garner resources and use them toward technology set-up, together with organization creation and marketing. Sometimes, manufacturing technology is complex and involves high development costs. On the other hand, modifications to work-piece handling and transport are possible levers and an easier part of discussions among makers and users.

In the same line and in accordance with the above discussion, the transformation of an innovative business concept into a marketable product presupposes the choice and set up of the suitable production technology. The commitment to physical creation is thus a significant transition point in venture creation (Bhave, 1994). Certain businesses require considerable resources for the set up of production technology and most of them besides the use of standard equipment and technology, develop production technology novelties in order to create respective products. Sometimes, successful product creation, contingent upon the development of the underlying technology, introduces uncertainty, requires risk capital, and makes venture creation qualitatively more hazardous for these businesses. After the initial breakthrough, incremental technological progress may enhance and extend the underlying technologies. This is for example evident in Hollander's (1965) discussion of rayon.

Such investments – together with developed repertoires of routines - lay the foundations for the future of the firms according to Teece (1997). Klocke (2009) in his paper *Production Technology in High-Wage Countries – From Ideas of Today to Products of Tomorrow* argues that the application of correct strategies is not enough to create value if not combined to relevant applications of processes of technological know-how. Much of the knowledge intensity enters as embodied knowledge:

"Embodied flows involve knowledge incorporated in to machinery and equipment" (Hirch-Kreinsen, 2006). One of PILOT's[41] results was that for innovating firms in traditional sectors the purchase of equipment is the only really relevant factor for the development of innovations.

Accepted the fact that the requisite knowledge and skills are distributed across many agents (as mentioned above), production technologies are made in turn by tapping together appropriate technology made of components of a vast range of origins. Thus, the **nature of knowledge** upon which technological activities draw is multifarious regarding types of knowledge bases and skills and the ways they are used and applied in order to transform a concept into products and processes (Granstrand, 2000). The basis of embodied flows is the fact that most research intensive industries (such as the advanced materials sector or the ICT) develop products that are used within other industries: that is machines and equipment or components and materials. The receiving industry develops the skills and competences to use these advanced knowledge-based technologies. Competitiveness within "receiving" industries depends heavily on the ability to access and use such technologies. Yet, because of increasing technology convergence, these fields are often relatively different even from the core industry technologies (Garcia-Vega, 2006), and this puts further emphasis on the importance of successful technology exploitation (Patel & Pavitt, 1997). This is especially evident in traditional firms (Lichtenthaler & Ernst, 2007).

Innovative technology processes can become difficult- to-imitate technological capabilities such as the near-net casting of Chaparral Steel (Leonard-Barton, 1995) and Toyota's successful introduction of the *kanban* production system (a truly systemic innovation according to Teece, 1996). Then there are always the issues of protecting novelties as well as the purchase of licences to use such protected technological knowledge. Usually process innovation and relevant technologies are protected as trade secrets, while patents apply in cases of inventions and products. According to Teece (1986) the nature of technology together with the nature of knowledge are major factors of appropriability regimes.

Production technologies and manufacturing capabilities appear to play significant role further in the commercialization of the innovative output; agents have to develop the

[41] EU funded transnational research project with the acronym PILOT – "Policy and Innovation in Low-Tech: Knowledge Formation, Employment and Growth Contributions of the 'Old Economy' Industries in Europe" (FP5 Key Action Improving the Socio-economic Knowledge Base (HPSE-CT-2002-00112). For details see www.pilot-project.org.

necessary manufacturing systems to develop complex designs. Manufacturing capabilities, therefore, can determine the initial survival and success of a new venture or the success of consequent innovations (Pisano & Wheelwright, 1995).

Of course, innovation can be also incremental in order, for instance, to maintain low costs or complementary advantages. Morceiro et al (2011) discuss on the development of a new method of iron ore processing by Vale Industries which had a significant environmental impact; the new production method allowed to save about 19.7 million cubic meters of water annually - equivalent to annual consumption of a city of 430,000 inhabitants - and 18,000 megawatts of energy, also preventing the construction of tailings dams and remove equipment and structures such as pumps, sieves, pipes, tanks and classifiers (Morceiro et al., 2011). However, Henderson and Clark (1990) exploring incumbent firms in the photolithographic industry, argue that seemingly minor innovations require the efficient integration and coordination of multiple engineering tasks (and thus advanced technological capabilities); changes related to even minor technology shifts are often hard to be addressed effectively (Tushman and Anderson, 1986; Henderson and Clark, 1990).

Thus, technological know-how and technological capabilities are clear performance characteristics by means of which companies can distinguish themselves from the competition (e.g. Klocke, 2009). In these efforts and besides the tangible technological assets, knowledge seems to be core and not "sidelining capital" (Drucker, 1993). Smith (2000) supports this view by adding that "for the OECD as a whole, physical investment is about two and a half times greater than 'knowledge investment as a percentage of GDP".

Production technologies are both affected and affect new product development processes and the subsequent principles of "design for manufacturability". For example, product design has direct effects on the unit-cost of production and on the ability of a firm to produce new products in a short period of time. However, the company *should own the capability* to realize such types of NPD which is translated in suitable production lines, materials, processes and systems, relevant technical and organizational knowledge and skills such as flexibility and adaptability (e.g. Suarez et al., 1991). Sometimes, a new product may even require a complete reconstruction of production lines and technologies. Ford's Model T is an exemplary case: Henry Ford revolutionized manufacturing with the introduction of his "transfer line" technology

for mass production. Besides the extreme specialization, the plants had to be shut down and redesigned when production of the Model T was ended (Hounshell, 1984).

At a sectoral basis knowledge can be added by trans-sectoral sources complementing functions and allowing for unique or innovative production methods. Technological knowledge then is completed through special links and interactions among machine manufacturers, technology providers, consultants, raw material and complementary asset suppliers. It is quite evident that **stakeholders** play a significant role in these processes Sabel et al.(1987) describe the mutually beneficial relationships between the German textile industry in Baden- Wiirttemberg and textile machinery producers in the same region. Rosenberg (1982, p.4) had also supported this argument: "In America the relationship between machinery makers and customers contributed to an interchange of information and a communication of needs to which the machinery producer gradually learned to respond in highly creative ways". Such relationships may even lead to novel technological insights and innovative ideas (e.g. con Hippel, 1988). Stowsky (1987) observed that 'innovations in the equipment sector have sparked-and continue to spark- key technological advances". The author described the creative cooperation among stakeholders in the semi-conductor industry; it appears as "frequent", "close', "information open-sharing" and "innovation enabling", producing important benefits for all. Commenting on this study, Gertler (1993, p. 671) adds: "Japanese manufacturers expect much of this information [i.e. on technical knowledge] to be produced through the extended interaction with their machinery producers, since this know-how simply cannot be embodied completely within the physical equipment itself, but can only be produced and transferred through a joint process of learning by doing".

The relationship among users-product technology producers seems to be a major characteristic of the transfer from the old-type conventional low-tech industry to the new *non-passive type* of low-tech firms. In literature there is a number of papers narrating the dominance of a few powerful, scientifically sophisticated equipment makers who ultimately controlled the advances and innovation in whole industrial sectors such as textiles and dairy industry (e.g. Keenan et al., 2004; Lundvall, 1988). Both industries were led to extensive "hyper-automation", obliging technology users to huge investments at regular intervals and a complete dependence on them. This is gradually changing through the adaptation of open innovation models and the

development of common research projects (as it will be discussed in the following chapter). The new model of co-operation imposes certain changes in all industries included.

In such cases **proximity** of stakeholders holds a critical role and affects the interaction and the quality of knowledge transfer among providers and receivers. Known examples of relevant effective co-operations are the famous *distretti industriali* in Italy and clusters all over the world (indicatively Lazerson and Lorenzoni, 1999). Today, the importance of physical proximity seems to decline due to the advancements in ICT and transportation.

In sum, the choice of production technologies constitutes a significant **strategic decision** at least at the venturing stage and of critical importance for a company's future success and survival (Vranakis and Chatzoglou, 2012). According to Teece (1996), technology evolves in certain path dependent ways while technological progress "builds on what went before, and that much of it is tacit and proprietary" (Teece, 1996, p.195), indicating that it usually has significant organization-specific dimensions. Therefore, these decisions seem to actually create a significant part of the new firm's history and … yes! ..."history matters".

Investments in production technologies and machinery and equipment have been argued to impact firms' performance (e.g. Barro, 1991; Li, 1998; Meliciani, 2000). Sohn et al. (2007) linked strategic investment decisions with financial performances, while DeLong and Summers (1991, 1992) and later Sala-i-Martin (1997) found strong links between equipment investment and economic growth. The same year, Sargent and James empirically exploring the impact of machinery and equipment on firm's performance conclude that knowledge and experience of managers / entrepreneurs have a direct and significant impact on the investments on machinery and equipment.

2.4.3. Technological Capabilities

Production technologies -as described above - include the capability to: design machinery, acquire turnkey facilities which require more sophisticated R&D expertise, operate technological/production processes, assure quality control, do preventive maintenance, debugging and adjustments of the equipment to the local conditions or to the technological line. They have been deemed fundamental or implicit in order to produce novel products or services in most low-tech sectors

(Spanos and Lioukas, 2001; Danneels, 2008). According to Lall (1992) they constitute *basic or operational technological capabilities* or otherwise the zero-order competencies that are needed for producing particular products. More precisely, the technological capabilities literature distinguishes between innovative and production capabilities (Lall, 1992; Bell and Pavitt, 1993), assigning the quality of 'advanced' to the prior and 'basic' to the latter.

Technological capabilities have been defined as the knowledge and skills required to identify, appraise, utilize and create appropriate technologies and techniques relevant to traditional industries, for the purposes of novel production facilities and production processes. They refer further to the engineering and organizational adaptations required to establish the potential of continuous upgrading and innovativeness on these process and product technologies (Acha, 2000; Lall, 1992; Iammarino et al, 2009). They institutionalize research and development (R&D) activities; and carry out more basic technological activities, that is basic research (Fransman, 1984).
Technological or technology capabilities are mainly based on technological knowledge which is called to fill the gap among business vision and physical implementation and which most times transcends sectoral limits. In their paper "Technology management process assessment: a case study", Phaal et al. (2001) presented a five-process model to explain technology management activities. This consisted of five processes and namely a) *identification* of technologies through scanning, monitoring, benchmarking and data collection, b) *selection of technologies,* c) a*cquisition* and assimilation of selected technologies including technology transfer, research and development, corporate mergers and acquisitions, d) *exploitation* of technologies such as licensing, new product development, incremental developments, process improvements, and supply chain management and e) *protection* of knowledge and expertise. The authors will later (in 2009) add learning as a sixth activity. The above list makes it quite obvious that technology management is related to the development and implementation of technological capabilities.

The conceptual and empirical literature on technological capabilities blossomed in the late 1980s and received considerable attention from the mid-1980s through and early 1990s (e.g. Katz, 1976; Westphal, Kim and Dahlman 1985; Lall, 1990, 1992; Bell and Pavitt, 1993, 1995). Bell refers to the notion as the "capacity to manage technology

and implement technical change" (Bell, 1984, p. 189). Abernathy and Clark (1985) called technology capabilities alternatively *production technologies* and described them with six classes:

- design and embodiment of technology,
- application of production systems and their organization,
- the cultivation of relevant skills (i.e. labor, technical, organizational),
- the development of relationships to material suppliers,
- the capital equipment and
- the knowledge and experience bases.

Westphal et al (1989) define a number of technological capabilities which however belong to three main categories: production, investment and innovation. An extensive number on technological capabilities appear in the tables of their paper "The Development of Technological Capability: Macro-and Micro-Scopic Approaches to Policy Research" among which many regard search, acquisition and installation of new technologies, production capabilities, operation and maintenance, operations management and quality control (dimensions of the productive category), investments (the second category), product and process (minor and major changes), knowledge acquisition and use of technology for new product development (innovative category). Consequently, Technological Capability focuses on efforts to "make effective use of technological knowledge in production, investment and innovation (Westphal, Kim and Dahlman, 1985, p. 171).

Figure 2.12 : Lall's (1992) matrix of technological capabilities

Table 1. *Illustrative matrix of technological capabilities*

DEGREE OF COMPLEXITY			FUNCTIONAL: INVESTMENT — PRE INVESTMENT	FUNCTIONAL: INVESTMENT — PROJECT EXECUTION	FUNCTIONAL: PRODUCTION — PROCESS ENGINEERING	FUNCTIONAL: PRODUCTION — PRODUCT ENGINEERING	FUNCTIONAL: PRODUCTION — INDUSTRIAL ENGINEERING	LINKAGES WITHIN ECONOMY
BASIC		SIMPLE, ROUTINE (Experience based)	Prefeasibility and feasibility studies, site selection, scheduling of investment	Civil construction, ancillary services, equipment erection, commissioning	Debugging, balancing, quality control preventive maintenance, assimilation of process technology	Assimilation of product design, minor adaptation to market needs	Work flow, scheduling, time-motion studies. Inventory control	Local procurement of goods and services, information exchange with suppliers
INTERMED		ADAPTIVE DUPLICATIVE (Search based)	Search for technology source. Negotiation of contracts. Bargaining suitable terms. Info. systems	Equipment procurement, detailed engineering, training and recruitment of skilled personnel	Equipment stretching, process adaptation and cost saving, licensing new technology	Product quality improvement, licensing and assimilating new imported product technology	Monitoring productivity, improved coordination	Technology transfer of local suppliers, coordinated design, S&T links
ADVANCED		INNOVATIVE RISKY (Research based)		Basic process design. Equipment design and supply	In-house process innovation, basic research	In-house product innovation, basic research		Turnkey capability, cooperative R&D, licensing own technology to others

Lall (1992) classifies technological capabilities with regard to their functions in facilitating particular productive activities (Figure 2.12). More specifically, the author proposed three dimensions which appear to be tightly related to production technologies:

Investment capabilities are capabilities needed "to identify, prepare, obtain technology for, design, construct, equip, staff, and commission a new facility (or expansion)" (p. 168). They refer to pre-investment and project execution in regard to technology search and process, product design and product mix.

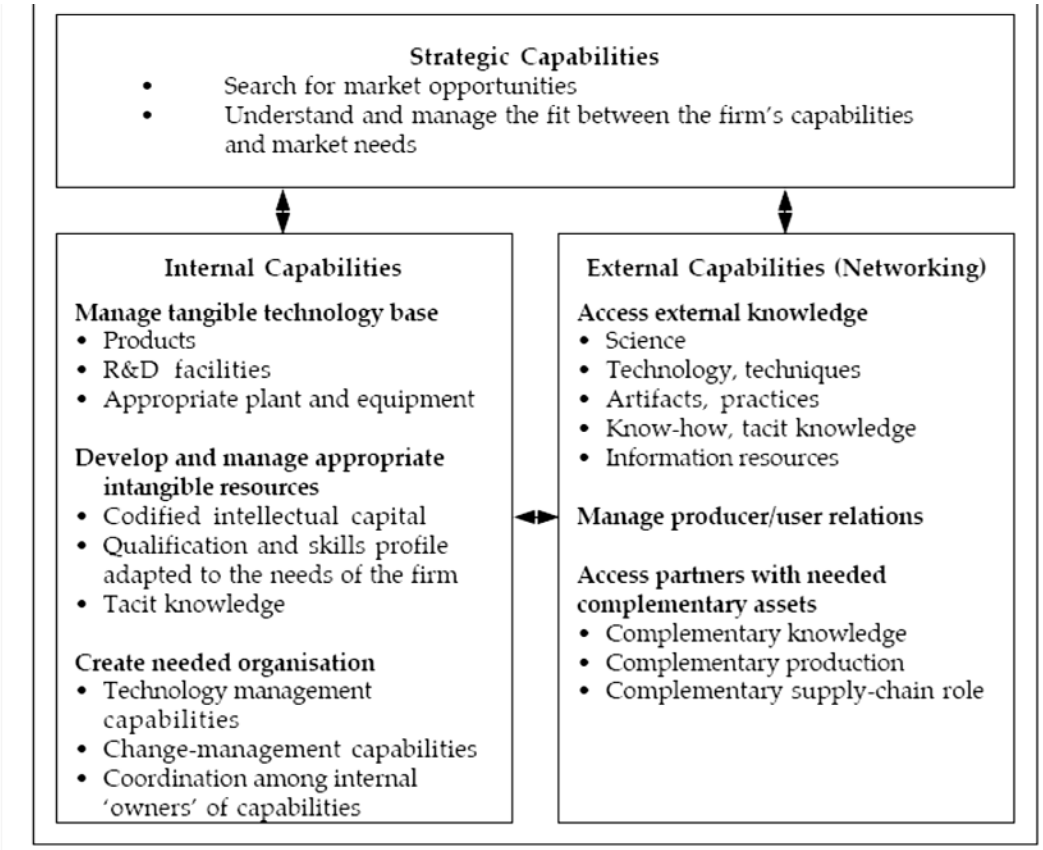
Production capabilities refer to process, product and industrial engineering including quality control, operation, and maintenance, research, design, and innovation. The skills involved control operations of given technologies and drive in-house efforts to absorb new technologies.

Linkage capabilities are translated as the abilities to receive information, skills and technologies from component or raw material suppliers, subcontractors, consultants, service firms, and technology institutions.

According to Dosi, Teece and Winter (1992) technological capabilities reflect the firms' abilities to design new products and processes, operate facilities effectively and learn on a continuous basis. Bell and Pavitt (1993) connected them with the management of technological change. Howells (1994) and Dodgson and Bessant (1996) distinguish the 'soft' and 'hard' elements of technological capabilities; 'technology' with its broad definition as "a set of pieces of knowledge […] and also, of course, physical devices and equipment technologies" (Dosi and Grazzi, 2009) comprises the 'hardware' which is surrounded by the ability to use and develop it; this in turn is deeply embedded in the 'soft' factors of the term.

Based on their literature survey, Arnold and Thuriaux (1997) presented a different categorization of technological capabilities: internal; external; and strategic, interlinked, interdependent, and involved in a dynamic learning process (Figure 2.13). The authors go further to define levels of technological capability by providing a range of Technologies' mastery from the acquisition of turnkey technology (and therefore no need to develop relevant capabilities to the ability of developing totally and purely innovative technology.

Figure 2.13: Arnold and Thuriaux's (1997) categorization of technological capabilities



Combining the taxonomies of Lall (1992), Ernst et al, (1998) and Bell and Pavitt (1992), Sampath and Oyeyinka (2008) classified technological capabilities in six functional categories with knowledge and skills positioned as the core elements and a roughly sequential order of complexity:

1. *Production and/or Manufacturing Capabilities* for plant operation, divided into three broad types of activities: a) production management; b) production engineering, and c) repair and maintenance of physical capital. They refer to the abilities to use machinery and equipment in efficient ways. They require knowledge on engineering, production and technology management and process technologies together with core production know-how and the technologies that are embodied into the machinery and the equipment. .

2. *Investment capabilities* for the functions of identification, preparation, design, setting up and commissioning of new industrial projects, or the expansion and/or modernization of existing ones including a) pre-investment capabilities and b) project execution capabilities

3. *Re-Design and Product Modification capabilities* including a) reverse engineering; b) analytical design, and c) system engineering capabilities

4. *Design and New Products and Process Capabilities* including the creation of new technology, and the ability to spread out scientific knowledge in developing patentable ideas

4. *Marketing and Network capabilities*

Quite in the same way, and the same year, Iammarino, Padilla-Pérez, and Von Tunzelmann, (2008) combine the taxonomies of Lall (1992), Bell and Pavitt (1995) and Ariffin and Figueiredo (2003) and create Table 2.12 with two main types of technological capabilities; product-centered and process organization regarding knowledge and skills to produce innovative products together with the existing ones and to create novel production processes and operate the existing ones respectively.

Table 2.12: Firm-level technological capabilities

Types of capability / **Levels of capability**	**Process organization**	**Product-centered**
Basic	Sub-assembly and assembly of components and final goods Minor changes to process technology to adapt it to the local conditions Maintenance of machinery and equipment Production planning and control Efficiency improvement from experience in existing tasks	Replication of fixed specifications and designs Minor adaptations to product technology driven by market needs Routine quality control to maintain standards and specifications
Intermediate	Manufacture of components Improvement to layout International certifications (ISO 9000) Introduction of modern production organizational techniques (e.g., just in time and total quality control) Automation of processes Flexible and multi-skilled production Selection of technology (capital goods)	Product design department (design for manufacturing) Development of prototypes Improvement of product quality
Advanced	Own-design manufacturing Major improvements to machinery Development of equipment Development of new production processes Development of embedded software Radical innovation in organization Process-oriented R&D	Development of new products or components R&D into new product generations Research into new materials and new specifications

(Source: Iammarino, Padilla-Pérez, and Von Tunzelmann (2008) after combination of the taxonomies of Lall, 1992; Bell and Pavitt, 1995 and Ariffin and Figueiredo, 2003)

In 2013, Peerally and Gigueiredo keep this categorizationa and redefine technological capabilities as resources that permit firms to undertake production and innovative activity; technological capability focuses on a firm's capacity to utilize and apply technical knowledge and skills in creating new products and processes.

It should be mentioned that in relevant literature one can find two terms and namely **technological capabilities and technological competencies**. Arnold and Thuriaux (1997) placed technological competences as zero-order competences which are needed to produce particular products or address specific customers' needs. Protogerou, Caloghirou and Lioukas (2005) relate technological competences focusing on technology development, new product development and manufacturing processes. In their paper "Inside the black box of dynamic capabilities: defining and analyzing their linkages to functional competences and firm performance" they describe them with three items: continuous adaptation of manufacturing technology to the firm's requirements, emphasis in the organization of R&D department, and emphasis in the co-operation with universities, research institutes and /or other firms to acquire know-how. Danneels (2002) describes as technological competences the manufacturing plant and equipment, manufacturing know-how, engineering know-how, and quality assurance tools while Danneels (2008) defines technological capability as an "ability of a firm to make certain physical products" (Danneels, 2008, p. 520). The two terms (i.e. technological capabilities and competencies) are often used quite liberally and interchangeably in the literature (Dosi and Greazzi, 2009). However, several scholar make clear distinguishes among the two notions; for instance, ''technological capabilities'' are clearly used by Lall, 1992; Figueiredo, 2002; Silvestre and Dalcol, 2009) and ''technological distinctive competencies'' by Real et al., 2006; Martı´n Rojas et al., 2011). Besides these differences, it is generally accepted that no matter the name, technological capabilities or competencies enable firms to adapt, integrate and reconfigure their skills, knowledge and capabilities on technology and production issues in order to adapt to the changing business environment and deliver value to customers (e.g Wang et al., 2004).

Technological capabilities can be found in the form of investment (feasibilities and project execution) and production (process engineering, product engineering and linkages within economy). Technological capabilities include the technology skills of

the individuals and teams, the processes and routines followed, and other technological assets (e.g., machines or information and manufacturing systems) that together contribute to the firms' path-dependent technology potential. They enable the creation of stocks of new technology and science-based knowledge together with technological expertise which support the recognition of opportunities; then accumulated technological knowledge can be applied in the form of new products, services and processes. In such efforts, firms with technological capabilities may utilize external science-based research findings and other information (Cohen & Levinthal, 1990). Thus, technological capabilities reflect not only the ability in using resources, but also capacities of resources, such as training, research and development (R&D), and maintenance of resources (Cohen, 2004).

According to literature, **technological capabilities are important strategic competences that foster competitive advantage** (Duysters & Hagedoorn, 2000; Kim, 2001). Firms with strong technological capabilities can boast innovation and relative performance becoming pioneers in the market by new products and new production processes development (Ritter and Gemünden, 2004). Protogerou et al. (2005) has empirically proven that specific technological resources and capabilities have a positive effect on firms' profitability and performance. Superior technological capabilities give the firm the ability to meet advanced market and niche expectations without excessive costs and valuable time or performance losses.

On the other hand, **production and operations are key elements of technology or technological capability** together with "materials, building, people, equipment, knowledge relevant to design and production [….], link to scientific, engineering and design disciplines and also knowledge embedded in the systems and procedures" (Abernathy and Clark, 1985, p.6). Technological capabilities are considered the prerequisite for being able to produce complex products at a high level of performance (Klocke, 2009) ranging from specific capabilities in certain scientific and technological fields to the conception and production of products and functions besides production, such as R&D and engineering. That is, they contribute to the a) introduction of new techniques (products and processes) through new investments in plants and machinery, b) evolutionary (incremental) improvements to existing techniques by effecting technical change to existing products or c) the generation of new knowledge through research within the firms or within separate R&D institutions. Renko et al (2009) include technological capability in a firms' knowledge

base, while Kogut and Zander (1992) reverse the relationship and see knowledge bases as sets of capabilities including technical knowledge bases.

Accordingly, we can assume that **technological capabilities start being formed since the time of venturing.** Acha (2000) indicates that during the foundation period, new ventures may not even have any technological capabilities; they have to acquire technology from other companies instead. Isobe (2000) reported that small and medium-sized manufacturing firms took, on average, more than four years to successfully change their technological competences, and over five years to earn a profit from them. Therefore, technological capabilities' development (and change) constitutes a rather incremental and cumulative process (Bell & Pavitt, 1993; Wignaraja, 2002). This fact creates the notion of path dependency for technological capabilities since they seem to be built on past investment and move from simple to complex and more knowledge-intensive activities.

"**Knowledge enters into production** in two ways" (Acs and Varga, 2002, p. 140). The first way corresponds to investments in production which target at the development of new technological knowledge in order to produce output; this kind of knowledge is usually protected from being used by others especially in cases of technology-based organizations (Romer, 1990; Acs and Varga, 2002). Especially in the cases of "*knowledge-based industries***,** the most important thing is using the technologies, and hence having the skills needed to use them" (OECD, 2005, p. 171, emphasis added). R&D is the second way to produce knowledge according to Acs and Varga (2002). We should add that the issues of technological capabilities building and the relevant learning processes have been questioned by a body known as the latecomer company literature and a second one known as technological frontier company literature (Figuereido, 2001, 2002).

Technological capabilities usually depend on knowledge derived from external knowledge sources and more specifically from various and diverse scientific areas. Specific technological skills in one field (e.g. pharmaceuticals) may be applicable in closely-related fields (e.g. pesticides) (Teece, 1996). They are significantly affected by changes in technologies beyond the technology base of the firms and organizations (Protogerou et al., 2005). According to literature, technological change affects technological capabilities by modifying production techniques or methods,

components or systems (Lavie, 2006; Orlikowski, 1992). In a sequential way, it may affect organizational capabilities too; new technologies might require adjusted processes (Teece et al., 1997). Actually, the co-evolution of technology and organization is one of the main dimensions of the transformation of firms and industrial structures, as shown in Chandler's works and it is essential for the enhancement of competitiveness.

Therefore, firms need to develop the necessary mechanisms to continuously scan for this knowledge and technical change and mechanisms to combine the knowledge assets it finds, create new knowledge and apply it creatively in output production. Scholars mention Universities and research centers mainly for high-tech organizations while suppliers and machine and equipment providers seem to be the main sources for low-tech industries. Consequently, in many cases, the technology trajectory is co-evolving due to the coordination and the development of the production processes.

However, these relationships are not or should not be of the "one-time transaction" type. Stowsky (1987) have explored the **user- producer interaction** in USA and Japan semiconductor sector. The author comments on the relationship among innovations in the equipment sector and the technological advances they spark and concludes that the manufacturing know-how gained through managing the process of equipment development constitutes an increasingly crucial source of strategic competitive advantage.

The above mentioned relationships among users and knowledge providers have been also described as **dynamic**. In most cases and besides customization, the imported technology has to be modified and improved requiring sometimes even expensive adaptations in order to be efficiently adapted to production processes or already established routines (Morceiro et al., 2011).. These significant relationships that range from co-design and co-development to modifications, improvements and adaptations, contribute greatly to innovation although they are not part of the statistics of R&D intensity (Patel and Pavitt, 1994; Robertson *et al.*, 2009; Rosenberg, 1963).

Furthermore, several scholars have long documented several mechanisms for the development of technological capabilities which may range from mere imitation, purchase of technology and turn-key production lines to reverse engineering and licensing and furthermore to joint R&D, acquisition of technology sources and own, in-house R&D and novel process development. It is then quite evident that production technologies constitute a significant dimension of technological capabilities

intertwined with knowledge and technical skills; according to OECD (1992) p. 262, all these are major elements of overall producers' capabilities and more specifically:

- knowledge and skills required for the process of production, where shop-floor experience and 'learning-by-doing' plays an important role
- knowledge and skills required for investment, i.e. the establishment of new production facilities and the expansion and/or modernisation of existing ones
- knowledge required for the creation of new technology
- The vast area of adaptive engineering and organizational adaptations required for the continuous and incremental upgrading of product design and performance features and of process technology, together with
- The managerial ability to identify and invest in the right physical infrastructure to meet the competitive requirements of the firm

Technological capabilities have been mainly related to technology-based and high-tech organizations (e.g. Agarwal et al., 2004; Ariffin, and Figueiredo, 2004; Chandler and Hanks, 1994; Henderson and Clark, 1990). Indicatively, Lee, Lee and Pennings (2001) use data from 137 technology-based start-ups to examine the impact of technological capabilities, firm resources and external networks on firm performance. Iammarino, Padilla-Pérez and Von Tunzelmann, (2008) explore the electronics industry in Mexico to find relationships among MNTs and technological capabilities and claim that they have customized the relevant taxonomy for high-tech sectors.

2.4.3.1 Technological capabilities and entrepreneurial capabilities

The literature makes evident that technological capability is one of the most critical resource endowments for new venture growth since it enables easier market penetration (e.g. Covin, Slevin and Heeley, 2000), opportunity discovery (Banbury and Mitchell, 1995), or differentiation (e.g. Zahra, Sapienza and Davidsson, 2006). On the other hand and according to literature (e.g. Lee et al., 2001; Petti and Zhang, 2011), a firm's entrepreneurial capabilities seem to be associated to its technological capabilities in terms of creating the ability to recognize technological opportunities and exploit them by developing new or significantly differentiated products / services which can be successfully commercialized. The relationship between the two types of capabilities appears to be the bridging of technology development and business creation (Petti and Zhang, 2011; Zou and Wang, 2009).

This dual relationship is the most frequent in relevant literature; the two categories of capabilities together are suggested to give new ventures significant competitive advantages. Zahra and George (2000) examined the differences in manufacturing strategies between new ventures established by corporations and nascent ones. Although they found significant variations, all results supported the significant role of manufacturing capabilities in new venturing. Using data from 238 new high-tech ventures in China, Chen Zou and Wang (2009) identified technological capabilities as the most relevant resources in new venture growth together with networking capability and financial capital. Terjesen et al. (2011) investigated the association between manufacturing capabilities and new firm performance in the context of high technology new ventures. In the same vein, Song et al. (2011) suggest that the development of production technologies and networking with major suppliers in production can offer significant competitive advantage. The authors claim that the development of such capabilities can be achieved by the acquisition of modern production technologies and development of the relevant technical and practical skills. Once again, they refer to technology-based ventures.

However, besides the significant growth of research on entrepreneurship and the literature on technological capabilities, *inquiries at the intersection between operations management*[42] *and entrepreneurship are relatively scarce* (Editorial of the special issue on operations management and entrepreneurship, Journal of operations management, 2011).

Our literature review on the notion of technological capabilities does not intent to be exhaustive. Its purpose is to indicate, their significance and, more specifically, the importance of production technologies for start-ups and firms in general, as precisely as possible. The discussion above makes it quite clear that technological capabilities are significant resources for entrepreneurs to gain competitive advantages. It is also widely acceptable that managing technologies is a great challenge (which becomes greater for newly-established firms) and needs entrepreneurial capabilities (Pitelis and Teece, 2009). However, while production technologies constitute significant entrepreneurial decisions there are scarce references to their relation to specific

[42] Operations Management deals with the design and management of products, processes, services and supply chains. It considers the acquisition, development, and utilization of technological resources that firms need to deliver the goods and services their clients want. (MIT Sloan definition)

entrepreneurial capabilities. Hirsch-Kreinsen and Schwinge (2011) borrow transformative and configurational capabilities from Bender and Laestadius (2006) referring to the synthesizing competence in order to explain how agents identify propositional knowledge in terms of technical concepts or technologies. Yet, according to our knowledge there is hardly any relevant approach to explore how entrepreneurial capabilities interact with production technologies in general.

2.4.3.2. Relations of technological capabilities to dynamic capabilities theory

According to many researchers, **technological capabilities present a dynamic and evolutionary nature** (Amit and Schoemaker, 1993; Eisenhardt & Martin, 2000; Teece et al., 1997). This perspective is often related to another strand of literature that considers dynamic capabilities as higher order strategic processes that integrate, recombine and generate new operational capabilities which in turn shape firm performance (Cepeda and Vera, 2007; Protogerou et al., 2008; Protogerou et al., 2005). In fact, Collis defined operational capabilities as "those that reflect an ability to perform the basic operational activities of the firm" distinguishing them from dynamic capabilities, which reflect "the ability to learn, adapt, change and renew over time" (Collis, 1994, p. 145).

For the majority of scholars, **operational capabilities regard technological and marketing capabilities** (e.g. Protogerou et al., 2008; Protogerou et al., 2005; Song et al., 2005) while some add organizational and managerial capabilities as well (e.g. MacInerney-May, 2012)[43]. For Helfat and Peteraf (2003) operational capabilities involve both the performance of activities, such as product manufacturing, and the use of routines to execute and coordinate the tasks required to perform the activities.

There is actually a significant literature regarding the relationship among operational and dynamic capabilities or a specific dynamic capability. For Winter (2003) dynamic capabilities enable the modification of operational capabilities and lead, for example, to changes in the firm's products or production processes. Helfat and Peteraf explain that "Dynamic capabilities do not directly affect output for the firm in which they reside, but indirectly contribute to the output of the firm through an impact on operational capabilities" (2003, p. 999); for them, as well as for Eisenhardt and Martin

[43] However, some scholars distighuish technological capabilities even further to operational which are accumulated mainly through "doing-based efforts" (Costa, 2001) and innovation capabilities, i.e. more complex technological capabilities which enable the understaniding of technologies' principles (Costa, 2001).

(2000) and Zollo and Winter (2002) the value of dynamic capabilities lies precisely in the configuration of operational capabilities they create. Cepeda and Vera (2007) used a sample of 107 firms in the information technology and communication industry in Spain to explore the link between dynamic and operational capabilities from a knowledge management view. Von Tunzelmann and Wang (2007) develop the "dynamic interactive capabilities" of firms to explain the extent to which changes in productive capabilities influence or are influenced by changes in the capabilities of external actors in real time. Zott (2003) relates dynamic capabilities not only to operational capabilities but also to firm performance. Protogerou et al. (2005, 2008, and 2011) explores in detail the mediating role of operational competencies on the relationship between dynamic capabilities construct and firm performance confirming DCs indirect impact on the development of long-term competitive advantage.

Actually, Protogerou et al. (2008, 2011) regard marketing and technological competences as the **zero-order competences** needed for producing particular products or addressing specific customers' needs. On the other hand, dynamic capabilities are the tools that shape and control the rate of change of the operational competencies. **Higher-order** capabilities serve as a basis for acquiring and reconfiguring lower-level capabilities (Protogerou et al., 2011). In the same vein, Zollo and Winter (2002) and Winter (2003) also differentiate between operational (zero-order) and dynamic (first-order) capabilities. Operational capabilities are needed for the operational functioning of the firm, such as for line activities and enable firms "to make a living". Dynamic capabilities are "complex, structured, and multidimensional" concepts, which make effective use of "zero-order" and higher-order capabilities (Winter, 2003). Jacobides and Winter (2005) named them productive capabilities relating them mainly with knowledge and investments in equipment, human capital and training. No matter the name, it is widely accepted that the main task for dynamic capabilities is creation, modification and combination of lower-level operational capabilities (e.g. Danneels, 2008; Helfat & Peteraf, 2003; Jacobides and Winter, 2005; Protogerou et al., 2005, 2008, 2011; Winter, 2003).

In sum, dynamic capabilities can be considered as the tools that allow firms to *create* operational capabilities faster and cheaper than competitors in order to gain and maintain competitive advantages. According to literature, dynamic capabilities address "the way organizations deal, or fail to deal, with technological challenges"

(Dosi *et al.,* 2000, p. 15) by linking the advent of new technological paradigms to the evolution of the firm knowledge-base (e.g. Dosi, 1984; Freeman, 1982). Based on this argument, dynamic capabilities are the driving force behind the development of new technological capabilities. Dynamic capabilities enable firms to recognize opportunities and threats arising from shifts in the environment, integrate internal and external knowledge and extend, modify or build operational capabilities (Eisenhardt and Martin, 2000; Teece, 2014; Wilden and Gudergan, 2014; Winter, 2003). According Protogerou et al (2008), the more a firm is endowed with capabilities that enable it to produce market offerings of superior value or at lower costs relative to competition, the more these capabilities can be translated into positions of competitive advantage and superior business performance. Technological capabilities, in particular, are identified as critical to creating competitive advantage since they are fundamental in producing novel products or services in most low-tech sectors (Spanos and Lioukas, 2001; Danneels, 2008) where the present thesis focuses.

2.5. Low-technology industries and Knowledge-Intensive Entrepreneurship

> *"Growth within the less glamorous, traditional sectors is certainly innovation-based, and moreover it rests on cognitively complex and deep knowledge bases, which from time to time are subject to discontinuous change"*
>
> *Smith (2008)*

2.5.1 Introduction

In the last few years a rich literature is emerging enhancing the role that traditional sectors play in modern economies and directing importance of innovation and technological change outside R&D-intensive fields (Hirsch-Kreinsen and Schwinge, 2011; Robertson et al. 2009). There is now a growing awareness that low-technology industries, which still make up a considerable share of production and employment in developed and developing economies, can be knowledge-intensive, develop knowledge-based innovation and invest in trans-sectoral knowledge seeking and learning (Hirsch-Kreinsen and Schwinge, 2011). Actually, according to von Tunzelmann and Acha (2005, p. 429) "there are no true 'low-tech sectors'. Instead, what we observe is a varying degree of permeation of high technologies into low-tech and medium-tech as well as into high-tech sectors."

An issue of interest within the low-tech knowledge-intensive entrepreneurship regareded the processes that translate knowledge to innovation (Robertson and Smith 2008; Hirsch-Kreinsen and Schwinge, 2011). Up to 2010, the discussion about low-tech sectors and innovation presented a growing tendency; however, the limited research focused on "low- *and* medium-low tech" (LMT). The underlying assumption of this perspective was that LMT sectors essentially offer only very limited opportunities for innovation activities due to their strong path dependency. However, there seemed to be a hesitation to focus research on *purely low-tech industries*. Indicatively, in their introduction, von Tunzelmann and Acha (2005) make it clear that besides the chapter title, i.e. "Innovation in low-tech industries" they refer to LMT ones. The same tendency was featured in a series of empirical research; researchers examined LMT cases.

On the other hand, the same period, knowledge-intensive entrepreneurship (KIE) had mainly focused on high-tech sectors. Little attention had been paid so far to sectors that conduct no or only few formal R&D activities and that can therefore be characterized as non-research-intensive. KIE in LTM sectors was regarded as a contradiction in itself. Yet, as some first empirical findings from LMT industries showed, there were clear indicators at least for successful KIE-LMT cases.

This chapter describes the low-tech category of manufacturing, the role of innovation and knowledge in such industries and deals with the evolution and the characteristics of knowledge-intensive entrepreneurship regarding nascent and corporate venturing in the low-tech context covering the whole spectrum of relevant activities; i.e. from founding to production technologies engaged.

2.5.2. What is low-tech?

Medium- and low-tech industries have persisted over the past decades despite the claims that we are undergoing a kind of structural revolution" (Sandven et al., 2005: 57).

"A sector is a set of activities that are unified by some related product groups for a given or emerging demand" (Malerba, 2004: 9). Sectors have been grouped in categories based both on direct R&D intensity and R&D embodied in intermediate

and investment goods proposed in Hatzichronoglou (1997). According to OECD (2005) the R&D intensity indicator covers in-house R&D expenditures for R&D staff, further R&D costs and investments as well as outhouse expenditures, for example, for R&D tasks assigned to other companies and organizations. It measures the ratio of the R&D expenditure to the turnover of a company or to the output value of a sector. By means of this indicator, sectors with an R&D intensity of more than 5 % are characterized as "high-tech", or "high technology" and those with an R&D intensity between 3% and 5% as "medium-high-tech". Sectors with R&D intensity between 3% and 0.9% are classified as "medium-low-tech" and those with R&D intensity below 0.9 % as "low-tech" (Table 2.13).

Table 2.13: OECD (2005) classification of technology intensity

High-Tech industries	R&D/Turnover > 5%
Medium-High-Tech industries	5% > R&D/Turnover > 3%
Medium-Low-Tech industries	3% > R&D/Turnover > 0.9%
Low-Tech industries	0.9% > R&D/Turnover > 0%

Regarding the industrial sector and according to OECD Bilateral Trade Database by Industry and End-use (BTDIxE, edition 2013), primarily "mature", low-tech industries are the food and beverage industry, the paper and print industry, the wood and furniture industry and the textiles, clothing and footwear industry (Table 2.14).

Table 2.14: OECD, BTDIxE, edition 2013

Industry	ISIC Rev.4
GRAND TOTAL	**TOTAL**
Primary and Manufactured goods	**01t32**
Agriculture, Hunting, Forestry and Fishing	**01t03**
...Crop and animal production, hunting	01
...Forestry and logging	02
...Fishing and aquaculture	03
Mining and Quarrying	**05t08**
...Mining of coal and lignite	05
...Extraction of crude petroleum and natural gas	06
...Mining of metal ores	07
...Other mining and quarrying	08
Total Manufacturing	**10t32**
Food, Beverages and Tobacco	*10t12*
...Food	*10*
...Beverages	*11*
...Tobacco	*12*
Textiles, Leather and Footwear	*13t15*
...Textiles	*13*

...Wearing apparel	*14*
...Leather and related products	*15*
Wood and Products of Wood and Cork	*16*
Paper and Printing	*17t18*
...Paper and paper products	*17*
...Printing and reproduction of recorded media	*18*
Chemicals, rubber, plastics and fuel products	19t22
…Coke and refined petroleum products	19
…Chemical and pharmaceutical products	20t21
……Chemicals and chemical products	20
……Basic pharmaceuticals and preparations	21
…Rubber and plastic products	22
Other non-metallic mineral products	23
Basic metals and fabricated metal products	24t25
…Basic metals	24
……Iron and steel	241, 2431
……Non-ferrous metals	242, 2432
…Fabricated metal products	25
Machinery and equipment	26t28
…Computer, electronic and optical products	26
……Computers and peripheral equipment	262
……Electronic, optical products; scientific instruments	26 excl. 262
…Electrical equipment	27
…Machinery and equipment not elsewhere classified	28
Transport equipment	29t30
…Motor vehicles, trailers and semi-trailers	29
…Other transport equipment	30
……Building of ships and boats	301
……Air and spacecraft and related machinery	303
……Military fighting vehicles	304
……Railroad and transport equipment not elsewhere classified	302, 309
Furniture; Other manufacturing	***31t32***
Electricity and gas	35
Other activities	36t99
…Waste textiles	
…Waste paper	
…Chemical waste	
High-technology	**21, 26, 303**
Medium-high technology	**20 27, 28, 29, , 302, 304, 309**
Medium-low technology	**19, 22, 23, 24, 25, 301**
Low-technology	**10t12, 13t15, 16, 17t18, 31t32**
Information and Communication Technology	**26 excl. 265, 266**

The so-called “low- technology” industrial sectors are claimed, on average, to be dominated by SMEs, to have no or low research and development expenditures, and to develop fairly standardized production processes and product design (e.g. Hirsch-Kreinsen et al., 2005; Jacobson & Heanue, 2005). They are characterized by established technologies and production regimes. This is why they are also called “traditional” or “mature” industries. According to literature (Economist, 1998; Hirsch-Kreinsen et al., 2005; Smith, 2008), they underwent a shorter or longer evolution, which resulted in the emergence of recognized standards, methods, and

knowledge related to both products and processes[44]. This is perhaps one of the most important reasons for the generally difficult competitive position of many of these industries in Europe: the basic technologies and relevant procedures in these sectors are well known and can often be easily copied by foreign competitors with a lower cost base. Furthermore, setup costs are low and a large number of firms operate at marginal costs competing fiercely on price (Scarpetta and Tressel, 2004). Therefore, the majority of low-tech firms seem to be more prone to competition from low-wage countries and less aggressive in terms of competition and innovation. These findings and the focus on high-tech industries have led Hirsch-Kreinsen, Jacombson and Robertson (2005) to state the need of stop *"de facto* treating these companies as dinosaurs destined for extinction as a result of natural selection".

However, besides the before-mentioned difficulties, low-tech sectors continue to be of surprising importance and to persist even in the advanced, knowledge-based societies of the developed countries. Actually, LMT sectors are still central to economic well-being; whether measured in terms of output, capital invested or employment, they dominate the economies of highly developed as well as developing nations, providing more than ninety percent of output in the European Union, the USA and Japan. Established LMT industries comprise 97 per cent or more of GDP and still make up the largest part of the manufacturing industries in OECD countries. Goods and services provided by all types of LMT sectors are absolutely vital for all societies (no matter how modern they are) and low-tech firms' preponderance is falling at a very slow rate (Kaloudis et al., 2005; Potters, 2009).

Low R&D intensity sectors make up a considerable fraction of employment and production and are important for economic growth and knowledge formation in European economies (Kaloudis, 2005; Potters, 2009; Robertson and Patel, 2007). According to Hirsch-Kreinsen (2008), in relation to the manufacturing industry as a whole, the low-tech (including low-tech and low- and medium-tech) sector in the EU 27 had an employment share of approx. 57% in 2006 which increased to 65% in 2010

[44] For example, Bruland (2004) showed that radical innovations such as knowledge codification, replaceable parts, production lines and large-scale enterprise management systems originated in agriculture and food industries. An interesting thesis on the significant role of LMTs in innovation during industrialization can be found in Smith (2008) „Innovation, Growth And Policy In Low And Medium Tech Industries: A Review Of Recent Research"

(Kreinsen and Schwinge, 2014). The respective shares of the high-tech sectors accounted for only about 10% and 7% respectively. Furthermore, as can be seen in Figure 2.15, in the EU15, the low-tech sectors account for about 32% (58% when medium low tech sectors are included) of total Value Added of the manufacturing sector, while the high-tech sectors only account for about 6% (42% when medium-high tech sectors are included). Lesley Potters (2009) comments on the stability of these figures for more than three decades (Fig. 2.14). The stability continued in 2010 for the EU27; the share became just 57%-43% respectively. It is also quite interesting that exports from both high and low-tech sectors account for almost the same percentage (22% and 20%) respectively.

Figure 2.14: Value added per sector group as [art of manufacturing value added
Adopted by Lesley Potters (2009)

Figure 1: EU15 - Value added per sector group as part of manufacturing value added 1979-2003

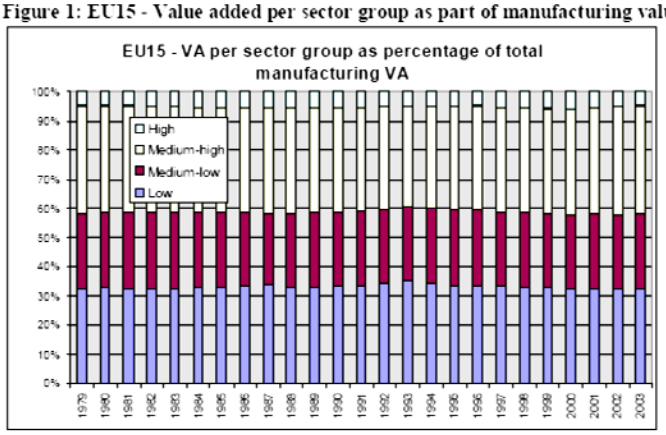
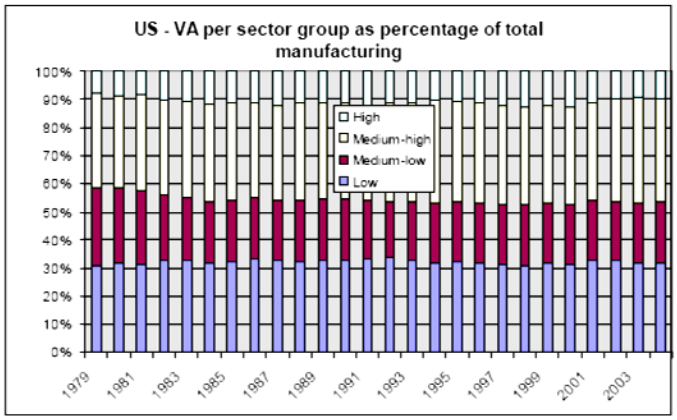


Figure 2: US - Value added per sector group as part of manufacturing value added 1979-2004



Besides their role in the economic growth, "LMT firms and sectors are by no means technologically and economically stagnant" (Kreinsen and Schwinge, 2014). There is a range volume of studies of LMT industries regarding the achievements of the so-called traditional industries within volatile and hostile environments. For example, Maskell (1998) explored the survival and the growth of the Danish furniture industry in the high-cost environment of Denmark. Kaplinsky and Readman (2005) discussed the significant technological upgrading of furniture industries, on global scale. A special issue of the International Journal of Technology and Globalization focused on the wine industries of Italy, Chile, Australia and Argentina, exploring aspects of innovation and knowledge creation (see Smith, 2007 for an overview).
Moreover, after the initial shock of the Asia-based low-wage competition in the beginnings of the new millennium, firms in the low-tech sectors are responding successfully to the challenges by becoming significant generators of new production technologies, by exploiting or developing new materials (e.g. technical textiles in the textile industry) and other forms of innovation. The adoption of such strategies enables them to obtain new high added-value products for multi-sector applications typically serving the high-end of the market (Potters, 2009; Hirsch-Kreinsen, 2008).

In general, literature on LMT sectors so far has dealt with four topics: a) the relative importance of LMT sectors and their place in modern industrialised economies (partly contrasting high-tech sectors); b) the roles played by LMT firms and industries in adapting new technologies to fit into existing technological frameworks; c) the role of innovation to LMT firms; and lately d) the role of knowledge in LMT industries.
In accordance, low-tech industries have been characterized as active contributors, rather than passive adopters regarding changing technologies and technology paradigms (e.g. Mendonça, 2009). They have been called "carrier industries" by incorporating new technologies elsewhere produced into making new products or implementing new manufacturing processes (von Tunzelmann and Acha, 2005). Furthermore, technology flows between low-tech and high-tech industries are highly dominated by the flows into low-tech industries (Hauknes and Knell, 2009). Hirsch-Kreinsen et al. (2003) based a long- time research (e.g. Hirsch-Kreinsen et al., 2003; Hirsch-Kreinsen et al., 2005; Hirsch-Kreinsen2008, 2010) on the claim that LMT industries are surviving and growing on the basis of technological upgrading, high-grade design skills and the intensive application of knowledge to innovation. Thus,

up to the beginning of the new millennium, there was a general acceptance that low-tech, traditional sectors have "a tradition of dynamism" (Mendoca, 2009).
This dynamism attracted the interest of many researchers; the central PILOT's research hypothesis on LMT industries was quite indicative: "*Many companies and branches within these industries [i.e. LMT] are growing fast in comparison to the rest of the economy, are interlinked with high-tech and service branches and provide an important basis for future growth and employment" (Hirsch – Kreinsen, 2000b).*
Theoretical and empirical research turned mainly to innovation; the project confirmed the fact that most growth and employment in OECD countries still emanate from the so-called LMT industries. However, its main contribution was the provision of a *striking challenge to the currently held notions about the sources of future industrial growth. ……..growth is primarily based not on the creation of new sectors but on the internal transformation of sectors that already exist* (Hirsch-Kreinsen, Jacobson and Roberts, 2005).

It should be however mentioned that when speaking about low-tech, researchers differentiate between the sectoral and the company level. While typical low-tech branches (see above) are characterized by a low level of R&D intensity, on the company level and according empirical data, the situation is not that clear-cut. These findings indicate that low-tech sectors include more but not only low-tech companies (cf. Kreinsen, 2010) which are to a large extent SMEs (cf, Kirner et. al, 2009).

Can KIE be relevant in low-tech firms?

Summarizing the chapter on KIE, Knowledge-intensive entrepreneurship regards the launch of new activities and organizations that intensively use existing scientific and technological knowledge or that intensively create new scientific and technological knowledge for commercial purposes or for bringing products to markets (Malerba and McKelvey, 2010). Knowledge was identified as being particularly potent for economic development (Baumol, 2002) and particularly for LMT sectors.

> "Knowledge search, identification and proof ... are likely to be of particular importance to innovation in the non-manufacturing activities of LMT [low-tech and medium low-tech] industries"
> *von Tunzelmann & Acha 2003, p. 4, SPRU on Innovation in Low-Tech Industries*

How easy is then to apply KIE in mature low-tech industries? Literature so far has confirmed the importance of market and technology knowledge availability and sharing that are considered as significant elements of firm-level LMT entrepreneurship (Kogut and Zander, 1992; Sciacia et al., 2008). A major feature in this case is the fact that knowledge often stems from various sources outside the firm's sectoral boundaries (Hirsch-Kreinsen and Schwinge, 2011; Robertson and Smith, 2008). Besides, latest theoretical and empirical research has pointed out the importance of knowledge and innovation in LMT sectors and suggested that opportunities for KIE do exist in these environments.

However, until very recently, the common belief on LMT-KIE was that KIE was difficult to be found in traditional sectors. LMT sectors and firms appeared to offer only very limited opportunities for KIE activities due to the fact that innovations in these contexts are more or less path-dependent i.e. they are based on technological knowledge and capabilities that have been slowly evolving around established technological trajectories (Hirsch-Kreinsen and Schwinge, 2011; Hirsch-Kreinsen, and Schwinge, 2014).

> It is also suggested that this path dependency has been further stabilized by incremental innovation activities that tend to optimize or further upgrade existing technologies. Unlike high-technology sectors where technological risks and uncertainties prevail, the technologies of LMT sectors are considered as well-known and mature. Furthermore, low-tech products are considered not only as highly-standardized but also at an advanced stage of their life cycle. The same applies for the LMT sector's knowledge base which is largely embracing codified and transferable components such as design methods, engineering routines and knowledge about the market and customer needs.
> Second, the nature of competition in LMT sectors which is mainly characterized by intensive price or cost antagonism force firms to continuously improve their technologies and processes rather than to involve in exploring innovative and risky prospects.
>
> *From: Exploring KIE in high-tech and low-tech manufacturing sectors: differences and similarities, Caloghirou, Protogerou and Tsakanikas, in KIE in low-tech industries, Hirsch-Kreinsen and Schwinge, 2014)*

However, all authors mentioned above agree that opportunities for KIE in LMT sectors should not be ignored (e.g. Hirsch-Kreinsen and Schwinge, 2011; Caloghirou, Protogerou and Tsakanikas, 2014). Besides this well-trodden path, nowadays the relevant stability of low-technology sectors is increasingly challenged while competitive pressures (i.e. by low-cost competitors) force an imperative need for changes regarding priorities and established practices. Thus, it can be argued that

path-dependency can always be questioned and stimulate new ideas that will in turn overcome fixed trajectories and create new more promising development paths.

Low-tech actors can even search for breakthrough innovations in order to gain competitive advantage as emphasized by recent case study findings (e.g. Tunzelmann and Acha, 2005; Hirsch-Kreinsen, 2008). In such cases low-tech companies try to overcome the existing paths of knowledge and technology pursuing strategies in regard of leading positions in niche markets beyond the main fields of standardized mature products or even in trying to create new markets. Hirsch-Kreinsen and Schwinge (2011) actually refer to statistical data that indicate a relatively large number of newly-founded low-tech companies that are based on new knowledge and novel technologies as well as the existence of "gazelles", i.e. fast-growing companies that induce low-tech sectoral growth.

Therefore, theoretical and empirical work mainly after the first decade of the new millennium confirms the existence of KIE processes in low-tech sectors and has partly explored several aspects such as its distinctive features, mechanisms and strategic perspectives (e.g. the relevant book of LT-KIE edited by Hirsch-Kreinsen and Schwinge, 2014). Following the more recent and broadly accepted definition of KIE, innovation and knowledge constitute the most significant elements of low-tech KIE and are analyzed below in the context of low-tech industries.

2.5.3. Knowledge and innovation in low-tech sectors

2.5.3.1. Low-tech Innovation

The LMT sector has been on various occasions the subject of the innovation debate in the past years with its significance for the technological and socio-economic development well under investigation (e.g. Cox et al., 2002; Mendonca and Tunzelmann, 2004; Hirsch- Kreinsen et al., 2005; Smith, 2005; Tunzelmann and Acha, 2005). According to Tunzelmann and Acha (2005), the key innovation drivers, i.e. changing technological paradigms and demand differentiations, have been the essential (pre-) conditions for the innovation courses of LMT enterprises assisted by turbulent demand structures and new technological developments in the field of general purpose. The authors consider the role of LMT sectors as ''carrier industries'' as a key driver of innovative behaviour since low-tech actors need to incorporate new technologies into the making of new products or implementation of new

manufacturing processes. Furthermore the authors attribute the trend towards innovation to the imperative need for changes regarding priorities and established practices caused by the almost extreme competitive pressures at global level.

A more spherical and updated view, that reflects the astonishing evolution of low-tech industries within the decade, is provided in the chapter of Protogerou, Caloghirou and Karagouni on *The relevance of the dynamic capabilities perspective in low-tech sectors*[45] in the book "KIE in low-tech sectors" (2014). The authors describe the globally changing business environment in low-tech industries and in particular,

- the *instability* caused by globalization and trade liberalization,
- the *technology pressures* due to changing industry structures, "industry convergence" (Bröring *et al.,* 2006)and the transformation of the technology base of mature industries
- the increase of *regulations* and *social pressures* from action groups, communities, governments, other shareholders and consumers to produce safer and more environmentally friendly items (Gereffi et al., 2001; de Bakker and Nijhoff, 2002).
- the changes caused by the recent *financial crises* at national, European and global level which have turned the environment to highly volatile

The authors argue that low-tech traditional sectors are far more volatile, vulnerable and turbulent than it is commonly thought and the need for new opportunities (Eisenhardt, 1989) and challenging disturbances is quite evident. Therefore, innovation seems to be a significant competitive advantage within this complex interplay, which may not be interpreted as rapid technological change (as in the high-tech cases) but as a highly dangerous instability in the market environment of the low-tech sectors.

Besides the skepticism of low-tech innovation in general, a quite significant stream of literature tried to explore the type and nature of innovations and innovation activities in these industries reaching the conclusion that **they are not necessarily the result of systematic R&D** (Pavitt et al., 1987; Henderson and Clark, 1990; Napolitano, 1991; Rametsteiner 2000; Robertson, et al., 2003; Bender, 2004; Caloghirou et al., 2004; Laestadius, et al.,2005; Chesbrough and Crowther, 2006; Robertson and Patel, 2007;

[45] Fort the detailed analysis please refer tot he book chapter

Leheyda et al., 2008; Hirsch-Kreinsen, 2008; Böheim 2008; Segarra-Blasco and Josep-Maria, 2008; Lichtenthaler, 2009). Accordingly, low-tech-sectors are characterized by ***low R&D activities and investments as well as incremental innovations in terms of product and process advancements*** (Hirsch-Kreinsen and Jacobson, 2008; Robertson and Smith, 2008). For instance, Napolitano (1991) used an extensive database on 8,220 firms which developed technological innovations during the period 1981-85. The author resulted in sixteen **sources of innovation** in the Italian manufacturing industry and namely, R&D, design, proposals from employees, purchase of technology, purchase of raw materials, purchase of intermediate goods, purchase of equipment, recruitment of specialized personnel, staff training, customer requests, cooperation with suppliers, joint ventures, trade fairs, public research labs, consultancy firms, analysis of competitors' products.

In the same vein, Laestadius, et al. (2005) emphasise that at least five dimensions should be considered when analysing the innovativeness of LMT firms: R&D, Design, Technological (related to the use of machinery and equipment), Skill (related to the qualifications of staff and ongoing training) and Innovation intensity. It should be mentioned that **design** constitutes a significant competitive advantage in some of the low-tech industries such as furniture and apparel. Design is explicitly included in the OECD's *Oslo Manual* and emerges as a critical driver of innovation in LMT firms; it is actually a pivotal problem-solving but creative activity that can be rational, innovative or artistic (Laestadius, et al., 2005; Santamaria et al., 2009). Hirsch-Kreinsen et al. (2003) and Böheim (2008)consider expenditure on design to be an important predictor of innovation performance at firm level, putting forward firms' cases like IKEA, Benetton and H&M. "Indeed, it could be argued that much of the clothing industry, and certainly the designer clothing sector, is based entirely on innovative design" (Hirsch-Kreinsen et al., 2003).

Actually, low-tech supporters tried to re-conceptualize innovativeness and dismantle it from R&D expenditures and patents (e.g. Bender, 2004; Lichtenthaler, 2009). LMT innovation is not then the result of the latest scientific or technological knowledge but the result of successful transformations of the general stock of knowledge into economically useful knowledge (Bender and Laestadius, 2005). LMT innovation strategies depend on demand factors and move within a spectrum that ranges between

‘‘incremental’’ and “architectural innovation”[46] (Henderson and Clark, 1990; Hirsch-Kreinsen, 2008); incremental innovations involve modifications of existing products and services (Neely and Hii, 1998), without materially changing the overall design. ‘‘Architectural innovations’’ regard the recombination of existing components producing new product designs or even forming new technical and organizational structures of the production process. Empirical literature confirms indeed the predominance of such types of innovation in low-tech industries; however, it is also argued that cumulative incremental innovations can expand, extend and leverage technological trajectories. In some traditional industries, incremental innovations are sometimes even more important than radical ones. For example, in scale-intensive industries such as mining and oil extracting, the fact that innovations are primarily incremental and regard processes does not necessarily mean that they play a secondary role or that those industries are less dynamic from an innovative point of view. This is because in such sectors incremental innovation can result in important productivity and profitability gains; therefore they can be considered to have the same positive effect as a radical innovation in other less- scale intensive industries. Finally, several incremental innovations when taken together can result in overcoming technological barriers and expand the production boundaries of the firms in these industries (von Tunzelmann and Acha, 2005).

Hirsch-Kreinsen (2008) embraces the notion of incremental innovation and indicates three types of low-tech innovativeness: a) *the step-by-step product development* i.e. a continuous further development of given products; b) *Customer-oriented* innovation, directed at securing and improving the sales market situation of the enterprise such as the fashion-oriented design of products. Textile and clothing as well as furniture industries invest in design and product development geared to anticipatable fashion cycles and c) *Process specialization* which focuses on technical organizational process structures.

Previous studies (Cohen, 1995; Kamien and Schwartz, 1982 in Santamaria, 2009) had also dealt with demand and market conditions ponting out that they are critical factors in explaining LT innovation performance. For example, he concentration of

[46] As explained in the relevant chapter

competitors[47] was accepted as the main determinant of the market dynamism which would trigger firms more or less to undertake innovation activities (Schumpeter, 1942). Furthermore, referring to expenditures, Leheyda et al. in their Final Report of the Europe Innova Project (2008) add that in all low-tech sectors, across all countries of research, the major component of innovation expenditure was the investment in capital equipment related to new product introduction..

Relevant low-tech reports confirm the findings at European level; For example, the sector report of 2008 for the Textiles and Clothing (T/C) sector, studied during the course of the Innovation Watch–SYSTEMATIC project (Europe INNOVA) revealed that textiles has a relatively small share of innovating firms and most of them innovate through diffusion. T/C firms innovate by means of buying advanced machinery and equipment, intramural R&D, marketing and personnel training. The 2011 report adds the use of multifunctional materials (intelligent clothing), virtual prototyping, novel organizational concepts e-commerce and further novel production technologies which join mass customization with rapid manufacturing.

According to relevant literature, LMT manufacturing industries are more active in **process innovations** (e.g. Segarra-Blasco and Joseph-Maria, 2008; Kirner et al., 2009; Heidenreich, 2009). These can be customer- or market-driven (e.g. Bender, 2004; Santamaria et al., 2009; Grimpe and Sofka, 2009) or they can even derive from relevant regulatory incentives or requirements**.** However, the stronger impact of process innovation is a clear indicator for the stronger role of cost competition and economies of scale (Fagerberg, 2005; Heidenrich, 2009). Actually, Segarra-Blasco and Joseph-Maria (2008) in their study on "Sources of innovation" found that between 1998 and 2000, 68.8% of low tech manufacturing firms carried out at least one process innovation. Heidenreich (2009) explored the specific innovation patterns of LMT industries[48], and confirmed that process innovations are more important than product innovations for LMT firm. The author goes further claiming that embodied technology is of substantial importance in low-tech innovation.

Lately, a part of relevant literature focuses on the use of advanced manufacturing technologies (AMT) as a critical factor in the innovation process of LMT firms. For example, Santamaria et al. (2009) concentrate on the importance of advanced

[47] Measured as the percentage of the market that is controlled by the four largest competitors (Kumar and Saqib, 1996).

[48] The study is based on Fourth Community Innovation Survey (CIS4), where 750,000 businesses with 10 or more employees

manufacturing technologies together with training and design in generating innovation. They include technological consultants, recruitment of technical staff, purchase of external R&D, and formalization of R&D joint ventures.

Such **mechanisms of pursuing innovation** refer to Pavitt's definition of "supplier-dominated" firms:

> "Supplier dominated firms can be found mainly in traditional sectors of manufacturing. . . They are generally small, and their in-house R&D and engineering capabilities are weak. They appropriate less on the basis of a technological advantage, than of professional skills, aesthetic design, trademarks and advertising. Technological trajectories are therefore defined in terms of cutting costs. Supplier dominated firms make only a minor contribution to their process or product technology. Most innovations come from suppliers of equipment and materials, although in some cases large customers and government-financed research and extension services also make a contribution . . . [I]n sectors made up of supplier dominated firms,we would expect a relatively high proportion of the process innovations used in the sectors to be produced by other sectors, even though a relatively high proportion of innovative activities in the sectors are directed to process innovations."

From: Pavitt, K. (1984). Sectoral patterns of technical change: towards a taxonomy and a theory. p.356

The reliance on external resources particularly for process innovation (Cox et al., 2002; Grimpe and Sofka, 2009, Kreinsen, 2008) denotes quite clearly that LMT innovativeness supports the argument that in-house R&D and external know-how are complementary (Cassiman and Veugelers, 2006; Cockburn and Henderson, 1998; Cohen and Levinthal, 1990). Among the most important activities is the acquisition of machinery, equipment and software (Heidenreich, 2009; Bender, 2004; Hirsch-Kreinse, 2008). **Suppliers** are indeed the most important source for information and knowledge flow in low-tech industries (e.g. Heidenreich, 2009; Grimpe and Sofka, 2009; Santamaria et al., 2009). Firms rely heavily on innovative technology embodied in the equipment that they purchase (Pavitt, 1984; Napolitano, 1991), while trade fairs and exhibitions are more important for low- tech (Falk, 2007; Chen, 2009) than for high-tech companies (Heidenreich, 2009). In supplier-dominated (e.g. Textile, furniture) sectors, new technologies are embodied in new components and equipment, and the diffusion of new technologies and learning takes place through learning-by-doing and by using. Besides intramural R&D (e.g. Tsai and Wang, 2009), innovation partnerships (Heidenreich, 2009), design (Santamaria, 2009; Pedersen, 2005; Laestadius, et al., 2005) and training (Malerba, 2005; von Tunzelmann and Acha, 2005; Santamaria et al., 2009) constitute further significant activities. Heidenreich (2009) further stated that the acquisition of machinery, equipment and software was

slightly more important in low-tech industries compared to high-tech industries, while the percentage of low-tech companies that engage intramural R&D is smaller compared to that of high-tech ones.

In many cases LMT firms do not just adjust or adapt to existing technology paradigms already developed in the more high-technology industries. They are also **key users of high-tech ideas** (Santamaria et al., 2009; Garibaldo and Jacobson, 2005), and can contribute significantly to the development of technologies and knowledge diversification directed to new technological fields (Mendonca, 2009). These firms by being 'lead users' place special demands on new technologies and call for novel performance attributes that exceed the normal requirements of the average user. In addition, they often find ways to expand performance characteristics of new technologies themselves and then allow for their improvements to be fed back to high-tech firms so that they can be applied to other uses (Von Hippel, 2005). It is also suggested that these "carriers and co-developers of the new technologies", as Mendoca (2009) calls them, are particularly effective in the introduction and diffusion of innovations when they search for solutions to problems analogous to their own in other sectors. A general conclusion of the PILOT research project highlights this significant but often overlooked symbiotic relationship of low-tech and high-tech sectors; the continued viability of the high-tech sector is inevitably linked to the on-going vitality of LMT industries.

It should be mentioned that in general, low-tech firms are quite reluctant to co-operation with universities and public research organizations (e.g. Seggara-Blasco, 2010). However, low-tech firms of an innovative culture seem to be more willing to join innovative efforts with scientific organizations, technology liaison offices, political institutions, associations, chambers of commerce and industry or also regionally focused support programmes.

In all cases, there are always **barriers** that hinder innovative performance even for those willing to innovate. According to a number of empirical research studies (e.g. Böheim M., 2008; Pirich et al., 2001; Skuras et al., 2011) such critical factors can be: financial constrains, conservative financial and investment culture, problematic access to finance with cumbersome and time consuming processes, lack of scale, relatively high transaction costs, scarcity of skilled labour, distance from major markets, inadequate market demand, regulation and taxation and lack of larger regional

economic co-operation initiatives. Indicatively, Böheim (2008) in his empirical research observes that banks scarcely finance innovative activities of low-tech SMEs due to the rather low probability of positive consumers' responsiveness to new low-tech products or services; this reluctance results in a low supply of loans for innovation financing. The common belief that LMT enterprises are old-fashioned and address mature markets, subject to overcapacity, is a major barrier not only for private financing but for the broader attitude of authorities and policy makers. Confronting innovation in traditional industries "as a contradiction in terms" (Mendoca, 2004), low-tech industries have been largely ignored by innovation policy and in innovation research to (Bender, 2004; Hiresch-Kreinsen, 2008).

2.5.3.2.. Knowledge and low-tech innovation

It was quite expected that research on low-tech innovativeness would turn in parallel to the questioning of sources of knowledge and distributed knowledge bases (for example, Granstrand et al., 1992; Lundvall and Johnson, 1994; Liebeskind, 1996; Nonaka and Konno, 1998; Veugelers and Cassiman, 1999; Howells, 2002; Smith, 2000, 2002, 2003; Hirsch-Kreinsen et al., 2003 and 2005; Bender, 2004; Robertson and Smith, 2008; Malerba, 2008 and 2005; Burger – Helmchen, 2008; Grimpe and Sofka, 2009; Chen 2009; Tsai and Wang, 2009, Stam, 2009).

Actually, innovation and knowledge in LMT sectors have been under the microscope of several research projects such as PILOT, KEINS and COST. Here knowledge is meant to be acquired through the ongoing process of production, developed and transmitted on the basis of learning-by-doing/using. Such knowledge shows an individual and a collective dimension and it has a highly informal character. The projects' results strongly support the view that non-R&D activities such as design, the use of advanced machinery and training are crucial to understanding the innovation process of low-tech firms. The empirical evidence also revealed the importance of external sources such as the use of consultants, the hiring of personnel, collaboration agreements and external R&D, with the greatest differences between LMT and high-technology (HT) firms being observed in process innovations.

Smith (2002) disconnected knowledge creation from R&D. In this respect, it appears that the knowledge that is most relevant for low-tech firms can be considered as *application-oriented practical knowledge* and is usually distributed across many

agents and organizations. This requires often firms to transcend their boundaries and seek external knowledge such as external technology sources for non-core technologies to complement internal R&D in their core areas (Chesbrough, 2006 in Lichtenthaler, 2009). Accordingly, they may increasingly acquire disembodied[49] technological knowledge in addition to their traditional inward transfer of embodied technology from high technology sectors (Robertson and Patel, 2007). Therefore, it appears that external knowledge sources such as other firms, organizations and other actors play a decisive role in the innovation strategies of LMT firms.

Examples for **external sources of knowledge**, for instance, in the case of the custome- oriented strategy, are the experience of long-time customers concerning new market and demand trends, the expertise of pertinent consultants or information about changing market requirements acquired in trade fairs and exhibitions. In the same vein, the fashion-oriented design of products by external design agencies plays a far from marginal role for successful sales strategies. Further important external knowledge sources are machine manufacturers and suppliers who as already mentioned above provide theoretically and scientifically generated knowledge through production technologies and materials, which is often an essential prerequisite for the innovation activities of process specialization (Hirsch-Kreinsen, 2008; Grimpe and Sofka, 2009; Santamaria et al., 2009). Indicatively, summarizing the findings of the PILOT project, Smith (2005) gives **five groups of sources of knowledge and expertise**:

(1) *Suppliers of equipment* as sources of embodied knowledge or as provokers of learning processes in cases of either tailored technology or at least technology adapted to the companies needs.

(2) *Suppliers of components and material*: interchange and reciprocal learning is evident in the majority of cases

(3) *Customers* both as important triggers for product innovation but also as relevant sources of related knowledge.

(4) *Various kinds of consultants* such as trades associations, scientific advisors (test laboratories and research institutes) and other external experts.

[49] Disembodied flows involve the use of knowledge, transmitted through scientific and technical literature, consultancy, education systems, and movement of personnel and so on (Robertson and Smith, 2008).

(5) *Service providers* such as consultants, designers, and other creative partners or providers of non-scientific testing facilities.

Therefore, low-tech firms own at least one **knowledge base** which refers to the knowledge a firm needs to be able to use, to be successful in its business and then have to find, integrate and synthesize different kinds of knowledge[50]. When this knowledge is "distributed", it is not necessarily in the possession of a company but can be spread out between various actors and different levels of accessibility. The concept of **"distributed knowledge bases"** developed in Smith (2003a) comprises the different forms of knowledge of actors who are independent of each other and often come from different sectors and technology fields. Knowledge base then means the "knowledge content of an industry".

Knowledge bases are developed, maintained and disseminated by institutions of various kinds who are independent of each other, originate from different sectors and technology fields, and are claimed to be 'deep, complex and systemic' (Hirsch-Kreinsen et al., 2003). Altogether, the forms of exchange between the different actors of the distributed knowledge base can be very diverse.

> "Even a cursory examination of LMT products suggests that these knowledge bases are complex, with many inputs of formal, codified and scientific knowledge results. In wood products, for example, even the first cutting of a wooden log in a sawmill might involve complex pattern recognition technologies using algorithms aimed at the maximisation of yield. In vehicle assembly, high-grade adhesives are normally used, and these are the outcomes of basic R&D in chemistry. In food processing,
> both production and monitoring require instrumentation technologies based on microbiology, bacteriology, and informatics. Modern synthetic textiles are the results of decades of R&D in the chemical industry".
>
> Hirsch-Kreinsen et al., 2003, pp. 21-22

Firms cultivate and develop their knowledge base strategically, mobilize it and, in doing so, they generate innovations. However, efforts to find or form distributed bases are quite difficult and by no means self-evident, since they can be quite vague and difficult to trace.

> "because of uncertainty and uneven distributions of knowledge, it is often difficult to know where to look for appropriate knowledge, if indeed there is any reason to suppose that such knowledge currently exists. …. Even when knowledge is 'in the air', a particular firm may not be breathing in the right spot to inhale it"

[50] This ability has been described as *synthesizing competence* by Bender (2004).

From *Robertson and Smith, (2007), technological upgrading and distributed Knowledge bases, p.12*

Supporting their view, Robertson and Smith (2008) developed the concept of *Management of the Distributed Knowledge Base* which is a central precondition for successful LMT innovation strategies. It refers to the ability to manage and effectively coordinate network relations across company borders, especially with other companies within the value chain.

The knowledge base of traditional sectors can be extremely expanded as products become increasingly systemic and embody knowledge emerging from scientific or technological breakthroughs that take place in high-technology sectors. More specifically, there is a merger of knowledge and industry boundaries which can be described as technology fusion that give firms the opportunity to introduce new technologies into products and systems for improved performance and new functionalities. For example in functional or nutraceutical foods the boundaries of food and pharmaceutical industries are blurring to create hybrid products that in addition to addressing basic nutritional requirements they also provide health benefits (Robertson and Patel, 2007; Broring et al. 2006).

Distributed Knowledge Bases enabled the distribution of knowledge that is relevant to a specific industry across many independent actors or sectors allowing a low-R&D industry to be a heavy user of knowledge produced elsewhere. This, of course, implies the notion of **'open innovation'** mainly introduced for its application in low-tech industries as discussed in detail above. Moreover, it is not simply a matter of passively absorbing knowledge from outside. Whether benchmarking and learning from the best or working jointly on a new project are becoming common practices which require the capability to observe, to obtain information, to analyse and to transform machines, design or organisational structures or even to co-produce knowledge in various. Even before the new millennium, researchers had dealt with such knowledge flows, e.g. contracting mechanisms which refer to the acquisitions of knowledge on a market basis (Granstrand et al., 1992; Mangematin and Nesta, 1999; Napolitano, 1991). "A firm can obtain new technology embodied in an asset that is acquired, such as new personnel, parts of other firms or equipment. But new technology can also be obtained disembodied, for example by outsourcing the technology from an R&D contractor or consulting agency" (Veugelers and Cassiman,

1999, p. 66). There are numerous examples with low-tech sectors in particular to use technological innovations, largely generated in other industries such as in machinery, software and technological hardware or raw material producers (such as technical wood and fibers).

As expected,a variety of skills and capabilities are linked to the ways of knowledge generation on low-tech cases. Within the PILOT's relevant framework, internal organisation practices such as knowledge management, direct reaction to market requirements, work organisation and personnel policy appeared to play a vital role, contradicting the often assumed low-skill, hierarchical model. In the same context, factors such as cultural and organisational proximity were considered significant for the passing on of knowledge (especially practical, non-codified knowledge) between companies, regarding the social context of critical importance for technological evolution and innovative capacity (Garibaldo and Jacobson, 2005). Other dimensions shaping the intensity and focus of low-tech but knowledge-based innovation activities of a firm are technological opportunities, appropriability conditions and market competition as well as the institutional framework the firm and its business environment is embedded in (Ollonqvist and Rimmle, 2006) .

2.5.3.3 The Capabilities issue in low-tech

In the saturated and competitive markets where LMT firms act, innovative capability has been claimed to form the competitive advantage since it can enable the creation of new customer value allowing firms to stay ahead of competitors (Ollonqvist and Rimmler, 2005). Innovative capabilities of low-tech organisations have been found embedded in their resource bases, internal organisational structures and operational and managerial routines, extending also to organising and managing external linkages. In stable business environments, the patterns of innovative capabilities are routine processes focusing on continuously and incrementally developing operational capabilities, whereas in a dynamic business environment there are less formal patterns and the processes are more experimental (Ollonqvist and Rimmler, 2006).

Following the findings of low-tech research, Hirsch-Kreinsen and Schwinge (2011) conclude that two kinds of capabilities are crucial for low-tech and knowledge-based innovativeness (cf. Bender and Laestadius, 2005; Hirsch-Kreinsen, 2008):

(1) The c*onfigurational capability* which constitutes the ability to synthesize novelty by creating new configurations of knowledge. According to the authors, "It refers to the ability of the individual actors involved to tap distributed knowledge and know-how from diverse areas and to recombine it creatively with already existing local knowledge". It further captures organizational dimensions such as routines or internal communication processes. Bender and Laestadius (2005) describe three sub-dimensions and namely:

- *cognitive*: configuring distributed knowledge of different kinds;
- *organisational*: configuring distributed actors and other repositories of knowledge and know-how;
- *design*: configuring functional features and solutions.

(2) The *transformative capability which* constitutes the enduring ability to transfer and transform existing general, global knowledge into local level knowledge *and enables the* establishment and co-ordination of network relations with external partners.

Furthermore, Hirsch-Kreinsen (2015) in a recent chapter on *Innovation in low-tech industries* connects the notion of transformative capabilities with the approach of **dynamic capabilities** arguing on the "overlooked yet highly dynamic development of LMT industries". Actually, t he existence of dynamic capabilities in low-tech industries had been not posed as a central research issue almost until the beginning of the AEGIS project (2009). Almost by definition, theoretical and empirical research on dynamic capabilities had been mainly focused on high-technology industries and high-tech environments, characterized by rapid technological changes (Teece et al., 1997; Zahra et *al.*, 2006; Easterby-Smith et *al*., 2009). Despite the fact that an increasing number of scholars advocated the important role of dynamic capabilities also in moderately dynamic environments (Eisenhardt and Martin, 2000; Helfat et al., 2007), up to 2010 there was hardly any evidence of the dynamic capabilities' existence and role in low-tech sectors which were normally considered relatively more stable contexts compared to their high-tech counterparts.

Research projects (such as the PILOT) indicated that traditional sectors, although called mature, contain dynamically competitive firms that shape markets and competition instead of just building defenses. Researcher even commended on the meaningless distinction among sectors in terms of technologies;

> "Conventionally, sectors of all types were supposed to be recognizably different from one another not only in the goods and services they produced but also in the technologies and processes they used to produce them. However the boundaries have become blurred in both dimensions. Technologies originally developed for one set of products spill over into use in the production or "architecture" of other sets of products. … One simple consequence is that even "old" products can be produced by, or partly consist of, elements drawn from what had previously been a totally different set of activities … as a result, conventional classifications of sectors as high- or low-tech, as long practiced by the OECD, are becoming less and less useful for analysis, though their sway still holds in government policy making."
>
> (Von Tunzelmann and Acha, 2005: 408-9)

Moreover, as mentioned above, in today's globalization frame, all companies – and not only of high-tech sectors – are found in the middle of turbulent and fast changing environments, characterized by high uncertainty. Thus, low-tech industries are far more dynamic than usually believed, as they have to confront the instability of global markets, the fast pace of inter-sectoral technological advances and the high probability of environmental shocks, i.e. major elements of environmental dynamism. Therefore, hints on the role of dynamic capabilities in mature industries were to be found in many cases. However, Protogerou, Caloghirou and Lioukas (2011) were among the first to indicate DCs' value in less dynamic environments and Protogerou and Karagouni (2012) the first to focus exclusively on the issue. Protogerou and Karagouni (2012) provide theoretical and empirical, qualitative and quantitative evidence on the DC existence and role in low-tech firms either in their start-up stage or later on, in their lifetime. The authors make a recall of the first efforts to engage LMT cases in DC research (Helfat, 1997) and present a table with the empirical studies on DCs and LMT sectors up to 2012. The research efforts, both qualitative and quantitative, address several issues such as

- the development of dynamic capabilities (Jones et al., 2013; Chirico, 2007; Evers, 2011; Kuuluvainen, 2011; Quentier, 2011),
- mechanisms and micro-processes that form DCs (Peltoniemi, 2013)
- the relationship between DCs and firm survival or performance or their role in achieving competitive advantage at the international level (Abro et al., 2011; Grande, 2011; Oswald et al., 2013; Protogerou, et al., 2011; Spanos and Lioukas, 2001; Telussa et al., 2006) and
- DCs' relationship to innovation, and their impact on innovative performance (Borch and Madsen, 2007; Rafailidis and Tselekidis, 2009).

Makkonen, et al. (2013, 2014) using both quantitative and qualitative data investigate how low-tech firms cope with the drastic effects of the global financial crisis under the perspective of dynamic capabilities. Karagouni and Kalesi (2011) building on qualitative data from knowledge-intensive firms active in the food industry, showed that low-tech companies basing their strategy on knowledge intensiveness and innovation develop relatively strong dynamic capabilities in order to gain competitive advantage. Karagouni and Protogerou (2013) explored the DC perspective in the wood and furniture sector within crisis while Protogerou, Caloghirou, and Karagouni (2014) discussed the relevance of dynamic capabilities perspective in low-tech sectors in a chapter of a book on KIE in low-tech sectors.

However, it appears that the LMT/DC issue becomes more and more attractive. A quite significant volume of relevant work has been further traced only in 2014; for example, Dries et al (2014) continue their analysis of the relationship between dynamic capabilities of the firm and open innovation. Feiler and Teece (2014) discuss DCs' identification and prioritization through a strategic assessment of an LMT company, the oil company Supermajor EXP. In the same vein, Dixon et al (2014) explore the microfoundations of DCs that sustain the competitive advantage in the Russian transition economy based on a longitudinal case study of the Russian oil company, Yukos. The same sector is used further for DC capabilities by Saad et al (2014).

Abiodun and Rosli (2014) confirm by a quantitative research in Nigeria the impact of reconfiguring capabilities on competitive advantage when combined with entrepreneurship. Hamthanont, (2014) discusses the relationship of dynamic capabilities with organisational resources, processes, and performance in the Thai food industry. Roaldsen (2014) investigates case studies of the value chain within the food industry and claims that low-tech SMEs holding specific dynamic capabilities are more likely to succeed in changing their business models for entrepreneurial purposes.

Therefore, we can assume that the increasing interest in the issue and the plurality of directions and intentions of researchers trying to capture the nature and role of dynamic capabilities in low-tech sectors indicates that the potential to examine low-tech through the lens of the dynamic capabilities approach remains largely unexplored.

Regarding entrepreneurial capabilities, to our knowledge, scholars have not yet turned to a more focused exploration of any specific ones within the new socio-economic

phenomenon called Knowledge-based or knowledge-intensive Entrepreneurship. Even among the scarce work on the topic, research turns to high-tech cases; Burger-Helmchen (2009), for example, tried to evaluate the innovative/entrepreneurial capabilities of small firms based on a longitudinal case study of a high tech start-up.

2.5.4. The emergent issue of KIE in low-tech sectors

Until the AEGIS project low-tech sectors had been characterized as innovative (at firm-level) but were clearly left out of the KIE discussion. As Caloghirou, Protogerou and Tsakanikas (2014) state "in policy circles and in press it was used as a basis for defining and discussing knowledge-intensive in contrast to traditional or non-knowledge-intensive industries". The AEGIS project (2009-2012) contacted both qualitative and quantitative research in a number of European countries in order to provide a comprehensive understanding of KIE (including low-tech sectors) and to shed light on its unclear complex interactions with determining factors.

The results of the extensive research created useful knowledge on LT-KIE and more specifically regarding a) the evolution and the characteristics of knowledge-intensive entrepreneurship in low-tech manufacturing sectors, b) the relevance of interrelationships between low-tech and high-tech activities for knowledge-intensive entrepreneurship and c) the impact of knowledge-intensive entrepreneurship on the growth and competitiveness of European traditional sectors. Some of the most interesting results of the project are summarised bellow:

LT-KIE and innovativeness: The research lead to four types of LT-KIE: a *market-driven* type, a *technology-driven* type, a *capability-driven* type and a type termed as *sectoral pressure* and identified the following determining factors:

a) The provision of new knowledge and technologies that stand out from the resources of the sectoral system, in particular scientifically generated knowledge, new combinations of practical knowledge and new markets' knowledge.
b) A bundle of capabilities that enable entrepreneurs to identify opportunities and to integrate and to commercialize the new knowledge. (i.e. social, organizational and cultural aspects). Very often the industrial experience of individual entrepreneurs is a crucial prerequisite for their success.
c) External factors such as the innovation policy, aspects of regional proximity or the opportunities and modes of funding.

The relevance of interrelationships between low-tech and high-tech KIE activities: results confirmed the complementarity with high tech industries, as initially pointed by Heidenreich (2009). Innovation and growth in LMT industries is to a large extent shaped by technological advancements in high or medium-high tech industries. On the other hand, KI low-medium tech industries open new market opportunities for high-tech industries. Thus, low-tech industries can be frequently part of high-tech systems. In that sense someone might argue for a more equilibrated pattern of specialization and development.

Within this context, the project highlighted further similarities between LMT and high-tech KIE: a) they use high skilled personnel b) they intensively use knowledge c) they need a high level of technological, production and organizational capabilities d) they are innovative.

However there are certain differences between the two categories such as: a) LMT KIE firms do not perform formal intramural R&D to a large extent but use t knowledge from external sources to produce innovative solutions that go beyond established technological regimes; b) they perform mainly process innovations contrary to product innovations of their high-tech counterparts c) LMT entrepreneurs find it more difficult to raise capital.

The impact of KIE on the growth and competitiveness of European traditional sectors

The survey and case study analysis indicated the existence of an innovative potential of LMT industries and firms based on exploitative learning processes. LMT- KI firms appear to differentiate positively from non-KI firms in terms of their growth and export intensity, even during the period of the current crisis.

LMT-KIE competitive advantage relies on the ability of firms to introduce innovative products or processes, to exploit and integrate technological advancements of other sectors mainly high- and medium-high-tech and to respond to new demand conditions. LMT-KI firms create new market opportunities and invest on technological development and capability building.

At the sectoral level KIE relates to the development of the sectoral knowledge base, the nature of competition, the generation of new opportunities for new entrants and the diffusion of knowledge to the whole value chain. In that sense someone can argue that LMT industries can constitute an engine of growth and competitiveness if subjected to a transformation process towards knowledge intensive activities.

Appropriability measures: Contrasting the use of patents in high-tech KIE, two forms of intellectual property rights (IPRs) which seem to be more important in LMT industries are registered trademarks, which "protect signs or combinations of signs that distinguish the goods and services of different traders", and industrial designs, which "protect the visual appearance or eye appeal of useful articles" (Eurostat, 2007: Statistics in focus, Science and Technology no 91/2007). This confirms further the important role of design and marketing in LMT industries—which Pavitt (1984, p. 354) expected to be a major feature of supplier dominated firms.

Repositioning of LMT KI firms in product supply chains: In contrast to the prevalent view of supplier-dominance and weak internal innovation capabilities the AEGIS research revealed that LMT firms increase their competitiveness by moving up the product supply chain.

Policy measures and policy implementation mechanisms proposed for the promotion of LMT-KIE: AEGIS researchers proposed a series of general and specific recommendations regarding:

(1) focus on the needs of LT-KI firms and, in specific, their entrepreneurial activities

(2) Start-up funding programs since companies in mature industries are actually not the main target group for such measures

(3) Appropriate measures such as tax incentives of (non-R&D based) innovation activities, financial support for payroll costs accrued by personnel involved in innovation tasks or for the establishment of specific R&D and design departments (cf. Rammer et al., 2010).

(4) Campaigns to raise awareness and generally understand better innovation processes in LT industries.

(5) Support opportunities for trans-sectoral knowledge for KIE LT processes through innovation networks to facilitate collaboration. In this context, policy measures could include more bridging institutions between LT industries and science, consulting in the area of network management and events –such as trade fairs and seminars – for the exchange of experiences with other networks.

(6) Support the enhancement of the necessary capabilities of LT firms and entrepreneurs so that they may access knowledge resources and new technologies in a critical and selective way.

Published work after AEGIS regarding knowledge intensive entrepreneurship and low-tech industries reflects mainly the researchers' experience from the AEGIS project as indicated in Table 2.20. Table 2.15 contains all relative work regarding knowledge intensive entrepreneurship in low tech sectors after the end of the AEGIS project, i.e. after 2012. Search included all databases of HEAL-Link (Hellenic Academic Libraries Link) and Google Scholar.

Table 2.15: Low-tech Knowledge intensive literature after the AEGIS project (2012)

AUTHOR	YEAR	TITLE	AEGIS-BASED
KIE AND LOW-TECH			
Hirsch-Kreinsen, H.	2015	Innovation in Low-Tech Industries: Current Conditions and Future Prospects.	YES
Hirsch-Kreinsen, H.	2014	Knowledge-Intensive Entrepreneurship in Low-Tech Industries (book)	YES
Kastelli, I., & Caloghirou, Y. D.	2014	The impact of knowledge-intensive entrepreneurship on the growth and competitiveness of European traditional industries	YES
Goedhuys, M., Janz, N., & Mohnen, P.	2013	Knowledge-based productivity in "low-tech" industries: evidence from firms in developing countries.	NO
Schwinge, I.	2012	Knowledge-intensive entrepreneurship in a low-tech sectoral innovation system.	YES
KIE INCLUDING LOW-TECH			
McKelvey M and Heidemann Lassen A.	2013	How Entrepreneurs Do What They Do: Case Studies in Knowledge Intensive Entrepreneurship	YES
McKelvey M and Heidemann Lassen A.	2013	Knowledge Intensive Entrepreneurship: Engaging, Learning and Evaluating Venture Creation.	YES
McKelvey M and Heidemann Lassen A.	2013	*Managing Knowledge Intensive Entrepreneurship*	YES
Protogerou, A., Caloghirou, Y., & Siokas, E.	2013	Publicly-funded collaborative R&D networks as drivers for promoting knowledge-intensive entrepreneurship: An exploratory exercise.	YES
Grønning, T.	2013	Creating and sustaining knowledge-intensive entrepreneurship.	NO
WITH LIMITED REFRENCE TO KNOWLEDGE–BASED ENTREPREENRSHIP AND / OR TO LOW-TECH			
Kirner, E., & Som, O	2015	The Economic Relevance, Competitiveness, and Innovation Ability of Non-R&D-Performing and Non-R&D-Intensive Firms: Summary of the Empirical Evidence and Further Outlook.	NO
Alba, M. F., Álvarez-Coque, J. M. G., & Mas-Verdú, F.	2013	New firm creation and innovation: industrial patterns and inter-sectoral linkages.	NO

In sum, it appears that low-tech knowledge-intensive entrepreneurship is today established and accepted as a key socio-economic phenomenon that drives innovation and economic growth, and is at the base of the competitiveness of developed and developing countries. Furthermore, it becomes quite clear that a changing business environment is not exclusively associated with high-tech sectors as it can also exist and play a significant role in low and medium-technology industries especially in the contemporary turbulent years and in the midst of the financial crisis that most European countries are experiencing.

It is evident that further theoretical and empirical research of low-tech knowledge intensive entrepreneurship is necessary and of great importance especially nowadays, since the pressures of increasing globalization and rapid technological and socioeconomic changes have major impacts on mature traditional industries and the role of low-tech industries continuous to be vital for the vast majority of the European business ecosystem.

2.5.5. Production Technologies and LT-KI entrepreneurship

The picture we see in the contemporary world is one of technologies (mechanical, chemical, biological, electrical) mapping onto products (textiles, food, motor vehicles, computers) on a many-to-many basis
von Tunzelmann, 2007

"Major technological breakthroughs in textile production and the application of steam power to production in Britain in the second half of the eighteenth century made a deep impression on contemporary and later observers. In the nineteenth century the term *industrial revolution* was coined to describe these developments in retrospect. In other respects, industrial revolution remains an apt term. It captures the introduction of radically new **production technologies**[51] which diffused across the globe and which have fundamentally affected the nature of global production. The emergence of modern manufacturing has led to dramatic changes in the structure of the world economy and to sustained increases in the growth of labour productivity and economic welfare.

Naudé and Szirmai, 2012

The notion of knowledge-intensive entrepreneurship connects venture creation to knowledge-intensive innovation quite tightly (Malerba and McKelvey, 2010). When referring to low-tech manufacturing, the transformation of an innovative business concept into a marketable product presupposes the choice and set up of the suitable production technologies. The creation of new firms becomes then an important

[51] Bold and underlined by the author

mechanism through which entrepreneurs *use technology* to bring new products, processes, and ways of organizing into existence (Schumpeter 1934). Consequently, technology can represent a major source of competitive advantage and growth for manufacturing firms (Dussauge *et al.,* 1994).

Certain low-tech but knowledge-intensive businesses require considerable tangible and intangible resources for the set up of production technology since most of them, besides the use of standard equipment and technology, develop production technology novelties. Activities such as design / customization, the installation and preparation of equipment and trial production are knowledge generating activities. Entrepreneurs, entrepreneurial teams or managerial teams, especially in low-tech knowledge-intensive cases, try to identify and acquire advanced production technologies to combine and create the technologies they need. If successfully applied, advanced production technologies enable "the firm to capture lucrative and more value added markets for growth" (Evers, 2011). In the view of knowledge-intensive low-tech innovation, production technologies involve applying the work of researchers and industrial practice to develop new products and processes covering technologies for an extremely varied range. Producers have to locate and organize the individual and often miscellaneous pieces of product and/or process technology they need. That may range from production lines to engineering and operating procedures. Besides focusing on a few technological core competencies, most of these firms sustain competencies in multiple technology fields (Granstrand, 2000).

Furthermore, because of increasing technology convergence, these fields are often relatively different from the core technologies (Garcia-Vega, 2006), and this puts further emphasis on the importance of successful technology exploitation (Patel & Pavitt, 1997). Many times users decide even to produce their own complex machinery in-house. The case studies of the PILOT project showed extensive inter-firm collaboration in low-tech industries and firms. Linkages from LMT firms to high-tech firms and industries involved the design and development of quite specific technologies which were designed or significantly adapted for the user industries. These frequently involved forms of numerically controlled machine tools, or monitoring or instrumentation equipment, or the use of specific computing technologies and software for design purposes.

The set-up of production technology occurs in parallel with organization creation. This refers to the building of the physical structure, and the organizational processes

that “surround production technology at the core” (Thompson, 1967). The procedures which are usually required when installing the purchased equipment or the *ex ante* specification for systems to be constructed in an application-oriented manner, are both to a large degree based on the accumulated practical knowledge of the respective agent (Hirsch-Kreinsen et al., 2003).

Furthermore, prospective low-tech and knowledge-based innovation challenges regard mainly process innovation (Hirsch-Kreinsen 2008a, Robertson and Smith 2008, Robertson et al. 2009) lying in new process (production) technologies or frequent changes of process technologies, automation and flexible high-tech processes that, for example, can offer tailor-made clothing in a mass production system. Staying in the textile and apparel sector, challenges are related to new textiles and composite materials and their need for process and production innovation. With regard to new machinery, processing methods and processing activities, challenges will lie in breakthroughs in technology areas such as biochemistry, biotechnology, plasma, laser and nanotechnology.

However, in many LT-KI cases it is often difficult to discriminate between product and process related innovation. While the phenomenon is more usual in the food sector there are many cases of innovative material treatments or additional process steps which introduce novelty. Combining literature on innovation and knowledge, a significant feature of low-tech but knowledge-intensive innovation appears to be the engagement of many stakeholders of particular knowledge stocks all along the value chain in an open innovation model; knowledge can be of a specific operative or practical nature including codified as well as tacit elements (cf. Hirsch-Kreinsen, 2008). Shared elements can be technological parameters, technical functions, performance characteristics, technological upgrading, the use of materials and products, etc. in the industry or in a product field (Robertson and Smith, 2008, p 100). Especially in learning processes, learning takes place through learning-by-doing and by using. Goedhuys, Janz and Mohnen (2008) name it technological learning in their analysis of the three low-tech-sectors agro-processing (especially food and beverages), textiles as well as garments and leather products. According to Hirsch-Kreinsen et al. (2003) major engineering, design and production knowledge constitute the main areas where LMTs seek for complex knowledge bases, besides scientific generated knowledge.

Therefore, it is quite clear that sources of knowledge play a significant role in the development of production technologies within LT-KIE. According to relevant literature (e.g. Bender, 2004, Heidenreich 2009; Hirsch-Kreinsen, 2008) knowledge and technological solutions tend to permeate through *sectoral boundaries;* suppliers of machinery, equipment and raw material are significant sources of knowledge and expertise[52]. Close relations to the developers and manufacturers of production technologies are crucial particularly if technical equipment is custom designed, or if at least certain components and functions are adapted to the particular user needs. In certain cases and most often in corporate LT-KIE, the exploration and development of new techniques and product architectures is likely to occur in the "neighborhood" of the techniques and architectures already in use (Antonelli, 1995; Atkinson and Stiglitz, 1969; David, 1975).

Studying the phenomenon of KIE in low-tech industries in detail, Hirsch-Kreisen and Schwinge (2011) focus on the importance of new knowledge, technologies, market knowledge and combinations of practical knowledge as significant trans-sectoral factors in order to create new knowledge. In accordance, "value-oriented production technology" is illuminated within the topic areas of creative design, production planning, flexibility and technological capability (Klocke, 2009). Furthermore, and according to Laestadius et al. (2005), the adoption and use of advanced technologies make the old competences obsolete and help to develop new ones, thereby opening the firm to new possibilities. Therefore, the availability of technological knowledge and access to sources of information pertinent to innovative technologies constitute key dimensions of LMT research (Albros-Gariggos and Hervas-Oliver, 2013; Hirsch-Kreinsen, 2013; Bönte and Dienes, 2013).

Lately, production technologies have been discussed further within a low-tech but knowledge-intensive context mainly at a sectoral basis; e.g. Adler (2004) for the German textile and clothing industries and Rasiah et al (2011) for garment manufacturing. Focusing on the empirical case of the food industry, Trippl (2010) provides evidence that the link between old industries and their high-tech contexts may be more complex than commonly thought. Rodgers (2008) studies technological

[52] For more please refer to the relevant literature review

innovation supporting different food production technologies. Warren and Nouman (2013) study the marble mining industry to explore low-tech innovative production technologies. Nahm, and Steinfeld, (2014) connect knowledge-based innovation to a full spectrum of manufacturing-related activities wind turbine manufacturing. Habets, Van Der Sijde, and Voordijk, (2007) provide insights into the adoption processes of novel production technologies in the Dutch road construction industry.

As analyzed above, production technologies are also *basic technological capabilities* (Lall, 1992). As such they also constitute a significant research issue for low and medium technology industries ever since the '60s; for example, Rosenberg (1963) explored the machine tool industry to show that technological capabilities may spin off in newly-created companies. In his paper to DRUID conference, Keith Smith (1999) stated that growth actually rests on technological knowledge bases with technological capabilities to define the "new epoch of growth". A significant number of research work includes technological capabilities as a major component of LMT industries' development and evolution such as internationalization (e.g. Fletcher, Loane and Evers, 2011), innovation (e.g. Heindenreich, 2009), interaction with high-tech firms (e.g. Freddi, 2009; Mendonça, 2009), or with competitive advantage (e.g. Danneels, 2008), being considered as fundamental in producing novel products or services in most low-tech sectors (Spanos and Lioukas, 2001).

However, perhaps the most known cases are the ones of two ladies' work and namely Virginia Acha's and Dorothy Leonard Barton's.

Leonard-Barton (1995) described the technological competencies that enabled Chaparral Steel to develop its near-net-shape casting process. The company created tacit technological competencies by using its in-house technical capabilities and skills such as its scientific knowledge of metallurgy and its expertise in molding and combining knowledge and skills from multiple individual sources by networking with industry experts and European suppliers. The author concludes that in this way, "the whole technical system can be greater than the sum of its parts," and creates difficult-to-imitate technological competencies (Leonard-Barton, 1995, p. 22).

Virginia Acha (2000) underlined the importance of production and technologies. Actually, she purported to unravel the relationship between technological capabilities and operational performance in the case of the upstream petroleum industry. She found that the case companies owned similar patterns with most of them to regard

production and technologies and "their greatest shares of publications were related to reservoir engineering (which is related to production)". She concluded that the ability to learn new methods and technologies are essential in the performance of a firm.

> *"A true core technological capability of the majors in the upstream sector has been defined as the capability to integrate new technologies and techniques and to elaborate new methodologies of exploration and production."*
>
> *Virginia Acha (2000, p. 20)*

Following the above research method, a significant part of the relevant empirical research appears to be sector-specific. For example, Garcia Martinez and Briz (2000) empirically explored the importance of in-house technological capabilities for the firm's innovation performance in a sample of Spanish Food and Drink companies. Figueiredo (2003) tried to explain how key features of the intra-firm learning processes influence inter-firm differences in technological capability accumulation in the late-industrializing or latecomer context. He addressed the issue by drawing on comparative case study of two of the largest steel firms in Brazil over their lifetimes of 40 and 60 years. Wignaraja (2002) seeks to shed light on the relationship between firm size and the acquisition of technological capabilities in Mauritius using cross-section data for a sample of 40 garment enterprises. Jonker, Romijn, and Szirmai (2006) examine relationships among technological efforts, technological capabilities and economic performance drawing on a case study of the paper manufacturing sector in West Java. Wignaraja, G. (2008) examines the links between firm-level export performance, foreign ownership and the acquisition of technological capabilities in a sample of 205 clothing enterprises in Sri Lanka.

However, there are also empirical studies that contact filed research including more than one low-tech sectors (e.g. Mendonça, 2009; Goedhuys, Janz and Mohnen, 2008). Robertson and Patel (2007) explore the nature of relationships among new and old technologies in the complex production methods that characterize major sectors of modern developed economies.

There is also much empirical quantitative research on technological capabilities that use samples of high-, medium- and low-technology industries**.** Indicatively, Vega-Jurado et al. (2009) use a sample of more than 600 low-tech manufacturing firms and an equal number of high-tech ones in Spain to assess the degree to which effects of

external knowledge-sourcing strategies on the development of both product and process innovations are influenced by the firm's internal technological capacities. Kyläheiko et al. (2011) derive hypotheses from the knowledge-based view of the firm which are empirically analyzed using survey data from 300 Finnish firms that belong to all three level of technological intensity[53]. The authors discuss the connections between technological capabilities, their appropriability, innovation activities, and internationalization. Costa and Queiroz (2001) explore FDI and technological capabilities in the Brazilian industry using a sample of firms belonging to 10 less- and 10 more technologically intense sectors.

Knowledge seems to be a common element of the majority of the above mentioned research efforts regarding technological capabilities in low-tech settings. Thus, it appears that there is a mutual acceptance of the important role of knowledge intensiveness in the cases examined. Some works such as Kyläheiko et al. (2011), Morceiro et al (2011) and Andrea Morrison (2011) state clearly the knowledge-based context of their research but most of them discuss the precondition of knowledge exchange within a broader and vaguer context. According to our knowledge there is scarce if any literature regarding the actual triplet of technological capabilities – low tech and KIE.

Recent research and empirical findings regarding LT-KIE indicate that low-tech technologies are far more than just "well-established with technological norms, methods and leitmotifs to exist for many generations" (Hirsch-Kreinsen and Schwinge, 2011); instead they appear to have complex links to science and technology, unique forms of knowledge creation and a rather unexplored system of producing innovation and creating unique competitive advantages. Therefore, technological capabilities in LT-KI cases need to be reconsidered and this can be a call for further research. Production technologies constitute a significant dimension of technological capabilities and are suggested to play some role in LT-KIE. On the other hand, they have to be properly formed by the LT-KI entrepreneurs / entrepreneurial teams in order to contribute to the creation of strong initial competitive advantages.

[53] Based on the four-level classification (low-tech, medium-low-tech, medium-high-tech, high-tech) developed by OECD. The criteria adopted by this classification is of overall R&D intensity (direct and indirect) (Hatzichronoglou, 1997)

Chapter 3

Problem Statement and Research Questions

Chapter Objectives

- To outline the theoretical background of this study.
- To develop the general background of this study.
- To establish the research questions of this study.

3.1. Introduction

The starting point of the present thesis back in 2009 was the just-arising scientific discussion on knowledge-intensive entrepreneurship (KIE) in low-tech traditional, mature industries[54]. As extensively discussed in the literature review, the KIE phenomenon turns mainly around the concepts of entrepreneurship, innovation and knowledge:

Innovation in low-tech industries has been long discussed and it is today quite clear that low-tech innovation differs substantially from the R&D-driven, technology and science-based innovation of high-tech sectors which creates turbulence and volatility together with high growth and rapid developments.

Knowledge constitutes a crucial factor; within KIE, knowledge-intensity refers to knowledge as the very basis of all entrepreneurial activities (Hirsch-Kreinsen and Schwinge, 2012). According to the authors, LT-KIE can be implemented in terms of a start-up, a spin-off of an existing organization or within an established company.

Entrepreneruship in low-tech industries is not easy; low-tech markets are generally assumed to be mature, slow-growing and subject to overcapacity and high levels of price competition forcing firms to focus on technology upgrading and process improvements rather than innovative prospects (Protogerou, et *al.*, 2013). ***New venturing*** seems extremely risky, while corporate venturing regards mainly defensive restructuring in terms of survival (see for example the overview of the textiles industry). Nevertheless, besides the severe economic downturn mainly on traditional industries due to the recent global economic recession, LMT sectors continue to be of importance, enjoying a share of 53% of total manufacturing for the EU-27 in 2010. The respective share of high-tech sectors accounted for only about 12% (Jaegers et *al.*, 2013). Furthermore, the impact of this global crisis on low-tech industries made quite clear that, besides the established perceptions, mature industries have to compete within a very vulnerable and volatile environment. Globalization and trade liberalization, increasing social pressures, and the transformation of the technology base of mature industries intensify even further the environmental instability and turbulence of their business ecosystems (Protogerou, et *al.*, 2013).

[54] Knowledge-intensive entrepreneurship had neither been analyzed in low-tech sectors nor had innovation studies dealt with KIE as a transformation mechanism for innovation in low-tech sectors till 2009.

Therefore, even if thought of as "exceptional" before, knowledge-intensive activities within the low-tech business have become quite significant today, both in terms of challenging the markets by promising competitive edges and as solutions to existing and arising problems. Thus, the nature of low-tech ventures has changed drastically the last years and has to change even more. This fact coupled with the emerging literature of low-tech KIE makes the study of low-tech knowledge intensive venturing a rather important topic. This thesis examines it.

The chapter is devoted to identifying the background of the topic and setting the problem and relevant research questions of the study. It starts with a discussion of the influences on the research topic and follows with the theoretical framework for the study. Subsequently, the research questions are then presented in relation to the study's framework.

3.2. Problem Statement and Research Questions

Knowledge-intensive entrepreneurship has been considered as a type of high potential entrepreneurship which helps renew the economy. It indicates ventures whose initiation or expansion is based on the dynamic application of new knowledge. According to Malerba and McKelvey's (2010) formal definition of knowledge-intensive entrepreneurship (KIE) KIE is associated with four basic characteristics: it concerns new firms (new ventures); new ventures that are innovative; new ventures engaging in activities that are knowledge intensive; and finally, new ventures that are not to be found solely in high-tech industries i.e. they may well be active in industries with medium or low-tech characteristics. Therefore, KIEs are involved in *venture creation* which is a mechanism to translate *knowledge* into *innovation* (and further on, into survival and growth). Thus the ultimate objective in KIE is market success and not just the development of a radical innovation. Furthermore, entrepreneurs are considered knowledge operators, dedicated to the utilization of existing knowledge, the integration and coordination of different knowledge assets, and the creation of new knowledge, and engaged in the development of new products and technologies.

The AEGIS project empirical analysis provided a detailed exploration of several KIE dimensions in an effort to unlock its riddles. Actually, the survey based on a large set

of data purported to identify motives, characteristics (including constituent knowledge assets and skills) and patterns in the creation and growth of new firms based on the intensive use of knowledge regardless sectors and levels of technologies. At firm level, the survey put emphasis on founders and founding teams' skills and characteristics, type of company formation, funding issues and potential obstacles. It further focused on the performance, innovativeness, success factors and relevant capabilities of the formed company as well as the system factors that affected these parameters such as the sources of knowledge and customers and the links and networks. The survey further extended to issues such as the institutional and market environment, strategic analyses and business models.

On the other hand, the AEGIS case studies addressed several of the conceptual issues which related KIE to innovation systems, growth and performance while many of the case studies focus upon strategy, business models, mobilization of resources and other internal processes of the venture creation, as related to a temporal dimension.

However, up to date, the discussion about knowledge-intensive entrepreneurship (KIE) is still mainly focused on new technology-based firms or academic start-ups in high-tech sectors. Little attention has been paid to sectors that conduct no or only few formal R&D activities and that are therefore characterized as non-research-intensive or "low- tech".

How easy is it to apply KIE in low-tech sectors? Hirsch-Kreinsen and Schwinge (2011) describe low-tech sectors as mature ones with established technologies and production regimes and well-recognized standards, methods, and knowledge related to both products and processes. LT industries face fierce competition due to the easy copy of their basic technologies by competitors with lower cost bases mainly in Asia. Furthermore, LT knowledge bases include mostly codified, transferable and well-known elements such as design methods, engineering routines or the know-how about markets and customer preferences with well-defined behavioral patterns. Innovations in these contexts are more or less path-dependent i.e. they are based on technological knowledge and capabilities that have been slowly evolving around established technological trajectories and thus incremental and of little value in producing competitive advantage. As a result, the growth rates as well as radical innovations in these industries are relatively low.

Consequently, the above constraints indicate that LT sectors and firms seem to offer only very limited opportunities for KIE development. However, such opportunities

seem to exist in spite the "stable environment of low-tech industries" (Deutschmann, 2008). Furthermore, competitive pressure and the ever-changing and volatile global business environment of today seem to force LT actors towards knowledge-based breakthrough innovations, even if they are not so spectacular as in the cases of high-tech (Bender and Laestadius, 2005; Hirsch-Kreinsen, 2008; Robertson and Patel, 2007). This is further confirmed by the existence of the so-called "gazelles" of mature industries (cf. Yudanov, 2007; 2009). Such cases indicate the KIE can be applied in LT sectors.

The literature review[55] highlighted the significance of low-tech sectors as well as their potential regarding innovation and the use of knowledge. Thus, paraphrasing Mendonça and von Tunzelmann (2004, 15) who referred to LT- innovation the present thesis supports the view that, "KIE in low-tech industries should … not be seen as a contradiction in terms." However, the limited research on LT-KIE shows that the sectoral conditions seem to affect to a significant extent the creation or exploitation of opportunities through knowledge, market, institutions, etc. as well as the creation of LT-KI ventures. The relevant AEGIS work package which dealt with the evolution and the characteristics of knowledge-intensive entrepreneurship in low-tech manufacturing sectors focused mainly on the types of LT-KIE, the type of knowledge, sources and abilities *needed for LT-KI innovation opportunities.*

Hirsch-Kreinsen and Schwinge (2012) relate LT-KIE firms' competitive advantage to the abilities of introducing innovative products or processes by the exploitation and integration of technological advancements of other sectors mainly high- and medium-high-tech. According to them, the impact of KIE at the firm level relates to technological development and capability building in order to create new market opportunities. However, there is no research or any approach to explain firm-level success and failure at the stage of LT-KI venturing. While there is some talk on competitive advantage and capabilities this discussion remains caged within the borders of the innovation theory and not the field of entrepreneurship.

Therefore, existent theory and empirical research has not so far offered deep insight or strong constructs of the LT-KIE topic into the direction of understanding a KI-LT new venture's survival and growth. In other words, there is actually a gap in the understanding and conceptualization of LT-KIE which addresses the very LT- KI

[55] Please refer to Chapter 2

venture creation from business idea to established low-tech business, not yet discussed by KIE researchers. Based on this discussion, the main research question is then:

***How* and *why* certain low-tech but knowledge-intensive ventures survive early death and prosper within mature ecosystems?**

In sum, the LT-KIE literature underscores the importance of a variety of factors, resources and innovation-related capabilities, but little work examines these from a new venture's survival perspective. With so much attention devoted to the conceptualization of KIE, significance of resources and skills, and the role of knowledge and innovation, the LT-KIE literature has been concerned primarily with "what" questions. There has been less attention paid to "how" questions. In relevant research so far, how LT-KI entrepreneurs/ entrepreneurial teams recognize or create opportunities, how they collect and process information, knowledge and other resources, how they arrive at valuations, and how they decide to act and succeed are issues not addressed by existing KIE theories. Therefore, it seems to be a gap in the understanding of the *entrepreneurial approach* of the LT- KIE phenomenon regarding the mechanisms by which new founders and founding teams will accumulate the bundle of resources, knowledge, skills and other inputs which have been quite expensively investigated in KIE literature.

The purpose then of the thesis is to contribute to the comprehensive understanding of KIE as a mechanism for the transfer of multifaceted knowledge into *innovative economic entrepreneurial activities in low-tech sectors* and to shed light on its unclear inter-relationships with determining venture-related factors. In its general view LT-KIE follows the KIE definition and therefore regards new knowledge and innovation-based venturing. Therefore, innovation, knowledge, venture creation with resources and capabilities, as well as entrepreneurial factors regarding the entrepreneur, the firm and the environment as derived from relevant literature, will be the initial building blocks for the preliminary attempt to explore further low-tech knowledge-intensive entrepreneurship.

Innovation

In the low-tech context, KIE is a mechanism of implementing an innovation which goes beyond the existing knowledge and it is new and significant to the sector or the

product field. Accordingly, **innovation** constitutes a crucial building block of LT-KIE. As indicated by the literature review during the last ten years, researchers have dealt with LT innovations and innovation activities and have found out that they are not necessarily the result of systematic research and development (Pavitt et al., 1987; Henderson and Clark, 1990; Napolitano, 1991; Walsh, 1996; Woolgar 1998; Neely and Hii, 1998; Rametsteiner 2000; Palmberg, 2001; Robertson, et al., 2003; Bender, 2004; Caloghirou et al., 2004; Laestadius, et al.,2005; Chesbrough and Crowther, 2006; Robertson and Patel, 2007; Leheyda et al., 2008; Hirsch-Kreinsen, 2008; Böheim 2008; Segarra-Blasco and Josep-Maria, 2008; Lichtenthaler, 2009). Research has been advanced with the engagement of the knowledge factor; alternative sources of knowledge and distributed knowledge bases have been intertwined with the spatial dimension of innovation (Granstrand et al., 1992; Lundvall and Johnson, 1994; Liebeskind, 1996; Nonaka and Konno, 1998; Veugelers and Cassiman, 1999; Howells, 2002; Smith, 2000, 2002, 2003; Hirsch-Kreinsen et al., 2003 and 2005; Bender, 2004; Robertson and Smith, 2008; Malerba, 2008 and 2005; Burger – Helmchen, 2008; Grimpe and Sofka, 2009; Chen 2009; Tsai and Wang, 2009, Stam, 2009). According to findings as narrated in the theoretical part of the thesis (e.g. Gupta and McDaniel, 2002; Hirsch-Kreinsen, 2008), low-tech firms seek mainly new technical and practical knowledge linking external knowledge with the firm-specific knowledge base (Bender and Laestadius 2005; Medanoça 2009; Robertson and Smith 2008) relying on training and highly qualified personnel skills.

Accordingly, LT firms have been found to engage mainly in frequent changes or improvements of process technologies and new product development (Hirsch-Kreinsen 2008a, Robertson and Smith 2008, Robertson et al. 2009). While a very small percentage of individual low-tech firms develop R&D activities, the majority apply mainly open innovation (Hirsh-Kreinsen and Jacobson, 2008; Likar et al., 2008). Process, organizational and marketing innovations are more common (Heidenreich, 2009), while product innovations are in their majority incremental (Bender, 2004). It is also argued that cumulative incremental innovations are quite significant since they can expand, extend and leverage technological trajectories and can cause major economic impact (Dosi, 1982). A significant feature of low-tech innovation is the engagement of many stakeholders all along the value chain in open innovation. Suppliers have been found to be of utmost relevance, since low-tech firms rely heavily on raw material, machine and equipment technological advances (Bender,

2004; Heidenreich, 2009). In this context LT firms are widely termed as "supplier-dominated firms" referring to Pavitt's taxonomy of sectoral innovation modes (Heidenreich, 2009; Robertson et al., 2003). However, they can also be key users of high-tech ideas (Santamaria et al., 2009) contributing significantly to the development of technologies and knowledge diversification directed to new technological fields (Mendonca, 2009).

However, even in the cases of LT-KIE, the relationship that exists between KIE and innovation is still straightforward; KI-LT entrepreneurs should transform new, knowledge-based ideas into economic activity. In order to succeed, the resulting knowledge-based innovation should go beyond the existing sectoral or product field-specific knowledge base by creating new knowledge, new ways of problem solving or new processes, products as well as new markets not applied or unknown in the industry before (Hirsch-Kreisen and Schwinge, 2011). In other words such innovations should be novel to the whole sector and thus creating the potential for the new venture to create new opportunities or otherwise develop a competitive advantage in order to enter the broader mature market in direct or indirect ways (e.g. get a share or by creating a niche market). Therefore, the producing innovation is strongly related to the novel business idea the entrepreneurs / entrepreneurial teams will develop in order to establish the new business. Sticking always to the fact that innovation is not born inside research or academic labs as in the cases of high-tech innovation, the following question then emerges:

How do LT-KI entrepreneurs/teams create innovative knowledge-intensive business concepts?

Knowledge

Knowledge intensiveness in LT sectors was heavily questioned though kinds of knowledge and ways of combining existing codified knowledge with practical knowledge in a competitive way (Napolitano, 1991, Pavitt, 1984, Chesbrough, 2006 in Lichtenthaler, 2009, Robertson and Patel, 2007, Hirsch-Kreinsen et al. 2005), Böheim 2008, PILOT project (2003-2008)) and a clear orientation to innovation (Heidenreich 2009, Fagerberg, 2005).

A major aspect regarded the importance of **trans-sectoral knowledge bases** (Bender and Laestadius, 2005; Hirsch-Kreinsen, 2008) and the broader need to transcend sectoral limits in cases of LT-KIE. Based on Robertson and Smith's (2008) emphasis

on the particular significance of the "distributed knowledge bases", we expect that firms and individual entrepreneurs alone will not be able to be the drivers of KIE processes; instead they have to connect with actors, resources and opportunities from well outside the sector. Thus, accumulated knowledge can support a new way of combining trans-sectoral inputs or resources based on exploitative learning processes. Therefore, it seems that there are major differences between high-tech and low-tech KIE; the origins of high-tech innovation rely often if not always in out-of the lab, R&D-based technology followed by patents and other types of appropriability measures (Adams, Fontana and Malerba, 2012) and based on sound scientific and technological knowledge. This does not seem to be the case regarding low-tech KIE where innovation activities are primarily based on "practical and pragmatic ways by doing and using" (von Tunzelmann and Acha, 2005). Yet, it is not easy to draw clear distinguishing lines between scientific knowledge and practical knowledge. While practical knowledge can be found in the context of operating processes, LT firms use and apply theoretical knowledge such as engineering knowledge or even R&D knowledge elsewhere produced. On the other hand, process innovations even if of incremental type entail a complex bundle of different pieces of knowledge which is not entirely practical and are mainly intramural, i.e. developed by the staff of the firm.

However, the science-based or technological knowledge within KIE does not have to be created by the entrepreneur or the diversifying low-tech firm. External sources of knowledge seem to be essential for low-tech innovation (Arora and Gambardella, 1990; Bessant and Rush, 1995; Cockburn and Henderson, 1998; Fey and Birkinshaw, 2005; Santamaria et al., 2009). A growing number of researchers suggest that different forms of collaboration enable firms to engage in innovation (e.g. Chesbrough, 2003a; Dahlandera and Gann, 2010; Lichtenthaler and Ernst, 2009). However, innovation occurs through new combinations of resources, ideas, and technologies imposing a need for constant inflows of knowledge (Fey and Birkinshaw, 2005) beyond firm- and sector-level boundaries (Chesbrough and Crowther, 2006). Accordingly, the third edition of the Oslo Manual (OECD 2005) has an expanded coverage of knowledge flows and the role of linkages in the innovation process. In its latest edition it thoroughly addresses innovation in less R&D-intensive, so-called low-tech industries implying the notion of open innovation. According to Robertson and Smith (2008) production relevant knowledge is distributed across firm-

specific, sectoral or product-field specific and widely applicable knowledge-bases, whereas scientific-based knowledge is applied at every level. Collaborations can be with any type or organization such as universities or research institutes (Griliches, 1995; Caloghirou *et al.*, 2000), suppliers and customers (von Hippel, 1988; Dyer, 1991; Brown and Eisenhardt, 1995; Joshi and Sharma, 2004; Cousins *et al*., 2011), or any type of networks, alliances or joint ventures with other firms holding relevant knowledge (Chiesa and Manzini, 1998; Hagedoorn, 1993). A key aspect regards the correct balance between the development of internal knowledge (e.g. intramural R&D) and the adaptation of the acquired external knowledge.

Venturing

LT-KIE regards **ventures** which are responses to innovative opportunities, emerging from knowledge in the form of new technology, new markets or even new ways of internal or external resources' exploitation. Since KIE has been considered as a significant mechanism through which new entries in the markets (in the form of new firms or diversification of existing firms) bring new ideas, products, services and processes (e.g. Radoceviz et al., 2010; Chaminade and Edquist, 2006), researchers have explored a significant range of factors; these factors can be broadly divided into those referring to the entrepreneur, to the firm, and to the environment within which firms and entrepreneurs operate. They are significant since they shape the process of KIE in terms of enabling or constraining entrepreneurial opportunities to implement an innovation. For example, Radosevic's (2010) systemic approach of entrepreneurial opportunities offers such a list of environmental factors (scientific/technological, sectoral, demand, social cultural, institutional). In this systemic perspective entrepreneurial opportunity is constituted by technological, market and institutional opportunity that are understood as complements and are matched by the entrepreneurs.

The transition from venture creation to an early survival and continuation of the new firm has been also extensively explored and attributed to individual characteristics of the founders, the resources, the process and the environmental conditions (e.g. Gartner, 1985; Mugler, 1998; Ardichvili & Gasparishvili, 2003; Beugelsdijk and Noorderhaven, 2005; Davidsson, 2006; Johnson et al.,2006; Kessler et al., 2012). Founders, firm, and contextual characteristics of new business ventures have been also explored regarding KI cases of high-tech industries or in general (e.g. Breschi,

Malerba and Mancusi; Buenstorf (both in Malerba, 2010); Caloghirou et al., 2012; Camerani et al., 2012).

Malerba and McKelvey's (2010) "KIE model" provided a novel conceptual framework, since active choices were made about the conceptualization of specific processes, key notions, parameters and characteristics of KIE. The phenomenon has been defined in terms of individual firm content of its human capital, irrespective of the sector. Human capital can be measured in terms of the education of the entrepreneur, the skills of the labor force, and so on. Accordingly, specific pre-firm assets (finance, resources and entrepreneurial perceptions) are translated into venture performance and growth through internal management, organization and networking. However, the source, quality and type of inputs and resources which could influence the success of LT- KIE as much as the internal management processes of the next phase are unexplored. For example, while classical theory on entrepreneurship has employed various classifications of resources and capabilities especially after the engagement of the resource based view (e.g. Amit and Schoemaker, 1993) in order to explain venture creation[56], this remained too vague in LT-KIE cases.

Actually, the task of attracting resources for a new venture has been assigned among the greatest challenges that new entrepreneurs face[57] (Brush, Greene, & Hart, 2001; Romanelli 1989; Stuart and Sorenson 2003; Ravasi and Turati 2005), since limited resources jeopardize survival (Arthurs & Busenitz, 2006). Taking into consideration the fact that knowledge is a core resource of LT-KIE there are certain questions that remain unanswered. For example, an academic spin-off has access to specific knowledge; on the contrary it is highly questionable **how LT-entrepreneurs will locate the new sources of knowledge, how they will manage access to these sources, how they will use it in order to produce innovation and how they are going to transform the result into production lines, products and market success.**

An interesting approach seems to be the Hirsch-Kreinsen and Schwinge model (2012) for low-tech industries which refers to the need of certain firm-level or individual-level capabilities in order to produce innovation. Even since the beginning of their research on LT-KIE, the authors regarded the activities at the level of individual firms or entrepreneurs to be an *indispensable prerequisite* for KIE in LT sectors, as the mediator of renewal of a whole system by making use of external opportunities.

[56] Please refer to the literature Chapter
[57] Please refer to to the literature Chapter

Attempting a cross-reference to conceptual considerations on the innovativeness of LT companies (cf. Bender and Laestadius, 2005), the authors stressed that this could be a matter of specific capabilities, a term provided by the well-known "resource based" approaches. The core message of this approach is that LT-KIE processes may be analyzed in terms of capabilities for *orchestrating and mobilizing knowledge and other resources at the disposal of actors and firms* (cf. Teece and Pisano, 1994). These capabilities are strongly interlinked with the knowledge bases; existing knowledge is the requirement for these capabilities development through the identification and effective integration of novel knowledge, while these capabilities lead to the specific knowledge expansion which constitutes the main feature of LT-KIE. Accordingly, major LT-KIE capabilities for Hirsch-Kreinsen and Schwinge are the *capabilities to question existing knowledge and to identify and acquire (new) relevant knowledge from other knowledge bases*.

However, this capability aspect approached mainly the innovation-side and not the entrepreneurial side of LT-KIE. The authors referred to it as "innovative capability" incorporating the "transformative capability" and "configurational capability" of Bender and Laestadius (2005), Bender's (2004) synthesizing competence, or the somewhat older "combinative capability" introduced by Kogut and Zander (1992) and the architectural competence described by Rebecca Henderson and Kim Clark (1990).

In spite the above ones, there are hardly any other efforts made to identify firm-specific capabilities (and their dimensions) that can be sources of competitive advantage, or explain how combinations of competences and resources can be developed, deployed, and protected in order to start a viable new LT-KI venture. Although the notion that the nature of firms' pre-entry capabilities determines the direction of expansion as firms survive and grow is not new (Nelson and Winter, 1982, Grant, 1991; Penrose, 1995), KIE models so far have focused more on the mechanisms of knowledge and innovation regarding capabilities; they seem to have neglected the entrepreneurial side of the issue. Several writers have lately offered insights on the important links between knowledge creation and its commercialization particularly at the early stages of a new venture. The capabilities perspective seems to be missing while the quotation of Zahra et *al.* (2006) is still popular; "…research has not provided a compelling explanation for the ability of some new and established companies to create, define, discover and exploit entrepreneurial opportunities".

Another issue of concern not well captured in KIE literature, according to our knowledge, regards the role and significance of the **initial competitive advantage** (CA) a new venture builds in order to survive and prosper. For Hirsch-Kreinsen and Schwinge (2012) the outcome of the KIE process is defined in terms of *technological innovations* as the direct result of this process and the *impact* of KIE innovations. In entrepreneurship literature the term of initial competitive advantage has been so far subject of discussions on the significance of resources and the importance of the founding team (e.g. Autio et al., 2009; Davidsson *et al.*, 2003; Lazonick, 1990; Prasad et al., 2013; Sánchez and Menguzzato 2006; Vanhoutte et al., 2010). Russell (1989) claimed that creativity and innovative spirit give the new-born entrepreneurial organization its initial competitive advantage. Yet, while there are well developed theories on how to create and sustain the competitive advantage of established organizations, there are almost no explanations of **how new ventures establish their initial competitive advantage especially in cases of low-tech venturing**[58].

Furthermore, new firms, once established, often face resource base weaknesses (Singh et al., 1986) and are confronted with subsequent performance loss if these weaknesses are not dealt with. The nascent entrepreneurship literature indicates that it is necessary for entrepreneurs to create and adapt the resource base of the new firm (e.g. Garnsey, 1998; West and DeCastro, 2001). Yet, this issue is so far both theoretically and empirically unexplored within the LT-KIE literature. However, a study of Protogerou and Karagouni (2012) indicated that the evolution of new knowledge-intensive ventures may be related to the creation and development of dynamic capabilities. In the same vein, Zahra, Sapienza, and Davidsson (2006) consider that "new ventures need unique and dynamic capabilities that allow them to survive, achieve legitimacy, and reap the benefit of their innovation". In addition, there is a limited but gradually increasing research on DCs regarding newly-founded firms with a number of empirical studies mainly of high-tech sectors, which indicate that new ventures need dynamic capabilities to reconfigure or modify their initial and rather poor resource bases in order to survive and grow (e.g. Arthurs & Busenitz, 2006; Zahra & Filatotchev, 2004; Grande, 2011). For example, Stam et *al.* (2007) found certain dynamic capabilities as most likely to accompany high-tech start-ups' growth. The

[58] Considering the fact that patented technologies and R&D results can be strong initial competitive advantages in cases of high-tech ventures. For example, a unique innovation is the motivation for the start-up of a life science firm (Audretsch, 2001), and innovation sets the strategic path of life science firms (in Carrick, 2012)

relative empirical studies regarding low-tech sectors are extremely few. For example, Telussa et al. (2006) analyzed the new firm growth in association to dynamic capabilities using a sample of mostly low and medium-tech firms. In spite the above assumptions the issue is still far from clear: **how can then just established low-tech ventures overcome resource base weaknesses and evolve?**

A perspective of particular importance in LT-KIE regards the assumption that the phenomenon includes not only newly founded companies as denoted by Malerba and McKelvey (2010) for high-tech sectors, but cases of change processes in established companies as well. This is due to a series of reasons and more precisely due to

a) the competitive pressure; existing low-tech firms are almost forced to change their competitive situation by adopting an increasingly reflective approach towards established practices and by looking for significant innovations (Hirsch-Kreinsen and Schwinge, 2011).
b) the declining course of the most traditional sectors and the global competitive pressures; it is quite difficult and rather risky for young entrepreneurs to start new low-tech companies (see for example the textiles and clothing industry)
c) the strong path dependency and the technologically established situation of low-tech sectors; it is quite difficult to come up with novel business ideas capable to allow new low-tech ventures enter existing mature and saturated markets and be viable

Therefore LT-KIE is expected to be found more within established organizations but it is quite ambiguous if KIE will mean the same in both modes and whether they will share the same characteristics. For example, how important will the role of the existing knowledge pool of the parent company be? Will its organized routines play a positive or negative role in corporate venturing? How will the agents seek novel knowledge? What will be the role of existing resources and capabilities? For example, while existing financial and human capital can solve relative problems, on the other hand technological or institutional path dependencies may create serious problems and core rigidities. This is an issue not yet addressed in detail in LT-KIE research. Therefore, *differences are expected to be found in most if not all the above LT-KIE building blocks regarding the emergence of knowledge-based innovation, the*

entrepreneurial process, the factors, constraints and opportunities as well as the evolution paths and performances.

3.3. Summary

There is a gap in the understanding of how LT-KI ventures are created, survive and grow within their mature and highly saturated business ecosystems. Literature has offered a significant amount of insights related to the basic building blocks of LT-KIE, i.e. knowledge, its sources and ways of exploitation, knowledge-intensive innovation, mechanisms and capabilities of achieving it, as well as types of LT-KIE ventures, among other issues. Furthermore, there is a plethora of skills, entrepreneurial characteristics and other antecedents and factors used as input, KIE management and output in KIE processes. These valuable constructs can assist the further exploration of the phenomenon called LT-KIE in order to understand how LT-KI entrepreneurs/ entrepreneurial teams recognize or create opportunities and transform them into successful knowledge-intensive business capable to survive the stagnancy of traditional mature markets. By posing the questions which are presented summarized in the Table 3.1 below, we purport mainly an *entrepreneurial approach* of the LT- KIE phenomenon.

Table 3.1: Research questions

Main research question:
How and *why* certain low-tech but knowledge-intensive ventures survive early death and prosper within mature ecosystems?
Guiding Research Questions:
a) How do LT-KI entrepreneurs/teams create innovative knowledge-intensive business concepts?
b) How do LT-KI entrepreneurs / entrepreneurial teams locate the new sources of knowledge, manage access to these sources and use knowledge in order to produce innovation and how do they transform the innovative result into production lines, products and market success?
c) How can new LT-KI ventures overcome resource base weaknesses and evolve?

Chapter 4

Research philosophy and methods

Chapter Objectives

- To identify the appropriate research paradigm for the research.
- To justify the research philosophy and methods used
- To discuss the reliability and validity techniques used

4.1. Introduction

Theory thus become instruments, not answers to enigmas, in which we can rest. We don't lie back upon them, we move forward, and, on occasion, make nature over again by their aid. (William James, 1907: 46)

Chapter two introduced the literature related to the main concepts of this study and chapter three presented the research questions and the proposed conceptual framework based on the extended review. This chapter introduces the philosophy and methods used to explore these questions.

The thesis aims to generate insights on how and *why* certain low-tech but knowledge-intensive ventures survive early death and prosper within mature ecosystems. Back in 2009,

Firstly, KIE was a rather unexplored phenomenon,

Secondly, low-tech sectors had hardly been approached, mainly by the innovation researchers.

Last but not least, the role of production technologies in the creation of a low-tech venture had never been approached by the entrepreneurship-researchers besides the significant evidence for their importance by the low-tech innovation scholars and their non-eligible role as a major dimension of the technological capabilities within the DC view. Actually, dynamic capabilities thrived in the high-tech arena but researchers were quite hesitant to question their existence in low technology, mature industries.

Therefore, in spite the fact that a thorough look into the literature (as evident from the literature review) found many constructs and measures with which to properly conduct an empirical, positivist study on entrepreneurial venturing in general, the area of low-tech but knowledge intensive venturing remains a highly unexplored issue; to our knowledge, its research cannot be satisfied by existing theories since LT-KIE constitutes a special type of entrepreneurship with quite different inputs, management directions and outputs as contemporary research reveals especially if focused on the rather neglected low-tech sectors. The present research had to start using the existing constructs regarding the entrepreneurship, innovation and knowledge management fields under the lens of the emerging KIE theory which, being developed in parallel with the present thesis, entailed hardly any well-defined constructs and measures.

It is important to note that **capabilities were not the initial target of the present research.** Aiming at exploring mechanisms and processes of KIE in low-tech industries, there *were almost no questions directly* on capabilities in general. However, the in-depth interviews during the engaged case study research and the subsequent reviews of transcripts revealed a wealth of data on patterns which appeared to strongly influence venture creation, while some of them related to certain capabilities attitudes. Furthermore, interviewees talking about the firms' life-course revealed a variety of processes and routines which could be assigned as dynamic capabilities. While these data were ancillary to the primary research question they proved central to the focus on capability development in KI-LT ventures.

It should also be mentioned that **there was no framework provided to the interviewees** with which to evaluate and interpret their answers. Therefore, due to these two reasons, the possibility of retrospective bias by informants was evidently minimized. On the other hand, the repetitive nature of certain data revealed similar patterns with different however tendencies regarding individual ventures and groups (e.g. different industries) providing a fruitful area for theory-building. Through multiple iterations between the developing theoretical framework and the data, a large number of themes and apparent patterns were first generated.

Therefore, it appeared that the researcher should consider different frames for her research, since she could not base research on previously held ideas about the issue. Been aware of the subjectivity of the issue, **a constructivist approach** was adapted since it appeared that emerging theory would be "a process of actively interpreting and constructing individual knowledge representations" (Jonassen, 1991, p. 5). It turned out indeed that Soobrayan (2003) was actually right: I had to be "constantly and consistently called upon to consciously and deliberately engage with the ethical, truth and political implications of [my]research and writing" (p.107).

Reliability and validity in qualitative work is a major issue and refers to the trustworthiness of the research (Lincoln and Guba, 1985). From the onset the author of the present thesis tried to establish dependability from proper design, appropriately selected cases and reliable data collected from multiple sources. The interview protocol used was based on the AEGIS guidelines for case studies and served as a guide for the present researcher to contact semi-structured interviews.

Another challenge of qualitative research is the proper application of the research findings. The Miles and Huberman's (1994) data reduction and packing methods was used mainly as a guide to reveal the most significant emergent issues related to the research topics. Data was collected, compared across the thirty cases and funneled into concrete themes through multiple data reduction steps.

This chapter intends to introduce the reader to the methods used for the present research. However, it is important to note that while research method steps are usually presented in a linear mode, it is actually an iterative process (Edmondson and McManus, 2007). In accordance with Kathleen Eisenhardt's (1989) "process of building theory from case study research" mainly as a guide, the steps of the research process were the following:

1. A broad definition of the research area and research question
2. Initial literature review to understand the LT-KIE phenomenon
3. Discussions with experts and an extensive study of the low-tech sectors in Greece for cases selection
4. Study design (instruments, methods and protocols)
   b) Collection of data with a) Interviews and data and notes' analyses (within case and cross-case ones in search of patterns for constructs and relationships observed)
6. Development of an (initial) theory and a relevant conceptual framework
7. Hypotheses shaping: iterative tabulations and search for evidence (further within case and cross-case analyses, expanded review of literature regarding emergent concepts due to the new findings
8. Theory evaluation against existing theories
9. Theory modification and refinement

The steps have been applied in a dynamic manner with continuous iterations backwards and forwards between the steps 5b to 9, redefining concepts and patterns gathering additional data from multiple sources and re-arranging orders. Each of the steps taken in this research is further discussed below.

4.2. Research philosophy

The question on how to conduct research has been long a significant issue of epistemological debate among philosophers of science and methodologists. Research

philosophy regards the development of new knowledge (Saunders, Lewis & Thornhill, 2007). Consequently, methodologies rest on the nature of knowledge (Corbin and Strauss, 2008). It appears that the researcher's frame of reference, or the set of beliefs and assumptions, which actually define paradigms, shape the nature of the world; the philosophical approach influences the choices of research strategies, methods and techniques.

In this vain, three major ways of thinking about research philophosy: ontology, epistemology and axiology influence the way in which of the research process.

Ontology revolves around discovering whether the phenomenon under investigation "really exists independently of our knowledge and perception, or exists as a result of it" (Symon and Cassell, 2012). Ontology led to the two main schools of thought and namely the "realist" and the "social constructivist" (sometimes called objectivist and subjectivist). The "objectivists" support the view that the world and social entities exist in a reality that is external to the social actors. "Subjectivism" opposes by considering the social phenomena or realities as creations of the social actors' perspective, who ficus on the actual existence of the phenomena and the actual actions (Lewis *et al.*, 2007). Against the positivistic static world, the constructivistic reality is multiple and socially constructed.

Epistemology reflects the researcher's assumptions about the appropriate ways of delving into the nature of the world (Easterby-Smith *et al*., 2012).

There are actually two competing schools of thoughts: logical positivism that views the phenomenon as valid knowledge when it can be measured and observed (Collis and Hussey, 2003) and uses quantitative and experimental methods to test hypothetical-deductive generalization and generally reduces the whole into simplest possible elements in order to facilitate analysis (e.g. Easterby-Smith et al, 1991). The qualitative methods rest on a post-positivistic, phenomenological worldview and characterize the second school which adapts an interpretative approach: constructivism. The constructivist (used in this thesis interchangeably with constructionist) view enhances the value of discovering the subjective meanings of certain actions in order to explain and comprehend the phenomenon these actions follow in. The different ways of looking at research philosophies include various research paradigms such as the four paradigms of Saunders et al. (2007) for management and business research; radical change, objectivism, regulation and

subjectivism. In another approach, Saunders et al.'s (2009) and Guba and Lincoln (1994) regard philosophies (positivism, realism, interpretism, and pragmatism) from an ontological and epistemological point of view. Furthermore, Guba and Lincolon (1994) related four paradigms and namely positivism, post-positivism, critical theory and constructivism to qualitative research.

Axiology regards judgements about value in the context of the research. Researchers study their objectives taking distances and not getting involved according to the positivist view; they are only concerned with the interrelationships of the studied phenomenon and the process of their research. Constructionists, on the other hand, believe that researchers are actually a part of their study since their research is of considerable value (Easterby-Smith *et al*., 2012).

The present research seeks to gain a holistic understanding of the LT-KIE phenomenon; however, knowledge-intensive entrepreneurial actions are, after all, a human construct and the success or failure of implementing KIE is dependent upon the perspective of the individuals or teams affected. That means that the entrepreneurial perceptions, conceptualization and actions are expected to be complex and to play a core role in the creation of the phenomenon indicating a subjective reality. Furthermore, **LT-KIE is viewed as a complex, dynamic phenomenon, situated phenomenon in historical / socio-economical and cultural context.** On an epistemological and ontological level, reality as applied in the LT-KIE phenomenon is emerging in nature and cannot be regarded as true or not in an absolute sense (Guba and Lincoln, 1989) as the positivists believe, but it is rather subjective. On the axiological level, LT-KIE phenomenon cannot be separated from the entrepreneurs themselves or other stakeholders who perceive that reality.

Following this rationale and adopting the basic axiom of Berger and Luckman (1966) that "society, its structures and its institutions are built out of individual meanings, perceptions and cognitions", the author suggested **the *interpretivist* / *social constructivism* / *interactionism* research philosophy approach** (Mertens, 1998, Denzin, 2001, Aram and Salipante Jr., 2003) which fits perfectly with the nature of the phenomenon under investigation.

This approach supports further the effort to shed light to both "*how*" and "*why*" questions, as well as the conceptualization and the operationalization of the observed

constructions and patterns. Actually, it appeared from the very beginning, that there were multiple realities to be understood in order to find out their impact on the overall success or failure of LT-KIE efforts. Their identification and in-depth understanding would reveal the 'underlying patterns and order of the social world' (Morgan, 1980: 609) with regard to this phenomenon.

Due to the exploratory and descriptive nature of this research (Robson, 2002), data collection, organization and analysis was guided by an inductive perspective; the researcher uses qualitative methods in the form of case studies to create an in-depth, rich account (Yin, 2003, Rubin and Rubin, 1995) of how LT-KIE is implemented.

This is in line with the research philosophy chosen; especially the constructivist paradigm traditionally follows qualitative research methods (Mojtahed et al., 2014).

Summarizing, the philosophical position of the current research rests is subjectivistic (the ontological position) constructivistic (epistemological position) and regarding axiology, it stands on the belief that research is value-laden requiring the researcher's involvement and commitment.

4.3 Steps 1-3

The main research question emerged mainly from a relevant work package of the AEGIS project which would deal with the evolution and the characteristics of knowledge-intensive entrepreneurship in low-tech manufacturing sectors. It would be primarily based on firm case studies and would investigate the determining factors of LT-KIE, the relevance of interrelationships between low-tech and high-tech activities and the impact of KIE on the growth and competiveness of European traditional sectors. Additionally, the personal interest of the researcher on the role of production technologies in low-tech sectors broadened the research towards this direction. However, it is again reminded that the engagement of the capabilities' view was not an initial target of the research.

An **initial literature review** was contacted in order to understand the LT-KIE phenomenon. It started with the field of entrepreneurship and more precisely from its origins up to the emerging phenomenon of KIE. Since innovation constitutes an integral notion of KIE, the innovation literature was further explored as well as the production technologies field. It should be mentioned that this required the search in a

significantly wide range of disciplines and sources. This review included further existing literature on low-tech sectors in general as well as work focused on innovation and production technologies.

In parallel, **the identification of the low-tech sectors** that would be examined required an extensive study of them within the Greek business ecosystem. This was achieved by several discussions with sectoral experts and a review of national and EU reports regarding descriptions, courses and specificities of the traditional sectors in Greece. This effort led to the choice of

- the wood and furniture industry,
- the food and beverage industry and
- the textiles and clothing industry as the most representative ones.

All three industries are clearly mature, traditional, low-tech ones and occupy a prominent position in the European and Greek manufacturing sector since they have a significant contribution to growth and employment at national and EU level. They have also undergone important changes and significant restructuring almost since mid-nineties. However, as it is described in detail in the relevant chapter, each sector has followed a different evolutionary path with important implications to their response in recent changing environmental conditions.

4.4. Steps 4-6

“ if you know which facts you 're fishing for
you're no longer fishing. You've caught them...."
Robert Pirsig, “Zen and the Art of Motorcycle Maintenance” (1974)

The constructivist paradigm traditionally follows qualitative research methods, while quantitative methods may support qualitative data (Mackenzie & Knipe 2006). In order to explore and explain the LT-KIE phenomenon exhaustively in all details, rather than search for external causes (Easterby-Smith et al, 1991), qualitative researchers collect data by doing case studies and fieldwork. The thesis follows the inductive research constuctivism philosophy, which means that the researcher uses specific findings to generalize.

The vast majority of inductive research remains interview-based. Case studies allow for the examination of a ‘‘contemporary phenomenon within its real life context’’ (Yin, 1994, p. 13). Stake (1994: 243) highlighted the fact that this research philosophy

and method allows for the deliberate choice of the case studies; this enables the maximization of the opportunities for learning through cross-case comparison. Yin (1994) also stresses the significance of multiple case study analysis against a single case since it offers increased robustness of results, strengthening the credibility of the research and enhancing the generalizability of the theory developed.

In sum, scholars committed to theory development through multiple case studies (e.g. Eisenhardt 1989; Siggelkow 2007) agree that case studies, when properly designed, are helpful for theory-building purposes. Furthermore, although there are no defined rules or protocols for case study research, according to scholars (e.g. Eisenhardt, 1989a; Yin, 2008), the research's objectives should direct the protocols. Case studies should incorporate different data and method techniques over specified time periods in order to allow research unfold over multiple stages providing rich insights. Case studies can be:

- exploratory looking at what is happening around the phenomenon of interest
- descriptive categorizing events and describing the phenomenon
- explanatory seeking to establish and explain causal relationships or
- a combination of all three types

In accordance, a **multiple exploratory case study** research design was selected (Yin, 2003) for the present thesis. As already mentioned above, KIE theory was still in its embryonic stage, low-tech sectors almost unexplored and production technologies were hardly ever connected to entrepreneurial settings[59]. Therefore, this research model was selected as the most appropriate tool for theory building around the core question of:

How and *why* certain low-tech but knowledge-intensive ventures survive early death and prosper within mature ecosystems?

Yin (1993) advices researchers to begin with exemplary cases, i.e. strong examples of the issue being researches, and complete research with some different ones. Furthermore, Perry (1998) suggested that replication and validity is enhanced by purposeful sampling where results can be compared. Following these recommendations the individual low-tech company was selected as the unit of

[59] Besides of the extensive initial literature review contacted in 2009, the start of the AEGIS project in 2009 can confirms the author's claims on the newness of the issues mentioned.

analysis; case study firms were chosen on the basis of particular characteristics and more precisely on the condition that they should evidently be KIE and low-tech.. Interviews with industry experts of the three selected sectors and scientists from relevant academic fields indicated suitable cases and provided an excellent overview of the topics researched, and a useful complement to the interviews.

It should be mentioned that cases should capture the KIE phenomenon as widely as possible and this created the contradictory need for diversity and variety together with a focus on new knowledge-intensive venturing. Moreover, the choice of an accurate sample to represent the population is especially challenging in qualitative work, where sample sizes are usually small (Yin, 2008). Eisenhardt (1989) suggests the use of four to ten cases because this number allows for in-depth analyses within a reasonable amount of time. A non-exhaustive search in PhD theses that used case studies as their research method confirmed the use of one to twelve cases. However, since there are three industries engaged and in accordance with the highest number proposed by Eisenhardt (1989) applied per sector, **thirty firms** were eventually selected for the research.

Case selection was based on the **following criteria**:

- Cases should be evidently knowledge-intensive ventures following the –by then - somewhat vague criteria of KIE[60] . Evidence of KIE regarded innovativeness and use of knowledge; the cases should be assigned to the most innovative companies in the market or product field through knowledge-seeking activities.
- Knowledge-Intensive venture creation should be within the decade 1998–2007 in order the cases to have survived early death[61] and on the condition that ventures established in 2007 would be closely observed *at least* until 2012. According to Petit (2009), the period of the 1990s and the turn of the 2000s "has not been a period of quietness for globalized finance" with large financial crises on the one side and emerging strategies of innovation on the other. Furthermore, this decade was quite crucial for all three sectors as it will be discussed more extensively later in the relevant unit. In general over the last

[60] Malerba and McKelvey (2010) definition of KIE was presented after the selection phase of the present research

[61] Please refer to the relevant discussion on firm survival in Chapter 2, page 165

decade, the composition of manufacturing has shifted towards more sophisticated products. A lively debate (e.g. Amiti and Freund 2008; Pula and Santabarbara 2011; Schott 2008 in Giovanetti et al., 2013) arose with some scholars to attribute changes in low-tech sectors to liberalization and the upgrading of Chinese firms' export capabilities or to internal conditions such as domestic policies and regional disparities (Giovannetti et al.,, 2013). Focusing on Italy, Bugamelli et al. (2010) show that it was actually the competition from Chinese exports that played a significant role in all changes observed in Italian firms of traditional sectors.

- Cases should cover both new-to-the-world and corporate venturing

The intention - although not at a critical level as above - was further to:

- cover the majority of the Greek mainland,
- include a range of sub-sectors per industry, in order to cover a wide area of low-tech economic activities
- avoid firms with less than three employees or multinationals and FDIs, and
- when possible –to control for the firm sizes

This quite heterogeneous composition would safeguard the need for the simultaneous homogeneity and diversity of the selected sample in terms of many factors including turnover, value chain position, batch sizes, etc.

The nature and the different courses of the three selected industries played a role in the search of knowledge-intensive new ventures, new-to-the world or corporate. More precisely:

The *food and beverages industry* included a significant number of nascent and established firms which invested in knowledge to produce innovative or highly differentiated products for niche markets. Sectoral reports and discussions with experts led to a quite easy choice of KI F&B firms that suited all above criteria.

On the other side, the *T&C industry* was in 2009 in a severe decline. The declining situation of the sector and the subsequent negative environment for new ventures has been evident even since 1997. Efforts to find really new companies were fruitless; firms which appeared as new were usually older ones that would change names, legal

status or owners[62]. In addition, spinning mills and textile industry in general have high entrance barriers such as substantive initial capitals while they did not promise high profits as well after 2000. Thus, most cases of new venturing turned around corporate venturing in the search of differentiation and excellence or investment on design.
With a tradition of high-level introversion and a low educational level, *W&F industry* presented a rather negative environment for KIE. It should be mentioned that it would be quite difficult to find knowledge-intensive new ventures without the contacts with industry members due to the Department of Wood and Furniture Design and Technology.

The final sample included **thirty case studies**, ten from each industry. The interviews were carried out from November 2009 to September 2011. All the firms were coded to keep their identities anonymous in order to keep them more comfortable in participating in the study. These codes are based on the firms' sectors (Senker & Sharp, 1997); according to them the firms were categorized into three groups: 1) Wood and Furniture Companies (WCo), 2) Food and Beverage Companies (FCo) and 3) Textiles and Clothing Companies (TCo). Previous studies have also used industry subsectors to classify firms for comparative purposes; subsectors provide variation that is a good basis for comparative purposes (Dewick, Green, & Miozzo, 2004; Feldman, 2005; Hendry & Brown, 2006).
According to relevant literature, qualitative case studies' common sources of **case data** include three major categories and namely interviews, documents and observation, covering both objective and subjective sides of studying a phenomenon (Kahn and Cannell, 1957; Seidman, 1991). This principle was followed in the present research mainly with the engagement of the first two categories. The core of the data came from face-to-face, open-ended, semi-structured, in-depth interviews with the key informants. These were the entrepreneurs themselves in their majority, as well as CEOs and technical directors, especially in the larger companies who were actively involved in KIE. The success of interviewing key-informants supported our intent to capture deep insights (Eisenhardt, 1989). The semi-structured questions were of a quite unrestricted nature in order to encourage the interviewees to converse freely (Maykut and Morehouse, 1994).

[62] E.g in the period 2000-2006 there were only 46 companies registered as new. A phone call to a sample of 10 of them proved that they belonged to other cases than been new, as mentioned above

The interviewees were asked about the story of their venture's creation, on the innovative business concept, history and firm's evolutionary behavior up to the present time, biographies, and future expectations. They were obviously comfortable during the discussion since the interviewer put special effort and emphasis in establishing trust. They offered very detailed responses, timelines and histories for their firms. The typical interview lasted 2-3.5 hours (3 hours average), with some lasting much longer followed by supplementary telephone conversations. All interviews were taped and transcribed after each interview.

The researcher conducted a total of **forty formal interviews** (Table 4.1), which referred to around seventy hours in total and produced over 500 pages of transcripts supplemented by a variety of exploratory codings, tabulations and brief written summaries.

Table 4.1: Interviewers and their relation to firms

Firm	Date of interview	Duration (hours)	Position	Role at the venture creation
WCo1 (pilot)	25/11/2009	3.5	CEO	Entrepreneur
WCo2	15/3/2010	4	President/ owner of the group	Entrepreneur
	19/3/2010	3.5	Group CEO	Assisting the president
	7/4/2010	4	CEO of the corporate venture	Assisting the vice president in the plant construction (physical implementation of the idea)
WCo3	31/3/2010	2.5	CEO	One of the three Entrepreneurs
WCo4	6/4/2010	3.5	General manager Technical manager	Entrepreneurs (brothers)
WCo5	8/4/2010	2.5	General manager	The major developer of the innovation
WCo6	23/7/2010	3	CEO	One of the two Entrepreneurs (brothers)
WCo7	15/7/2011	2	CEO	Entrepreneur
WCo8	7/2/2010	3	CEO	Entrepreneur
WCo9	28/12/2010	4	Spin-off CEO and shareholder	One of the core team dedicated to the development and physical implementation of the innovative idea as a spin-off of the group
WCo10	27/12/2010	4	President/owner	Entrepreneur
FCo1	25/2/2010	4	CEO	One of the three entrepreneurs (brothers)
FCo2 (pilot)	20/11/2009	3	CEO	One of the five entrepreneurs
FCo3	11/3/2010	2.5	CEO	One of the two entrepreneurs (brothers)
FCo4	24/7/2010	3.5	CEO	Family of entrepreneurs

FCo5	9/5/2010	4	CEO	One of the two entrepreneurs
	9/5/2010	2	Technical director and member of the board	None (however, he is involved in the subsequent radical innovations)
	5/3/2010	2.5	Consultant	Scientific contributor of the science-based innovation (biotechnology professor)
FCo6	19/8/2010	4.5	CEO	One of the entrepreneurs and main contributors to the corporate venture
	10/2010	(30 minutes)	R&D managing director	One of the main contributors to the corporate venture (Phone conversation)
FCo7	20/8/2010	3	CEO	Entrepreneur
FCo8	7/9/2010	4	CEO-President of the Group	One of the two entrepreneurs (brothers)
FCo9	10/1/2011	3	CEO	One of the two entrepreneurs (brothers)
FCo10	28/12/2010	2.5	CEO	Entrepreneur
TCo1 (pilot)	22/12/2009	3	CEO and Vice President	One of the two entrepreneurs
		1.5	Production Manager	Chemical engineer, main contributor to the innovation
TCo2	17/3/2010	4	CEO	One of the three entrepreneurs (two brothers and the father)
TCo3	30/3/2010	0.5	CEO	One of the three entrepreneurs
		1.5	Technical Director	None – contributor to subsequent novelties
		1.0	Financial Director	Involved in the economics of the new venture
TCo4	16/12/2010	2	CEO/Owner of the group	One of the two entrepreneurs (brothers)
		1.5	General Director	Main contributor of the KI-innovation
TCo5	11/1/2011	2	CEO	Entrepreneur
TCo6	7/6/2010	2.5	CEO	One of the two entrepreneurs (brothers)
TCo7	15/2/2010	2	CEO/Owner of the group	Entrepreneur
		1	Production Manager	Assisting the entrepreneur in the physical implementation of the idea
		0.5	Financial Director	Involved in the novel business model innovation
TCo8	8/3/2011	3	CEO and shareholder	One of the main contributors of the KI corporate venturing
TCo9	20/9/2011	2.5	CEO/President of the Group	One of the entrepreneurs (family)
TCo10	14/11/2011	2.5	Owner	Entrepreneur

- Table 4.1: Interviewers and their relati 2

Following the advice of Kvale and Brinkmann (2008) the information given during the interview was filtered listening for key terms and asking clarifying questions throughout. Additional sources of information were long plant visits, telephone talks, and talks with clients (mainly in the W&F cases), company and public documents, such as administrative documents, reports, news, awards and company websites. In a number of cases there were also informal chats with consultants, sectoral experts and

even friends who had assisted the entrepreneurs in their business idea implementation (e.g. all W&F cases, FCo2, FCo3, FCo10, TCo1, TCo4, TCo7 and TCo9). Collecting data from multiple sources supports triangulation; such data offer potential new insights and can confirm ideas from interviews' data (Yin, 2008).
In most cases, their historical background before and after the venture creation (e.g. new innovations, new spin offs, mergers and acquisitions etc.) has been studied in detail to provide a better understanding of the phenomenon explored. In the same vein, the evolution of the ventures after the day of the interview has been taken into consideration, in order to assess the performance of the selected cases. The occurrence of the severe Greek long-lasting crisis provided a further (unexpected) significant criterion for that purpose.

The cases would take their primary unit of analysis as the LT-KIE new venture creation and growth. In general, though, the process of following LT-KIE included three levels of analysis:

- Individual entrepreneur
- Venturing
- Network between individual/firm and all knowledge–based stakeholders

The researcher used the interview guidelines as provided by the AEGIS project. These were identified in the AEGIS review of literature on innovation management and entrepreneurship and satisfied the needs of the present work, since they were general enough to cover the LT-KIE area of research:

- *Inputs to the knowledge-intensive venture:* Among them, the most important for the present work was the LT-KIE sources while of some significance, but playing an auxiliary role figured the traits and characteristics of the entrepreneurs. The other two factors related to financing and Institutional impacts were not central in the study. However, notes were kept since such information could be of an explanatory nature for the findings.
- *Managing the knowledge-intensive venture/process*: Seven dimensions were provided by the AEGIS project (Table 4.2); these related to how firms and entrepreneurs manage the internal KI-processes which are often related to the

growth of the firm *per se*. They are all considered as important for the present research except the one corresponding to incubators and CVC units; these are highly unlikely to be found in traditional industries.

Table 4.2.: Dimensions of the KI-venture process management

KI venture process management dimensions
Human resources
Network/social capital
Growth patterns
Relationship between knowledge, innovation and entrepreneurship
From R&D to market
Dynamics of the KI venture

Source: AEGIS project

- *Output of the knowledge-intensive venture:* Our review indicated that new firm's initial competitive advantage, survival and performance including survival, growth and innovation are the most usual outputs studied in SMEs. Knowledge creation and patents were not usually among the main topics when low-tech industries were examined.

In the specific research context, the entrepreneurial process was conceived as *"the process, from the venture idea to the newly formed business's strategic success, in terms of the development of knowledge",* according to the broader a knowledge-based approach to entrepreneurship of Ihrig et al. (2006). Furthermore, knowledge-intensive innovation should transcend existing sectoral or product field-specific knowledge bases; i.e. it resulted to the creation of novel products, processes or services, new markets and even new knowledge. Semi-structured questions should actually try to give answers to the initially formed research question of Table 4.3.

Table 4.3: Guiding Research Questions

Guiding Research Questions
e) **How do LT-KI entrepreneurs/teams create innovative knowledge-intensive business concepts?**
f) **How do LT-KI entrepreneurs / entrepreneurial teams locate and access knowledge, and how they use knowledge in order to produce innovation**
g) **How do LT-KI entrepreneurs / entrepreneurial teams transform the idea into production lines, products and market success?**
h) **How can just established low-tech knowledge intensive ventures overcome resource base weaknesses create strong initial competitive advantages and evolve?**

According to the above discussion and the literature review, the semi-structured questions were grouped in the following five categories which represent the key dimensions for the analysis of LT- KIE at the firm level:

a. the presentation of the entrepreneurs' personalities and background and the origins of the business idea
b. the foundation process (actions, assets)
c. the type of knowledge used and innovation produced in the start-up phase combined to the ways of its physical implementation (production technologies)
d. performance and innovation
e. determining factors

In the *a-b* category of questions respondents were asked to a) provide a description of themselves and other critical partners b) provide a history of the firm, c) establish why and how the firm was founded, d) narrate any national or international environmental factors that were important in the formation of the business idea and the foundation of the firm, e) explain their aims and objectives when they formed the business idea, and f) provide an overview of the firm's competitive position in both domestic and international markets. This set of questions was aimed at probing the main drivers of the knowledge-based business idea, the firm's foundation, the impact of the entrepreneurial team's personal characteristics as well as the major assets and significant milestones that influenced the firm's survival.

Categories *c and d* directed respondents to a) describe the emergence of the innovation that led to the creation of a firm (reasons, types, and sources), b) narrate the types of knowledge needed, the kinds of stakeholders involved, ways of contacting and co-operating with them, and c) specify how they implemented their idea in the form of production as well as the organization of the whole value chain. The questions aimed to unearth insights on the influence of knowledge-based innovation and the role of knowledge on the survival of low-tech but knowledge-intensive new ventures.

Category *e* regarded questions on significant factors which affected the process of LT-KIE in terms of enabling or constraining these entrepreneurial opportunities to implement an innovation. It included environmental factors as well as main internal/organizational factors. In this category, interviewees were asked to a) discuss the knowledge they had as well as their experiences from approaching new

knowledge as individuals or as already established firms (depending on the type of KIE), b) provide an overview of the resources they had, the ones they needed and the ones they actually obtained, as well as the ways they manages such processes, c) narrate how they managed the whole process (and here underlined the notion of capabilities in general at personal or corporate level)[63], d) describe they contacts and linkages, and e) discuss the several enabling and constraining environmental factors they encountered and how they did so.

Three **pilot interviews** (one for each sector) permitted the validation of the interview guidelines. Questions were rearranged and the author gained some experience on the areas that needed more focus and dedication. As already mentioned above, thirty case studies were contacted while data were retrieved mainly by the forty interviews as well as the other sources mentioned above. The profiles of the thirty case-firms as well as some core information on the knowledge-intensive venturing are given below in Table 4.4

[63] However, it is important to note at this stage, that none of the questions asked directly about capabilities.

Table 4.4: Case firms profiles

Table 4.4a) General Information

Firm	Foundation year	Year of Corp. venturing	Legal Form	Location	Product Family	Employees at start / the time of the interv.	Educated staff	% sales national /intern. markets	Patents	Trade marks	Awards
Wood and Furniture Sector											
WCo1	2007		Ltd	Larissa	Veneers, veneer stitching	4/ 10	2	90/10	no	yes	no
WCo2	1981	2004	SA	Grevena	Lacquered/printed MDF laminate flooring	126/NA	13	75/25	yes	yes	yes
WCo3	2007		SA	Karditsa	Kitchen, wardrobe	10/ 14	3	100/0	no	yes	no
WCo4	2003		Ltd	Grevena	Panels, flooring, glue – laminated products	8 / 11	4	100/0	yes	yes	no
WCo5	2001		Ltd	Kozani	Light-weight honeycomb furniture	8/ 6	2	100/0	no	no	no
WCo6	1924	2005	SA	Kalamaki Korinthias	Plywood wooden flooring decorative panels	185	13	50/50	no	yes	yes
WCo7	2006		GP	Elateia Larissas	Wood pellets	8 / 5	2	100/0	no	no	no
WCo8	1998/9		SA	Chalkidiki	Kitchen, wardrobe	30/32	5	100/0	no	yes	no
WCo9	1989	2006	SA	Chalkida	Decking fedges	11	6	40/60	no	yes	no
WCo10	1989	1998	SA	Xanthi	Matresses	100/180	45	55/45	no	yes	Yes (20)
Food and Beverage Sector											
FCo1	2003		SA	Larissa	Antipasti olive spreads	58 /40	7	0/100	no	no	yes
FCo2	2002		SA	Larissa	Cucumbers	9 (20 part)	2	100/0	no	yes	no
FCo3	1998		SA	Larissa	Whole egg yolk, albumin	7	4	97/3	no	yes	no
FCo4	2003		GP	Korinthos	Organic, quasi- pharmaceutical chocolate	9/11	2	93/7	no	yes	yes
FCo5	2002	2004	SA	Serres	Biological gluten-free wheat flour, and bio-functional foods	30	7	80/20	yes	yes	yes

FCo6	1995	2000	SA	Agrinio	Parboiled rice, exotic rice, specialties	180	16	80/20	yes	yes	yes
FC7	1960	2002	ICSA	Makrakomi Lamias	Gourmet dairy products	4 / 35 (and 15 part)	4	80/20	yes	yes	yes
FCo8	1960	2000	SA	Larissa	Milk juices yogurts cheese	345	75	80/20	yes	yes	yes
FCo9	2006		ICSA	Kilkis	Crackers, snack cheese-ups	18 /35	12	0/100	yes	yes	yes
FCo10	1995	2001/2005	SA	Agrinio / Athens	Oil olives spreads-dips	50	20	18/82	no	yes	yes
Textiles and Clothing Sector											
TCo1	1995	2000	ICSA	Larissa	Dyeing – finishing	65	10	40/60	no	yes	no
TCo2	1961	1998/2004	Ltd	Oinofyta	Special use and high perf. fabrics, garments and protective systems, for armed forces, police, fire brigade and industry	158	6	70/30	yes	yes	
TCo3	2005		SA	Larissa	Innovative dying treatment	9	2	70/30	no	no	no
TCo4	1988	1999-2003	SA	Kilkis	tricot , single and double jersey plain and jacquard circular knitted fabrics for apparel and technical applications from cotton viscose polyamide spandex and blends	136	16	70/30	Yes (2)	yes	no
TCo5	1978	2006-2007	SA	Thessaloniki	Children's brand clothing	45	15	85/15	no	yes	
TCo6	1974	2000	SA	Naoussa	Cotton yarn, cellulusic fibres blended yarns multi-ply yarns	197	31	30/70	no	yes	yes
TCo7	1992	1998	SA	Larissa	Jeans and T-shirts	218	14	45/55	no	yes	yes
TCo8	1942	2000	SA	Thessaloniki	Underwear sleepwear and lingerie	250	26/20	90/10	no	yes	yes
TCo9	1974	2000	SA	Giannitsa Pellas	Indigo-denim	1200/580	12/25	2/98	Yes (2)	yes	yes
TCo10	2002		Ltd	Athens	High-fashion clothes and shoes	15/ 22	7 (not subject-related)	98/2	no	yes	no

Table 4.4b) Case venturing profiles

Firm	Entrepreneurs		Innovative business idea		Level of Resources' availability				Investment budget	
	Age	Educational level[1]	Description	Level of innovation	Type of capital				Volume (in 000 €)	Subsidy
					Knowledge	Human	Social	Other[3]		
WCo1	42	TEI	Uniformity in veneer surfacing: veneer processing with paper backing and stitching	Pioneer in Greece among the first in Europe	EL	EL	A	EL	800	yes
WCo2	50	TSE	Innovative process in MDF production Decrease in the Consumption of Glue and Wood (glue blender). Saving of 1.600 tons of glue and 4.000 tons of wood per year. The final product is friendlier to environment (less formaldehyde E1 and lesser quantity of wood per MDF cubic meter)	Radical process innovation	A	R	R	R	70.000	yes
WCo3	38-40	TEI	Innovative production model a combination of Italian *distretti industriali* and modular design in order to cover distance disandvantages	Incremental- business model /process	EL	L	A	L	3.600	yes
WCo4	33 & 35	TEI	Biomass from wood and agricultural residues • Utilization of wood residues for solid fuel production • Utilization of wood industry waste for innovative gluelam production	Radical / process & product	EL	L	A	L	2.500	yes
WCo5	37&38	E1-SE E2 - TEI	Use of lightweight paper honeycomb panels in furniture manufacturing	Pioneering in Greece and among the first in Europe	EL	EL	EL	EL	380	yes
WCo6	42	HE	Innovative plywood processing (stitching) for higher quality products	Pioneering in Greece and among the first in Europe	A	R	R	R	2.500	no
WCo7	38	HE	First to produce wood pellets in Greece (exploiting Italian patent)	Pioneering in Greece	EL	EL	EL	EL	1.500	yes
WCo8	26	PhD	Novel box-concept, CIM in kitchen industry in Greece with innovative multi-machinery in whose design and realization participated the Entrepreneur	Radical innovation / process	EL	A	A	A	5.000	yes
WCo9	62 &51	E1-TSE E2-MSc	WPC production line -product's trademark	Pioneer in Europe / product	EL	A	R	A	5.000	no
WCo10	40	HE	Building a totally ecological image around the company extending to R&D on all natural sources for matresses, furniture and linen (absolute ecology all along the value chain) - use of unorthodox methods in marketing and	Business model / globally	L	L	L	L	NA	NA

			R&D							
FCo1	32 to 36	HE & MSc	Stuffed products with cheese from pure Greek agricultural products / Further differentiation with customization of tastes and addition of exotic agricultural products.	Creation of niche market	EL	EL	R	A	3.300	yes
FCo2	31 to 38	HE	Use of hydroponics in cucumber cultivation.	pioneers in Greece / process	EL	EL	EL	EL	1.200	yes
FCo3	32 & 34	HE	pasteurized whole egg, yolk, egg albumin and relative products	pioneers in Greece / process-product	EL	EL	EL	EL	NA	yes
FCo4	49 and son (26)	SE-PSC and MSc	chocolates with natural sweeteners for quasi - pharmaceutical use, organic products -first to propose chocolates in drugstores	Products / Greece	EL	EL	EL	EL	400	yes
FCo5	52	MSc	White wheat gluten free bread which would resemble normal conventional bread	Product / Radical / global	EL	A	R	R	5.000	yes
FCo6	38	HE	Development of innovative parboiled rice patented process, knowhow and innovative technology: continuous cooking.	Process / Radical / global	EL	R	R	R	NA	yes
FCo7	34	HE	Innovative gourmet dairy products	Products / gourmet niche market innovation – process patented	L	L	L	A	500	yes
FCo8	41 & 39	SE	KI revitalizaton of a bankrupt company 2000 and innovative fruit juice production in 2004	Process / European level	L	A	R	L	18.000	yes
FCo9	25 & 27	MSc	Production of gluten free snacks and food products based on cheese	Products / a patented formula and exclusive rights at global level	EL	EL	A	EL	5.000	yes
FCo10	41	MSc	High quality production of a range of authentic Greek Mediterranean products consisting of both innovative value added recipes and traditional ingredients/ in the international markets and Greece.	Business model / global niche market	A	A	R	L	4.500	yes
TCo1	41	MSc	Exploitation of cutting edge technology (some parts of which developed by own ideas) which are the basis of working with innovative high-tech yarns, fabrics and innovative dyeing – finishing and treating elements The newly established plant starts by using of a process for finishing and treating textiles with skin-care oils and emulsifiers, patented a year before.	Process / European level	EL	A	R	A	8.000	yes
TCo2	40	MSc	1998: Introduction of new products with innovative characteristics and a suitable flexible model 2004: introduction of a new product category the	Products radical – incremental)	EL	A	A	R	NA	NA

			bulletproof vests and helmets and initialization of e-commerce and B2C.							
TCo3	48 & 46	SE - HE	Innovative dyeing method based on one and/or total piece dying with ecological processes and by combining the production and usage of biodiesel under green innovation.	Process / pioneering at European level	EL	A	A	L	2.000	yes
TCo4	52	HE	Exploitation of cutting edge technology for differentiation and high value products in finishing and treatment elements.	Process/ European level	A	R	R	R	NA	yes
TCo5	57	HE	Development of a new sales model close to franchising but with certain alterations on behalf of the company's plans	Business model / unique	EL	L	A	R	600	yes
TCo6	48	HE	Exploitation of cutting edge technology for differentiation and high value products and production of innovative products (in cooperation with raw material suppliers)	Process- product among Europe's pioneers	A	A	R	R	30.000	yes
TCo7	40	SE	Exploitation of cutting edge technology (some parts of which developed by own ideas) on denim dyeing – finishing and treating elements	Process / leading denim company in Greece (more than 80%)	L	L	A	A	2.000	yes
TCo8	43	HE	Design and mass customization production with all parallel changes (from 30 to more than 8000 codes, new production strategy, ERP systems, development of design competencies) new marketing etc.	Pioneers in Greece and among the first in Europe	EL	A	R	R	NA	no
TCo9	37	MSc	R&D –based production model (from mass production to mass customization)	Pioneers in Greece and among the first in Europe	EL	R	R	R	60.000	yes
TCo10	40	PSC	Design - creative innovation (fashion industry)	Fashion innovation	L (a)	EL	A	EL	300	no

1: Abbreviations: HE- higher education, TSE – Technical Secondary Education, SE-Secondary Education, PSC-Private School Certification
2 (EL-extremely limited, L-limited, A-adequate, R-rich)
3 e.g. technical, physical

(a) regarding entrepreneurial activities

For the **analysis of the data** the two main approaches, and namely within-case and cross-case analysis, were used according to the suggestions of Eisenhardt (1989b) for theory building from qualitative case research. This choice was also strengthened by the fact that it involved multiple (thirty) cases. Within-case analysis enables unique patterns of each case to emerge (Eisenhardt, 1989) and thus the massive information is limited into manageable amounts of data that can be properly analyzed. On the other hand, cross-case analysis allows the comparison of such emerging patterns, enhancing the possibility to capture novelties hidden in the data and allow for generalizations (Eisenhardt, 1989)

Data coding of transcripts and the field notes followed three out of the four most usually applied techniques in cases of verbatim texts of information-rich narratives, suggested by Ryan and Bernard (2003); these regard: 1) the *identification of repetitions* (Silverman, 2006) to identify emergent themes. Such an example is the repetition of the capability to mobilize, transform and absorb external knowledge which appeared to be of utmost importance in all cases[64].

2) *the identification of similarities and differences:* Although the most detailed analysis demands the analysis and comparison of every line alone, this was not possible for the data of the present research mainly due to the large amount of data

3) *the cutting and sorting of notable quotes* to make categories regarding the three levels of analysis (entrepreneur – venturing – networks) and the *a-to-e* key dimensions as well as to create new ones from emergent themes (see below).

For each of these techniques the transcripts were read separately in order to achieve the maximum insight every time. Extracts were recorded on excel sheets.

Each case was analyzed individually and emergent data was recorded. The first round of within-case analysis focused on developing an outline of constructs and relationships within the low-tech but knowledge intensive cases in an inductive way (Table A1, Appendix A); these emerged from the data through case write-ups, data coding and pattern coding (Graebner and Eisenhardt, 2004; Ryan and Bernard, 2003). Data was then analyzed across groups and cases. The cross-case analysis followed one of the tactics proposed by Eisenhardt (1989) i.e. the selection of both categories (i.e. the three levels of analysis) and dimensions (the *a-to-e* key dimensions) and then

[64] This will be discussed in detail in the following chapter.

the search for within-group similarities coupled with intergroup differences. Cross-case analysis indicated cross-case patterns.

Besides the objectives that were set during the interview design, some further objectives emerged from this **first within-case and cross-case analysis** which attracted the interest of the researcher, and namely:

a) Critical events of the firm up to the date of the interview regarding the new firms' boldness, creativity, and innovativeness up to the date of the interview

b) The firm's current positioning

c) The firm's product portfolio management up to the date of the interview

d) A wealth of data was revealed that led the researcher to **go back to literature** and study the capabilities' theories (entrepreneurial capabilities, innovative capabilities, RBV, dynamic capabilities). A further elaboration of the emerging issues under the new prism provided by the relevant literature review indicated the core role of both entrepreneurial and dynamic capabilities in LT-KIE exploration.

e) Production technologies proved to be of core importance in cases of LT-KIE.

Thus, **the first round of analysis** provided the first drafts of the general conceptual framework (Figure 6.1) and research shifted to the general proposition that LT-KIE's success in terms of survival and growth can be a capabilities' matter. That same year (2011) this assumption was confirmed by Hirsch-Kreinsen and Schwinge, (2011), who argued that "A bundle of firm-specific capabilities is a crucial precondition for this (i.e. low-tech KIE)".

In the second round of the within-case and cross-case analyses, the technique of *theory matching* was further used (Russell and Bernard, 2003). In this step the interviews were searched for themes relating to prior and emerging theory and compared to the existing literature on low-tech firms, the theories of capabilities, RBV, dynamic capabilities, performance measures, and competitive advantage. This round:

- focused the researcher's interest on those elements per case and across cases which could build capabilities; in fact elements of certain types of capabilities and namely dynamic capabilities we traced in all cases

- traced the initial competitive advantages, their importance and their relation to the starting knowledge-based innovations
- Put some emphasis on performances as measures of successful KIE application.

In parallel, the researcher had to delve into the relevant literature once more, as it will become evident in the next chapter.

4.5. Steps 7-9

Once preliminary analyses had been developed, they were combined and induced hypotheses for building theory from case studies (Eisenhardt, 1989; Glaser & Strauss, 1967). However, in order to build the hypotheses, the researcher had to consult theories exceeding the initial literature review and ranging from the bricolage and improvisation theory to the Kantian philosophy. The hypotheses were further followed by revision of each case to see if the data confirmed the proposed relationships and if they did, to use the cases to improve understanding of the underlying dynamics. After a number of iterations between our developing theoretical framework and the themes and patterns, existing literature on several topics was used to sharpen the insights yielded by the inductive process.

4.6. Triangulation

Triangulation is a powerful technique that secures reliability and validity. In particular, it refers to the application and combination of several research methodologies in the study of the same phenomenon, involving the use of multiple data sources, multiple theoretical perspectives, and/or multiple methods (Allen, 2006; Schwandt, 2001). The possibility of retrospective bias by informants could be a potential threat to the quality of the data. However, the fact that the study addressed relatively young ventures and the fact that respondents were asked to describe specific events without been provided a framework with which to evaluate and interpret their answers, minimize this threat. Furthermore, although there were no questions to ask directly about capabilities, the relevant data that emerged by the transcripts can be considered to bear no kind of bias or subjectivity. Furthermore, this information proved to be central to the subsequent focus on capabilities.

The present research combined multiple data sources, theories, methods, and empirical materials, in order to overcome the weakness or intrinsic biases and the problems that may otherwise come. Data emanated from several sources: the

interviews with key informants from the firms; news articles, industry reports, the Internet and trademarks and prizes. The internet data was collected from the case firms‟ websites, and sector-specific websites and web blogs. The web can provide rich qualitative data for academic research (Robinson, 2001). Moreover, web data would sometimes serve in order to compare the secondary data to the data from the interviews (following Herring, 2001).

Triangulation of the present research work is also secured by the multiple theoretical perspectives and fields and namely: the entrepreneurship theory, knowledge management, knowledge-intensive entrepreneurship, innovation, RBV and dynamic capabilities –competitive advantage, venture creation, production technologies, low-tech industries and even elements of the philosophical field. The use of this variety of theoretical views provided additional insight and multiple angles to answer the research questions.

Chapter 5

Research Context: The Low-tech Greek Industry and the case studies

Chapter Objectives

- To give a background of the three selected low-tech industries
- To discuss the general characteristics of the three selected industries
- To provide a description of the thirty cases

5.1 Introduction

Sectors can be regarded as a coherent way of looking at the economy since economic conditions vary across them, providing usually key insights into the design of policies. They have specific technological and knowledge bases, face common market conditions, share similar concerns, networks and institutions, and develop specific learning patterns and modes of innovation.

Following both the NACE codes and the OECD codes, Food and Beverages, Textiles and Clothing, and Wood and Furniture are assigned as low-tech industries together with paper and printing (Table 5.1). The three first categories constitute strong industries in Greece with different courses within the various socioeconomic contexts at national and global level. Introducing the three sectors:

Table 5.1: OECD, BTDIxE, edition 2013

Food, Beverages and Tobacco	10t12
…Food	10
…Beverages	11
…Tobacco	12
Textiles, Leather and Footwear	13t15
…Textiles	13
…Wearing apparel	14
…Leather and related products	15
Wood and Products of Wood and Cork	16
Paper and Printing	17t18
…Paper and paper products	17
…Printing and reproduction of recorded media	18
Furniture; Other manufacturing	31t32

The **Food and Drink or Food and Beverages** sector is the most important and most dynamic of the Greek Economy and the only one not threatened by the long and severe crisis. The industry holds the first place among all sectors accumulating 25% of the GNP, 4% of total investments (including investments in trade and services) and 25% of Greek exports (SEB, 2012). The Greek F&B industry operates within a moderately dynamic environment with changing markets, high competition, social changes and pressures, constant changes in demand as well as regulations, directives and their amendments. In addition there is an orgasm of creativity and innovation; novel niche markets and NPD areas (which in turn need new regulations) mainly due to rapid technological advances and science engagement such as the “biotechnology revolution” and the novel technologies in packaging. Multifunctional products, novel approaches of large multinationals, more rapid rates of product turnover and the

internationalization of markets enhance competition and cause further technological pressure to Greek food producers.

Yet, the Greek F&B sector reacts positively following the amazing development of the relevant industry at global level. While till the mid-nineties the industry did not own any specific capabilities showing almost no propensity to innovate, with the dawn of the new millennium, a small but constantly increasing number of new firms make their selves known globally with novel products and the opening of niche markets, new areas such as "nutraceuticals", pharmaceutical and cosmetic industries next to bio-functional and super-foods or eco-friendly production methods and eco-innovation. The industry is one of the most dynamic sectors in Greece with a rather positive evolution throughout the years, operating within a rather healthy and positive type of environmental dynamism.

On the contrary, **the textiles and clothing industry** faced since middle 90s a severe declination. Traditionally it has been one of the most highly protected sectors in the global economy. Greece enjoyed a rapid growth of almost all sub-sectors as a result of decentralization strategies, EU protectionism, the fine quality raw materials, high quality of production criteria, the relatively low-labor cost and the extensive use of subcontracting (Labrianidis, 1996). The abolition of the quota system in the course of the phase-out of the Multi-Fibre Agreement (MFA) between 1995 and 2004 has left significant changes in the T&C industry. The world economic crisis and the euro – dollar parity completed the already negative situation of the T&C sector. All the above evolutions turned to the transfer of the production to developing countries and extremely increasing imports from Asia and especially China. Competition was becoming fiercer and market structures were dramatically changing. Greece reacted with intense transfer of technology, technological knowledge and ICT applications, mergers and acquisitions and a mass transfer of the productive units to neighbor countries due to low wages and favorable tax systems. Meanwhile a big number of companies closed because of too high debts. After 2002, efforts in Greece focused mainly on treatment-finishing methods, eco-fabrics and novel, ICT-based production methods such as mass customization. There were also some isolated cases of more advanced innovations such as functional fibers and multi-functional clothing and efforts to establish globally accepted fashion design.

The Greek textiles and apparel industry confronts fierce market competition and new competitors, extremely high unpredictability and ambiguity as well as global regulatory changes. It operates within a hostile environment (contrasting to F&B sector) being pressed by both low-wage competitors and value-added global producers, confused of the new types of suppliers (new industries and sciences like biotechnology and nanotechnology) and customers (healthcare, car-industry etc), increasing customer preferences and speed of product changes (e.g. "fast fashion" concept) as well as technological pressures.

Between the two polar positions of the above mentioned sectors, the **wood and furniture sector** stands somewhere in the middle. The sector is mature, highly fragmented and labor intensive with many firms operating in a 'craft' production mode to cover domestic demand, while exports are rather insignificant. Changes were rather slow till the end of the previous century; combined with the prosperity of the sector till 2007, an illusion of stability did not allow Greek W&F firms to prepare and confront the oncoming multilevel crisis. Well protected and stable, the industry faced during 90s the increase of imports. Yet, furniture production recorded an average annual growth of 6.8% in nominal terms, thanks to the positive economic activity in Greece in recent years. However, after 2008 the sector was dramatically hit by the crisis, while it had already become vulnerable due to decreasing production in absolute numbers, as well as the increasing number of mainly trendy products from Italy[65] and Spain, cheaper products from Turkey, China and India and different approaches such as of IKEA.

Moderately paced changes at technologies, products, market development and competition combined to pressures for environmental sustainability by EU regulations, government and groups had spurred both product and process innovation such as the eco-design and the "intelligent" furniture, engaging other industries as well. Greek firms were mainly followers with production methods restructuring based on advanced CIM systems. Unfortunately, even in this area the Greek furniture sector has no reputation being overwhelmed by Italian, Spanish or Scandinavian design. Easier transport, competitors with lower prices (economies of scale), faster deliveries (advanced logistics) and established design threat to share the Greek market pie while

[65] *Since 2001 Italy is however loosing share in favour of imports originating in China. Chinese made furniture destined for the Greek market registered in 2007 an increase of 78%, almost doubling its value, and an average annual growth rate of 55% between 2002 and 2007.*

export numbers show major weaknesses of Greek producers. Environment is far from stable, especially when considering the Greek economic recession and its effects on furniture as durable goods and the collapse of building activity.

This chapter will try to delineate the nature and the courses of the three selected industries in Greece, in order to justify their selection and introduce the reader into the sectoral contexts and the national environment the selected cases applied KIE.

5.2. The national context

Greece can be even today (2015) characterized a "developed country", classified as an advanced, high-income economy (World Bank, 2013) and estimated as the largest economy in the Balkans with the service sector to dominate the economy (80.6%), industry to count for a 16% and agriculture for an estimated 3.4% of the national economic output in 2012. More precisely, the Greek Merchant Navy is the largest in the world and tourism the most profitable service industry; food and tobacco processing, textiles, chemicals, metal products, mining and petroleum follow. The country is also regarded one of the top foreign investors in the Balkan countries. However, the Greek economy has long faced significant problems, including an inefficient public sector bureaucracy, tax evasion, corruption and low global competitiveness.

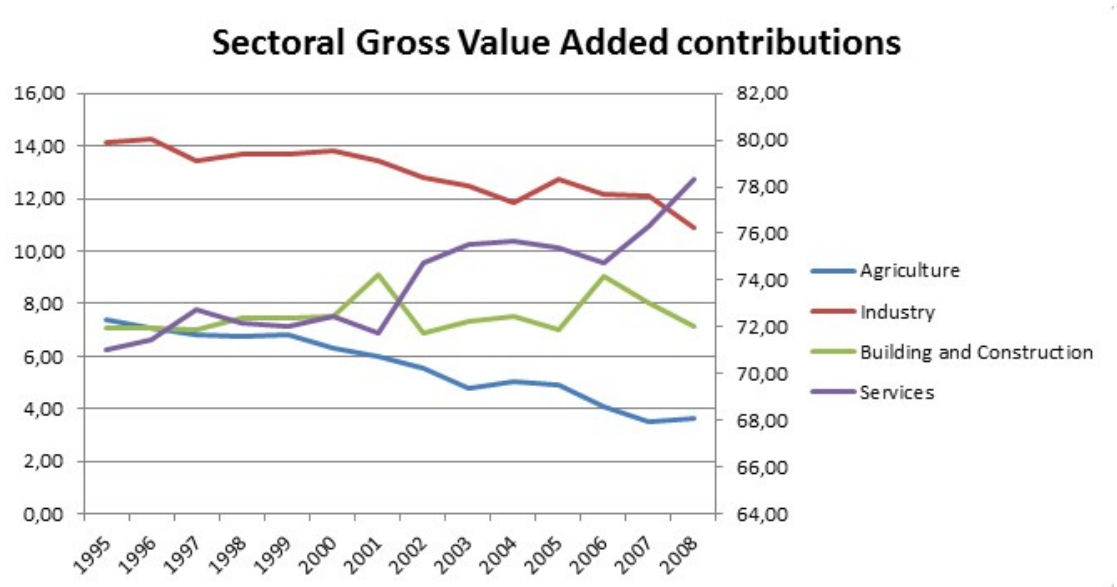
In January 1st, 2001, Greece became the 12th member of the Economic and Monetary Union in EU setting off a decade of impressive growth performance. Average real GDP growth was close to 4 percent per year between 2000 and 2009, against 2 percent in the euro area, peaking at 5.9% in 2003 and 5.5% in 2006. This reflected a domestic demand boom, in particular in consumption and residential investment. High real wage increases, rapid credit growth and loose fiscal policy were drivers of buoyant growth (European Commission, 2011). Between 2005 and 2011, Greece has had the highest percentage increase in industrial output out of all EU members, with an increase of 6% (compared to 2005 levels, Eurostat, 2011). Between 1999 and 2008, Greek industrial productivity enjoyed a growth of 2.4 CAGR (vs. 1.1% for EU15) while the volume of retail trade in Greece increased by an average of 4.4% per year (a total increase of 44%). By then, the manufacturing industry (407,000 people), and the construction industry (305,000) were the largest industrial employers in the

country, followed by the mining (14,000) (Eurostat, 2011). Actually, manufacturing accounted for 11% of employment and GDP in 2008 with food/drinks/tobacco, refined petroleum and basic metals and metal products being the most important sectors.

With the aid of EU grants, Greece tried to update infrastructures, such as roads, rail, harbors, and airport links. EU structural funds were directed also to the improvement of the Greek economy in terms of employment, productivity, investment, agriculture and trade (Sampaniotis and Anastasatos, 2011). EU programs played a major role in efforts to advance R&D and innovation activities. It should be mentioned that in 2003, preparations for the 2004 Olympics drove investment, but spending on the Olympic Games contributed to a general government deficit of 6.6% of GDP in 2004.

In parallel, fiscal targets would be set and consistently missed, despite the rather benign economic environment, due to "systematic overspending, endemic tax evasion and persistently overoptimistic tax projections" (Commission staff working paper, 2011).

Figure 5.1: The courses of the main Greek economy sectoral categories



Source: AMECO database, retrieved on 20/4/2015 from https://kkalev4economy.wordpress.com/tag/greek-economy/

Figure 5.1 presents the courses of the main economy sectors since 1995. The dominance of the service sectors is clear; on the other hand, it appears that industry had a rather indifferent course till 2008, with a decline of 12% in 2007against a 14% in 1995. However, besides the absorption boom, the first decade of the new

millennium proved to be a quite turbulent one in terms of economic and social changes at global level. Emerging Asian exports demanded large market shares mainly in periphery, low-tech products such as food and textiles. Greek industry reacted[66] with investments mainly in equipment and technology but while imports of commodity products grew strongly[67], exports did not equally increase. Besides the weak external competitiveness, the nominal appreciation of the euro vis-à-vis other currencies, the transfer of production initially in Eastern Europe and later in Asian countries and Greece's lagging behind regarding high-tech industry (IMF Working paper, Chen et al., 2012) were negative factors affecting the seemingly strong growth performance of Greece that time[68].

In 2008 however, the repercussions from the international financial crisis were unavoidable felt also in Greece. Although GDP growth remained strong during the first three quarters of the year, it was the beginning of the worst crisis Greece has ever known. By the end of 2009, a combination of international and national factors led the Greek economy to its most severe crisis since the restoration of democracy in 1974.

Table 5.2: Core annual data of the Greek economy

		2005	2006	2007	2008	2009	2010	2011	2012	2013
Real GDP growth rate	**EU-28**	2.0	3.4	3.1	0.5	-4.4	2.1	1.7	-0.5	0.0
	Greece	0.9	5.8	3.5	-0.4	-4.4	-5.4	-8.9	-6.6	-3.9
General government debt (% GDP)	**Greece**	101.2	107.5	107.2	112.9	129.7	148.3	170.3	157.2	175.1
GDP per capita[1]	**Greece**	91	92	90	93	95	89	81	76	75

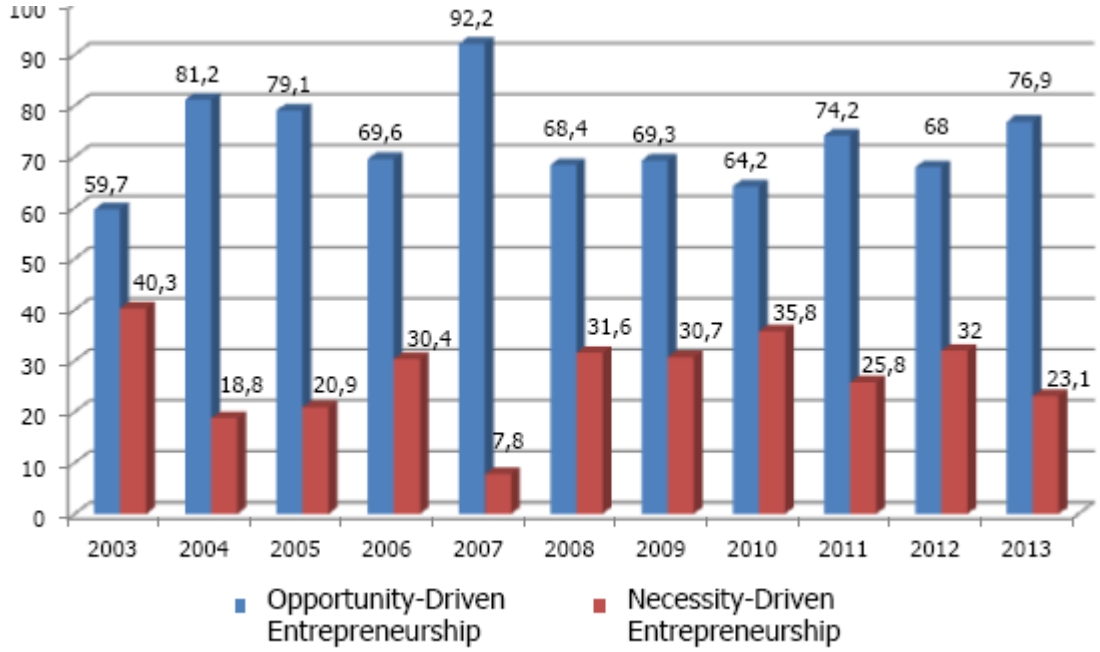
1 *(in PPS, EU-28=100)*
Source: Eurostat

The subsequent recession and the government-debt crisis plunged the economy into a sharp downturn; GDP growth rates would fall dramatically for the subsequent four

[66] As it will be better explained in the subsequent sectoral analyses
[67] High oil and other raw material prices were significant reasons
[68] There has been a massive volume of papers and reports regarding the reasons and causes of the course of the Greek economy in the new millennium. However, it is not the purpose of the present study to analyze them. The description of the national context is only introductory in order to place the sectoral developments of the selected three low-tech industries in their real framework.

years (Table 5.2) showing a tendency to recovery in 2013 (−3.9%, HEL.STAT. data). Shrinking household consumption and the sharp drop in fixed capital formation were reported among the main reasons for the drop (IOBE, 2014). During these years, unemployment skyrocketed, from a 7.2% in the third quarter of 2008 to a 27.9% in June 2013, leaving over a million jobless. In the beginning of 2015 it averaged 25.7%. Youth unemployment peaked at 64.9% in May 2013 (HEL.STAT data). In the same vein, the percentage of population aged 18-64 who started a new business fell significantly and necessity-driven entrepreneurship emerged (Figure 5.2). According to IOBE[69] (2014), in 2013 efforts to create a new business reached their lowest number since the beginning of the survey in 2003. Nevertheless, it is quite remarkable the fact that, within this percentage, new opportunity entrepreneurship constitutes the major part recorded over the period of the economic crisis.

Figure 5.2: Evolution of distribution of necessity and opportunity driven entrepreneurial activities



Source: *IOBE, Data processing GEM*

During the three year period (2009-2011) of the interview process, one out of four of manufacturing firms active in 2008 became a victim of the crisis. The industrial sector was hit with domestic output decreasing by 5.8% and industrial production in

[69] IOBE "The Greek Economy" vol. 03/14

general by 23,7% (HEL.STAT, 2012). Production decline was estimated around 55.5% in the T&C sector, 47% in the furniture sector, 18% in the wood sector and a 10% in the food sector. The same period more than half T&C and one third of W&F employees lost their jobs. Indicatively, that period around 7000 firms unsubscribed from the Athens Chamber of SMEs while there were around 3600 new subscriptions of relevant companies. The worst picture was the one of the T&C sector; 1075 clothing firms and 139 weaving ones shut down with 374 and 24 to be registered; most of these were old ones under a new trademark. The best picture regards the F&B sector with 418 firms to shut down and 383 new to open. W&F industry stood again in the middle; 750 firms stopped and less than half (245) started.

The general production index kept falling all these years; taking 2010 as 100 it was 94,3 in 2011; 92,4 in 2012; 89,6 in 2013 and 87,1 in 2014 (Bank of Greece, 2015). Especially regarding the selected industries, the decline is evident in Table 5.3, while the first information for 2014 shows no significant changes.

Table 5.3: Industrial production Index (2005=100)

	2009 ***(start of the research)***	**2010**	**2011**	**2012**	**2013**
Textiles and Clothing	52,1	41,9	32,7	26,2	22,3
Furniture	78,9	62,9	49,0	34,3	28,1
Wood	66,7	60,4	75,5	53,2	40,0
Food	103,7	96,7	95,8	92,5	87,9

Sources: Eurostat, 2015, HEL.STAT, 2011

On October 10, 2014, HELSTAT published new data on the Greek National Accounts for the period 1995- 2013 (applying ESA[70] 2010). According to the report, the recession was sharper in the period 2008- 2011. In 2014, housing construction shrank more sharply followed by contraction in metal products, machinery and agricultural machinery. A 5.3% increase in exports was observed for the first time but still it was not enough to bring back optimism. In April 2014 Eurostat confirmed the 2013 Greek primary budget surplus highlighting the importance of fiscal consolidation. At that time, the decrease of the interest rates and the return of Greek banks to the capital markets reflected a significant improvement of the credibility of the Greek economy abroad. However, the future seems too radical and bleak but highly unpredictable as

[70] European System of Accounts

well. “The Godfather, Lord of the Rings, and Star Wars. Great dramas come in trilogies and Greece's debt crisis is no exception.” (Source: Internet)

Table 5.4: Main Economic Volumes-Quarterly National Accounts

Quarter Year	GDP		Final Consumption		Investment		Exports		Imports	
	mil. €	Annua rate of change	mil. €	Annual rate of change	mil. €		mil. €	Annual rate of change	mil. €	Annual rate of change
2000	189,86	4,00%	164,523	3,20%	43,61	9,60%	42,91	22,20%	61,86	19,00%
2001	196,95	3,70%	171,457	4,20%	44,34	1,70%	43,15	0,60%	62,59	1,20%
2002	203,18	3,20%	178,732	4,20%	44,47	0,30%	40,00	-7,30%	60,45	-3,40%
2003	216,67	6,60%	186,407	4,30%	53,40	20,10%	39,71	-0,70%	63,97	5,80%
2004	227,40	5,00%	194,403	4,30%	53,39	0,00%	47,10	18,50%	68,51	7,10%
2005	229,43	0,90%	203,243	4,50%	45,36	-15%	48,65	3,40%	68,05	-0,70%
2006	242,77	5,80%	210,384	3,50%	57,71	27,20%	51,20	5,20%	77,37	13,70%
2007	251,36	3,50%	218,637	3,90%	63,97	10,90%	56,61	10,60%	89,10	15,10%
2008	250,24	-0,40%	222,534	1,80%	59,48	-7,00%	58,59	3,50%	91,35	2,60%
2009	239,25	-4,40%	221,619	-0,40%	42,99	-27,7%	47,77	-18,5%	73,41	-19,6%
2010	226,21	-5,40%	207,34	-6,40%	38,27	-11,0%	49,98	4,60%	69,38	-5,50%
2011*	206,2	-8,90%	187,308	-9,70%	31,99	-16,4%	49,98	0,00%	63,11	-9,00%
2012*	192,6	-6,60%	173,894	-7,20%	25,32	-20,8%	50,56	1,20%	57,36	-9,10%
2013*	186,2	-3,30%	168,632	-3,00%	22,20	-12,3%	51,64	2,10%	56,46	-1,60%
Q1 2014*	36,87	-1,10%	34,863	0,10%	4,68	-11,9%	8,897	5,40%	11,58	2,20%
Q2 2014*	40,68	-0,30%	35,636	0,00%	4,787	-4,10%	11,46	5,30%	11,39	4,60%

* provisional data

Source: 2000-2013: Annual National Accounts with ESA 2010 in 2010 prices, October 2014, EL.STAT. 2014:Quarterly National Accounts with ESA 95 in 2005 prices, September 2014, EL.STAT.

5.3. The sectoral context of the three low-tech sectors

Within the context described above, a mixture of threats and opportunities formed the courses of the three selected industries in Greece. Furthermore, over the last decade Greek low-tech industries confront the instability of globalization, the fast or moderate pace of inter-sectoral technological advances and the uncertainty of environmental shocks such as the severe crisis, therefore major elements of environmental dynamism. Three sectors, three different business ecosystems, three different courses; however in no case changes were easy to anticipate or too clear, simple and “slow” as to be isolated and confronted.

5.3.1 THE WOOD AND FURNITURE SECTOR

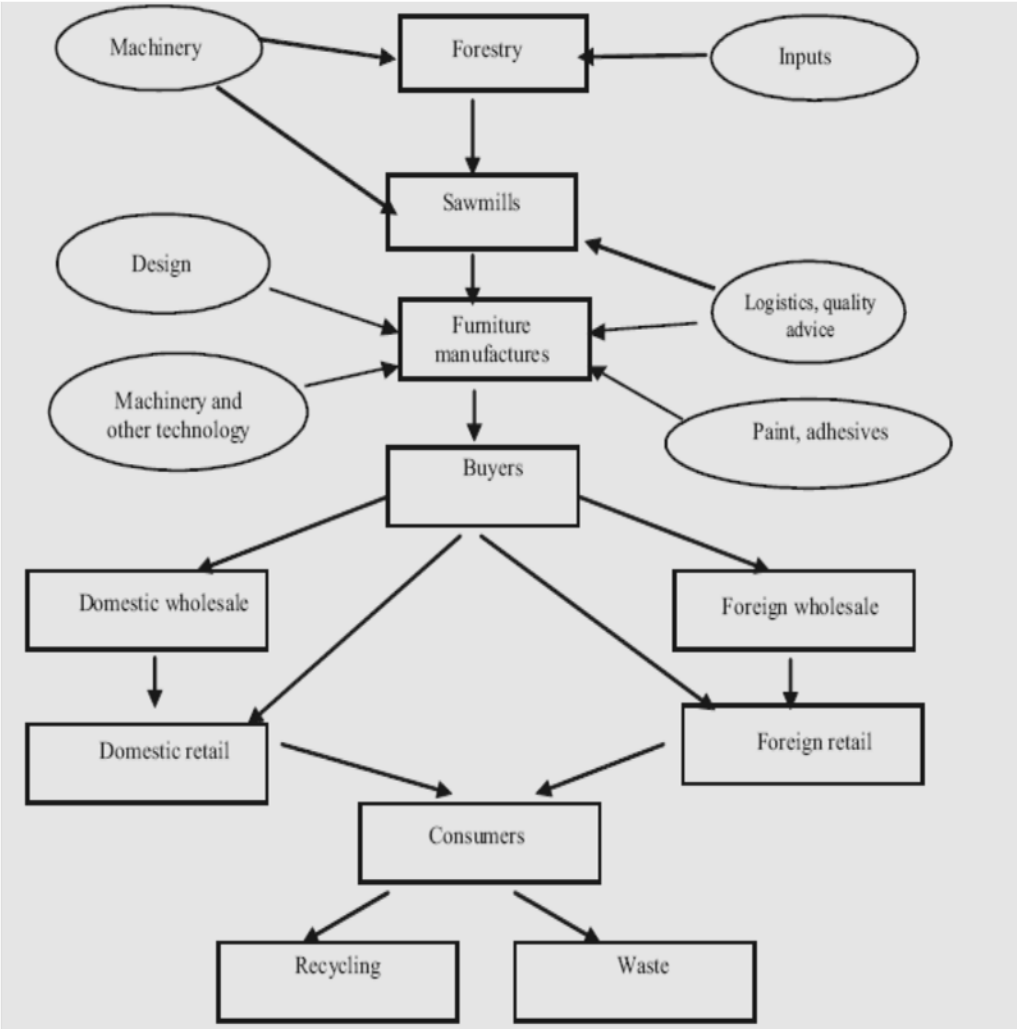
NACE rev2.2 codes C16 (wood products) and C31 (furniture)

The Wood and Furniture sectors are included in traditional manufacturing (NACE 36) According to the NACE classification (Rev 1.1 and Rev 2 classification in operation since 2008):

- ***the wood product manufacturing industries*** or woodworking industries include the production of sawn wood, wood-based panels, parquet,and other wooden products, such as joinery and carpentry materials, wooden packaging, pallets and other wooden articles. Most wood in the EU is used in construction.
- ***the furniture sector*** includes the following subsectors: chairs and seats; office and shop furniture; kitchen furniture; other furniture (home and garden furniture); and mattresses as presented and defined in NACE 31.

Figure 5.3: The wood value chain.

In the figure, packaging is missing next to furniture



Source: Adapted from UNIDO, 2003.

In general, furniture production forms part of the active downstream value chain activities of the larger wood-based product industry (Figure 5.3) 36%, which was

faster than merchandise trade as a whole (26.5%), apparel (32%), and footwear (1%). These industries target fashion-oriented segments and are often marked by low wages, unskilled workers, and sweatshop employment conditions (Scott, 2006).

A description of the general Industry structure, trends and markets in Europe and sources of information ares given in **Appendix C.**

5.3.1.a. Industry structure in Greece

Woodworking and furniture industries play a significant role in Greek economy, with a turnover in 2008 of around €2 billion, an added value of around €1 billion and an employment rate of 35.000 people in more than 15.000 companies (Eurostat, 2009).

The vast majority of ***woodworking companies*** is micro-companies, with the wood-based panel sub-sector and sawmills to be the exception. Indicatively, in the good pre-crisis times, there were no more than five large firms in Greece which would cover more than 80% of the domestic production of wood-based panels. 66% of the firms are less than 30 years old and cover mainly the domestic market, as exports are rather insignificant. They are the main suppliers of the furniture and construction industries with sawmills (sawn wood) to compete wood-based panels.

A major feature of the sector in Greece is the high proportion of imports. According to hellastat.eu, in the pre-crisis period (2006-2009) there was a constant decrease of the enterprises at a rate around -3% with a parallel increase of investment activity (around 10%) indicating the efforts of the big counterparts to invest in modernization. Most imports refer to sawn wood and most important import countries are Sweden, Bulgaria and Russia. On the other hand, Greece exports mainly to Cyprus.

In the context of the wider socioeconomic crisis in Greece, the decrease of the building activities and the crisis in the furniture sector caused significant problems and shrinkage. The lack of demand, liquidity and confidence leads to the shut-down of many well-known enterprises. A typical example is the case of Shelman; one of the biggest and strongest wood-based producers which supplied almost 100% of plywood in the domestic market. The company was sold and then bankrupted.

The Industrial Production Indicator for timber (February 2010 /February 2005) decreased by -24.7%, and for furniture -31.2% (February 2010 /February 2005, Hellenic Statistical Authority (2010)). In the end of 2014 production was less than 55% of the 2010 production.

The industry faces growing competition from low-cost, emerging economies and a growing number of technical trade barriers. Lately, the competition is focused on the level of prices, with extremely limited mixed margins of profits

The ***Greek Furniture Industry*** is predominantly characterized by a population of micro and small, privately- owned firms (the majority employing less than 50 people) with a not irrelevant share of medium ones which, most of the times have the characteristic of family run businesses with years in the industry and with relatively low turnovers. The sector is a mature one, highly fragmented, with many firms operating in a 'craft' production mode and labor intensive. About 87% of the total furniture manufacturers are small companies with annual turnovers up to Euro 300,000. Today about 80% of all firms employ between 1 and 4 workers, only a few companies count more than 100 employees. The sector is highly competitive, with a lot of small family businesses, not internationally oriented, which are loosing market share to the well-established big companies. Most companies operate for more than 15 years with turnovers that do not exceed the 300.000€. Actually, 36% of furniture manufacturing companies have been established during the decade 1990- 2000 and a 30% during 1980 -1990. There is a 16% established among 1970-1980, a 12% before 1970 and a 6% after 2000. According to official statistics, some 7,000 companies (90% of which are very small companies) employ more than 11,000 employees in the sector but according to a number of field research studies there are still more than 15.000 including a big number of individual enterprises (67%). The number continuous to be too big and if one adds the imports, can understand the fierce competition for a small to moderate share of a relatively small market (in order to make comparisons the reader can consider that Italy, the first exporter globally, with a population of around 60 million people hosts about 36.000 companies).

One out of three producers is also in the retail market, while hardly 1 in the 5 is activated in wholesale. 20% has a standardised production, which is usually correlated to higher turnovers and a bigger number of employees. Among the producers of standard products 1 in 3 has no show room. On the other hand, the 90% of the custom made producers own one at least retail shop. A 20% participates in trade shows and is advertised by magazines. The most usual type of promotion is the mouth-to mouth type.

Products can be classified according to primary material (wood, upholstered, metal, other), use (case goods such as dining room and bedroom furniture, occasional furniture such as coffee and end tables), as well as style, finish, quality, and price. The production is highly diversified (i.e. chairs, dormitories, armchairs, living rooms, kitchen furniture etc.).

Greek's furniture production is not yet very automated. Geographically the major productive districts in Greece are located in Thessaly, Macedonia, and Attica. In particular 62.5% of Greek manufacturers are located in Attica and Macedonia and almost 10% in Thessaly. The producers of Attica have the higher number of points of sale because of the increased volume of production and the significant size of the market. The majority of producers (about 80%) manufacture furniture based on custom orders, meaning that they are able to produce the category of furniture that each customer desires and this is their strong competitive advantage. Those producing with customised mode are highly fragmented and in most cases they have only 1 retail shop. On the other hand, the standardised production is closely related to higher turnovers than the customised production and with more persons being employed. There are significant differences per region in the number of producers with standardised production and those with customised production.

Thessaly has plenty of standardised production units with specialised production in some product categories like beds, sofas/upholstery and tables. On the other side, e.g. Sterea Hellas region (Central Greece) is characterised by more manufacturers with customised production mode, producing mainly household furniture in general.

The manufacturers that import most are located in Attica, Macedonia, Thessaly and Crete. The reasons for importing differ among the regions, with some regions having as main reason the price, while others are having design. These differences reflect the preferences of end consumers per region. The vast majority of imports come from Italy and the main reasons are price and then design. High import penetration to manufacturers has achieved China as well. IKEA has ripped a big share of the market pie and open in 2009 the third department in Thessaly (Larissa) affecting mostly the medium and low – price producers of everyday furniture.

Although entering the specific industry is quite easy, the further progress is rather difficult, since there are too many stakeholders (extremely high competition), the new

computerized equipment is expensive and there is a need for well-organized distribution channels.

Till the beginning of nineties the sector was well protected and stable; the term "imported furniture" addressed a very small and almost eligible segment of high-value added niche markets. During the 90s imported furniture started gaining bigger shares not only in high-value but in other segments as well[71]. The main drive of furniture production in Greece is still the domestic market with a little bit more than 4 million households. Between 2002 and 2007, furniture production recorded an average annual growth of 6.8% in nominal terms, thanks to the positive economic activity in Greece in recent years and the Olympic Games, 2004. The growth was reconfirmed in 2007 with an increase in GDP of 4.1%, one of the fastest rates in Europe, although in deceleration if compared to 2006 (+4.3%). Private consumption remained robust and the improving business environment and increasing corporate profitability benefited investment, which rebounded strongly, compensating partly for the slowdown in residential construction. Therefore, up to 2007 furniture production in Greece recorded increases (e.g. a 7.5% increase of consumption and 7.9% at current prices or +3.4% in real terms in 2007 compared to 2006).

The import/consumption ratio improved also significantly until 2004, decreased in 2005 and presented a further increase reaching a percentage of 30% in 2007. EU17's imports/consumption average was 44% in 2007. Imported goods offered on the Greek market were primarily furniture of high design, made in Italy, or lower cost furniture made in China and Turkey.

Changes were rather slow till the end of the previous century; combined with the prosperity of the sector till 2007, an illusion of stability did not allow Greek W&F firms to prepare and confront the oncoming multilevel crisis.

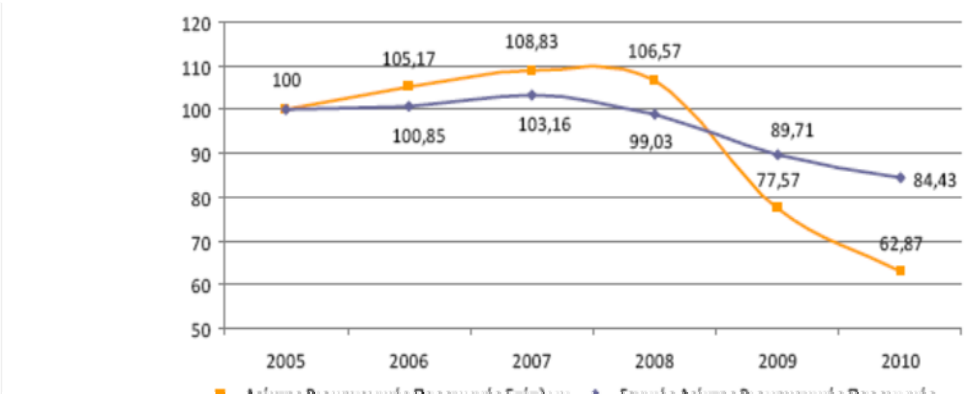
In 2008 the crisis started; most companies presented losses of profits (56.8%) or even damage (27.3%). The sector presenting net profits of about 4,55 million Euros, decreased roughly at a 64% compared to 2007. The furniture production which emanated in it majority from small and medium size manufactures (75%) was dramatically hit by the crisis, while it had already become vulnerable due to decreasing production in absolute numbers, as well as the increasing number of

[71] 1990 first Praktiker in Greece, 2000 first IKEA.

mainly trendy products from Italy[1] and Spain, cheaper products from Turkey, China and India and different approaches such as of IKEA.

The production volume decreased around 47% in the period 2009-2011, with a further decrease of around 30% in 2012 (EL.STAT).

Figure 5.4: General industrial production index and furniture production index (2005-2012). Reference year: 2005



Blue: furniture production index
Source: EL.STAT.

In 2007 (just before the crisis), Greece ranked in the middle in terms of the size of the population, and the annual per capita home furniture consumption with 116 Euro which although lower than the average for EU17 (152 Euro representing the index number for EU28=100) it presented an index higher than 50. In 2012, the relevant Greek index is around 40. Table 5.6 highlights the dramatic decrease of consumption (almost one third) while it indicates a minor turn of consumers to national products (3%).

Table 5.5: Furniture consumption in Greece

Greece	**Consumption** **€ million**	**Share of national production out of total consumption**	**Share of imports out of total consumption**
2012	715	69%	31%
2007	2010	72%	28%

Sources: CSIL (2008), Renta et al. (2014)

Today surviving furniture companies try to open up to new markets. However, this strategy is quite unfamiliar; the degree of openness of the Greek furniture market is still very low; in 2007 the Greek export/production ratio was just 2.9% (EU17's average was 39%) while Greece is the last furniture exporter in the EU17 rank. Greek furniture manufacturers rather concentrated their efforts in the local market but today

domestic demand is worse than ever. Even if they are still very low, furniture exports show an increasing tendency; indicatively, in 2010 they were more than double than in 2004. Major outlets for Greek exports are Cyprus and Bulgaria accounting for shares of 30% and 14% respectively.

Approaching some of the most representative sub-sectors in Greece, home furniture constitutes a significant one as

a) it includes all mobile furniture used at home excluding office, kitchen, bath, baby and outdoor furniture
b) it addresses a considerable number of firms of various sizes, organization and product groups.

However, some of these companies produce other types of furniture as well as kitchen and bath furniture offering integrated solutions to home furnishing. The sub-sectors presented a dramatic decrease with the reduction of building activities volume (indicatively by -22.6% and of the number of building licenses by -14.2% between December 2009 and December 2008) being one of the major reasons.

Table 5.7: National production of home furniture in volumes (1998-2011)

Year	Volume	Change
1998	2,300	-
1999	2,200	-4.40%
2000	2,100	-4.60%
2001	2,000	-4.80%
2002	1,850	-7.50%
2003	1,750	-5.40%
2004	1,700	-2.90%
2005	1,750	2.90%
2006	1,760	0.60%
2007	1,810	2.80%
2008	1,740	-3.90%
2009	1,350	-22.40%
2010	1,150	-14.80%
2011	1,000	-13.00%
Volumes in 000 pieces	*Source: ICAP Group*	

Table 5.8 : Home furniture exports (2004-2010)

Year	Value	Volume
2004	6,487	1,189
2005	8,369	1,784
2006	11,340	1,857

2007	13,171	2,748
2008	14,323	3,237
2009	12,493	2,462
2010	13,290	2,794
Value in €000 , Volume in tons		*Source EL.STAT*

Table 5.9: Domestic consumption of home furniture (1998-2011)

Year	Production	Imports	Exports	Domestic Market	Change
1998	402,000	38,000	8,800	431,200	-
1999	408,000	59,000	7,300	459,700	6.60%
2000	411,000	80,000	5,900	485,100	5.50%
2001	407,000	105,000	5,000	507,000	4.50%
2002	400,000	130,000	5,500	524,500	3.50%
2003	395,000	145,000	9,000	531,000	1.20%
2004	390,000	170,000	9,000	551,000	3.80%
2005	410,000	200,000	10,800	599,200	8.80%
2006	430,000	220,000	12,500	637,500	6.40%
2007	456,000	258,000	14,000	700,000	9.80%
2008	390,000	275,000	14,000	651,000	-7.00%
2009	330,000	270,000	12,000	588,000	-9.70%
2010	270,000	250,000	13,000	507,000	-13.80%
2011	220,000	210,000	15,000	415,000	-18.10%
€000					
					Source: ICAP Group

The **kitchen furniture** production represents 10% of total furniture production and is almost exclusively destined for the local market. Production There is an increasing and very strong competition from mostly Italian and German products (the first for their design and the second ones for their price, ergonomics and on-time delivery and good after sales service). In order to face it, Greek producers offer a vertically organised set of services, starting from the completely tailor made product (design according to the customers wishes on a 3-d monitor) to the complete installation of the set. However, the crisis had the same effects on sales; production decreased of more than 40% between 2008 and 2012.

The **office furniture** is the only sub-sector where one can find mostly big companies with strong trademarks and strong advertising in Greece. Most of them (e.g. Dromeas, Sato) have invested on modern technological equipment and organisation methods. Greece is the smallest producer of office furniture in terms of value, with a quota of total European production of just less than 1%. Greek production of office furniture increased significantly in 2004 to reach a value of 89 million Euros in 2007 due to the Olympic Games 2004 in Athens. However, only a 5% of the value was due to exports.

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The **furniture retailing sector** is also highly fragmented. The majority of retailers are family owned firms with low turnovers and are located in Attica (37%), followed by Macedonia and Peloponnesus (9%), Thessaly (7.5%) and Crete (7.3%). Most of them are many years in the trade, have an annual turnover of more than 300,000 Euros and employ on average 6 people. The smaller firms employ on average 3 persons. 50% of retailers are being supplied with furniture by branded Greek manufacturers and 20% by imports. Main country of importation is Italy but also other countries such as India, Turkey and China.

Italy accounts for a 35% share on total imports. Since 2001 Italy is however loosing share in favour of imports originating in China. Chinese made furniture destined for the Greek market registered in 2007 an increase of 78%, almost doubling its value, and an average annual growth rate of 55% between 2002 and 2007.

The manufacturers that import most are located in Attica, Macedonia, Thessaly and Crete. The reasons for importing differ among the regions with some regions having as main reason the price while others are having design. These differences reflect the preferences of the end consumers per region. Main country of importation for retailers is Italy, but also other countries such as India, Turkey and China. Major suppliers in the upholstery segment are Italy and China which together supply over 65% of total imports.

Besides the other furniture segment, the dining and living room segment is the strongest segment in terms of imports accounting for a share of 19% of total imports.

Imports of kitchen furniture satisfied 34% of consumption and during last year they totalled Euro 75 million (+29.3%). Italy was the leading supplier providing a share of 77% followed by Germany with a share of 11%. Both countries increased their sales.

Italy is the leading supplier of office furniture with a share of over 60%. In the office seating segment the leading supplier was again Italy until 2005, but it is now China which, as expected, became the top supplier in 2006 and further increased its share of the market in 2007 (50%).

IKEA is a strong competitor since the two stores in Athens have surpassed the 200 million per year in sales volume and the one in Thessaloniki exceeds the 60 million yearly, while it has been recorded that more than 32 million people have at least visited the stores (including the one of Cyprus). With the new store in Larissa, IKEA occupies 1800 employees.

There is also the Ready-to-Assemble group of products (mostly imported) and big foreign chains which besides their products sell furniture as well (e.g. Praktiker, Carrefour etc.). Technological change has paved the way for important on-going globalisation trends in the industry. In combination with flat-pack or ready-to-assemble furniture, high-speed automation opened the way for firms to design, manufacture and ship products in large quantities. Moreover, mass-produced, low to medium-price furniture is increasingly manufactured in low-wage economies, with a considerable degree of concentration in large production facilities. Due to higher transportation costs per unit of output, global competition in the furniture sector has been less fierce than in industries like footwear, leather, apparel, and textiles. However, the influence of this factor has been diminishing with the spread of flat-pack and ready-to-assemble furniture. Hence, proximity to the market, while continuing to be important, is no longer the determining factor. *Overall, the furniture industry can be characterized as an industry "in the throes of intense global competition"* (Kaplinsky and Readman, 2005), as indicated by growing number of exporting countries, falling unit prices, and a tendency towards a common price.

The demand is determined by new households, marriages, furniture replacement, private building activities, students, emigrants and people who change job – places. The kind of furniture correlates to price, income and the dealing conditions. Demand presents annual fluctuations with higher rates in autumn and spring. Other determinants are: aesthetics, fashion, decoration trends, design trends, ergonomics, trademarks and publicity.

5.3.1.c Sector dynamics and the role of technological change, R&D and innovation

Woodworking companies are considered highly innovative and knowledge-intensive (Smith, 2008); they build high-quality innovation systems regarding mainly production technologies which result in both novel products and processes. Sectoral research and technological development knowledge centers, global machinery manufacturers, suppliers, the chemical industry, and Universities develop synergies with firms of the sub-sector. Innovations turn around engineered wood products, wooden composites, novel fittings and other wooden products or issues such as productivity increase and quality improvement.

The wood industries have gained from technical developments mainly in the chemical industry. Indicatively two Greek chemical firms, Chimar and Nanophos apply innovation in wood-based panels. Chimar is actually providing the global wood-based panel industry with state-of-the-art technology for the products. A similar synergy also exists within the machinery. Eco-efficiency and sustainability, new materials, innovative adhesives, novel machine parameters and enhancement of mechanical processing are some of the areas woodworking firms invest for innovation.

According to Smith (2008), forest-based industries could benefit from cluster approaches which facilitate close cooperation between businesses, research communities and end users, offering a platform to overcome resource limitations due to the fragmented structure of industry and contributing to improving SME innovation and potential for growth. The potential for growth and jobs in these industries provides particular opportunities for the development of underprivileged, rural and peripheral regions in the EU where many related specialized skills are often concentrated.

Important issues for the future of both European and Greek woodworking industries, are wood availability at an affordable cost since there is a shortage of wood at global level, competition with bio-energy, certification/ sustainability issues, recognition of carbon storage in wood products, the problem of formaldehyde/VOC emissions, as well as standardization (Ladislaus Döry, key speaker at Hannover Wood-Based Panel Symposium, 2014, European Panel Federation (EPF) president)

Furniture companies are less innovative than woodworking ones regarding technical innovation. Knowledge evolves mainly around aesthetic, design and fashion related issues and focuses on creativity and strong image building. Yet, process and product innovation is evident in the undertaking of lengthy processes of restructuring and modernization, development of sustainable production methods and novel business models (e.g. modular design). Major factors of competitiveness for the sector consist of research and innovation along the whole value chain and mainly material and fittings, skills and quality, design and fashion. However, design is still underdeveloped referring mostly to creative imitations or improvements. It should be mentioned that actions such as replication of new furniture design mainly from European countries (Italian, Spanish and Swedish design) had not been considered as innovations.

At a European level, the furniture industry has presented a significant reshape mainly by integration activities and economies of scale; companies like IKEA and Habitat have managed to reach mass markets. However, according to Hirsch-Kreinsen (2011) "European competitiveness has been based on rapid product and process innovation, and the transformation of furniture into a flexible, design-based and knowledge-based production system. Recent research has shown that learning in furniture rests on local innovation systems, characterised by inter-firm collaboration, good quality regional infrastructures, access to high-grade design resources, and highly skilled labour forces".

Greek wood and furniture companies are not considered as innovative even with the Schumpeterian concept of innovation (Karagouni et al., 2010). Sector-specific research studies on innovation indicate the poor rate of innovating (Karagouni et al., 2009; Karagouni et al., 2010).

Two empirical studies covered the region of Thessaly in the frames of the Innovation Pole of the Region. The results showed that the improvement of existing products and the purchase of process innovation were the only innovation acts by a rather limited number of companies in Thessaly (Trigkas et al. 2008, Karagouni et al., 2008).

Manufacturers' main innovation strategy consisted of efforts on further *development* of their products; individual product components were improved and changed regarding materials and quality. However, the structure and the technological principles of the products remain unchanged.

A second innovation strategy was characterized by innovation measures directed at *securing and improving the sales market position* of the enterprise, such as the fashion-oriented design of products, the functional and technical upgrading of products, a rapid response to changing customer wishes, market niches, branding strategies and the expansion of product-related service activities.

A field research in Macedonia proved that companies innovate when they are prompted to enter an EU programme and use innovative products (e.g. new materials) mostly in W. Macedonia. The majority had less than 10 employees and occupied less than 1000 m2 (Papadopoulos et al. 2007).

Karagouni et al.'s (2009) research covered wood and furniture companies all over Greece and indicated only an 18% of innovative firms in the sample, considering the fact that - according to the European Innovation Trend Chart; - a firm is innovative when its innovation rate is greater than 20%. The companies were characterized as

Innovators if they presented one at least innovative movement during the last three years before the field research. Improvement of existing products and the purchase of process innovation were assigned as the only innovation acts by a few companies in Thessaly, while the pilot use of new or improved raw material or semi-finished products was observed mostly in W. Macedonia. Conventional Innovation may refer to the development of equipment (from conventional to CNC- AMT), the import of design systems (CAD), the application of CIM and MRP in certain cases, as well as the first use of new or improved raw material of semi-finished products.

In their paper on the economic efficiency of W&F sectoral innovation system in Greece, Trigkas, Papadopoulos and Karagouni (2012) state the absence of a strategy in the sectors with regard to innovation, and utilization of the relative expenditures.

Innovative activities observed in Greek wood and furniture sector:

A. New Products Development - Technology : New technology-based products appear mainly in the woodworking industry while the furniture industry exploits their potential. According to Clark (2012) "We are seeing today a tremendous proliferation of useful and innovative wood-based products, with new ones being invented or discovered all the time". NPD turns mainly around:

1. Exploitation of waste and by-products of timber in the productive process, in order to gain added value by importing by-products in the productive process. They usually employ methods for the effective application of technology or the use of materials that have been developed abroad. They contribute to the opening of new markets and the configuration of ecological profiles.
2. Innovative products that owe their creation to the development of machine technology (e.g. parametric cutting, new techniques of welding and format of wooden surfaces etc).
3. Many sawmills have invested in additional finger-joint capacity over the last few years due to the ease of integration, low market-entry barriers and the synergies with their traditional business.
4. Innovative products that owe their creation to the development of technology of timber (stratification of fibres in MDF, new methods of refrigeration, replacement of old wooden material in furniture etc) with final contribution to the reduction of consumption of energy, the protection of environment, recycling and saving of materials, improvement of quality.

5. Innovative products that owe their creation in new materials (p h. Honeycomb, WPC, pellets) and in technologies of recycling (very recent research of the Technological and Educational Institution of Thessaly, Department of Technology and Design of Wood and Furniture on new technologies of recycled wooden surfaces and new materials with variety of attributes and uses (pharmaceutical, decorative etc)), new types of cross-laminated timbers (CLT), newly developed products such as Brettstapel, Holz100 or Appenzellerholz are gaining market shares, especially in central Europe (Bresta, 2012; Kolb, 2008)[72].

Categories 1-4 also contribute to the creation of niche markets.

6. Collaborations for production of "intelligent" furniture and furniture for persons with special needs (eg relative innovative products in the "XL" enterprise)
7. Adoption of patents main of German or American technology for improvement of existing products in the Greek market (e.g. in the sector of frames and materials)
8. Reverse engineering on innovative furniture products from abroad.
9. Equipment: Introduction of CNC machines and CAD (Advanced Manufacturing Technologies) from 1998 until today, which led to new production processes concepts.
10. Specialised solutions on existing production and technology problems.

<u>B. Processes</u>

1. New control methods such as the traceability of products from the beginning to the end of its production value chain. The characteristics of the relative certificate incorporate elements as the rational management of forests, the raw material transport and overall treatment, the distribution and sales.
2. Software development for the improvement of output degrees for saw wood in combination with CNC (Computer Numerical Controlled) machines, automatically regulated so that the optimal cutting is achieved (quantitative and qualitative output improvements).
3. Adoption of modern methods of production organisation (with exploitation of CAD and CIM).

[72] Switzerland is the main contributor to the development of many innovative wood engineered products (Holzkurier, 2012).

Technological, market and institutional determinants

The sources of technological changes are often found outside the sector, for example, in the wood processing machinery, IT services, paints and lacquer. Most of the changes towards high-speed automation already took place 1 decade ago. The production processes in most furniture producing firms have not witnessed any significant changes over the last decade. A robust automation process has taken place in the kitchen and office furniture. CAD/CAM techniques are standard in big companies but are also introduced in SMEs, increasing the overall level of flexibility.
The evolution of EU regulations pertinent to the furniture sectors over the last 15 years is characterized by growing importance of the four main areas: a) Consumer rights and labelling; b) Safety at work; c) Environmental issues, and d) Product safety, mainly children's furniture and fire behaviour.

Environmental concerns have become overwhelmingly important. The use of water paints, powder paints, foams and polyaminates free of CFC are all examples of innovations carried out by the furniture sector due to tightened environmental norms and regulations. Efficiency has become a major source of cost control due to rising energy, water, and similar costs. This has also spurred innovation processes geared at process improvement, process redesign, and integration. However, these improvements offer little potential in terms of consumer added value.

In general, the most important determining factors are found to be:
(1) Suppliers of equipment: Especially the introduction of CNC which was one of the most important differentiating factors in the period 1998-2008, followed by the supply of multiple CAD programmes. This is a point for all of the companies. In some cases standard machinery is used, here one may talk of a transfer of embodied (or reified) knowledge. But in other cases the technology is either tailored (e.g. in the case of "trypani S.A."), or at least adapted to the companies needs (in most cases, since most companies produce tailor – made products).
(2) Suppliers of components and material: Big foreign companies innovate in producing new materials (wood composites, plastics, new types of components etc) and promote them in order to be used in new end products and create new niche markets (e.g. the *Honeycomb* of "Rehau" which promoted a new type of light and flexible furniture)

(3) Foreign competitors: in order to compete imported products Greek furniture makes follow reverse engineering in order to promote similar or improved products (e.g. the new types of wood leafs overlapping). The copy of foreign design is not considered as an innovative action.
(4) In some cases collaboration in R&D activities plays a part but these are not described as a trigger for change. As a general rule they were only started to support a planned innovation project (e.g. K-clusters in the INVENT EU project). This has to do at a great extent to their networking to Technological Institutes and Universities and local Development Agencies and Chambers. Proximity seemed to play an important role, since companies that have revealed some important innovation action are situated around the Technological Institute of Wood and Furniture.
(5) Main drivers of both product and process innovations: customer or market demand and regulatory incentives or requirements: The increase of imported furniture and the high competitiveness of the sector force producers to find new ways of keeping their share in the market (above mentioned). Environmental incentives led to the new ways of exploitation of waste and by-products and a focus on energy consumption. Customers (usually retail –stores that transfer customer's wishes and regulatory requirements) press for specialized solutions (e.g. the paints problem which led to the need for ecological paints, the percentage of Formaldehyde in furniture etc, the FC regulation etc).

Business culture is very important – and especially the entrepreneur's own culture and vision for any innovation action. Access to funding and the ability to cooperate with Technological Institutes promote the innovativeness of the companies. European standards and laws impose sometimes the need for innovative solutions (e.g. the percentage of Formaldehyde in furniture etc, the FC regulation).
Furniture companies that have taken part in innovation activities pointed out decidedly negative political factors such as high costs, particularly labour costs and taxes, or an inflexible and restrictive state bureaucracy. Access to funding is rather difficult and there is mistrust for private consultants and governmental structures.
Another problem that entrepreneurs with fresh innovative ideas confront is consumers' responsiveness to new products or services. The small size of Greek markets and people's mentality –all over Greece excluding Athens - is a very strong reason for their discouragement and holding back investments in innovation.

Relevant actors and constellations of actors

The main actors in promoting innovation in wood and furniture sector in Greece are:

- the Department of Technology and Design of Wood and Furniture of the Technological and Educational Institution of Thessaly
- the Institute of Technology and Management of Agricultural Ecosystems
- Big wood processing companies such as AKRITAS, and PINDOS and a number of wood and furniture companies that have long-term cooperation with the TEI of Thessaly (e.g. ALFAWOOD, KARWOOD, INTERSCLA A.B.E.E. MONDO PORTA E.P.E, SYLOR S.A etc)
- chemical companies (e.g. A.C.M. Wood Chemicals Ltd which develops and produces resins and resin additives for the manufacturing of wood products), Chimar, Nanophos S.A.
- financial institutions
- ELKEDE, a modern centre of technology and design that provides services in the sectors of shoemaking, leather, textile, apparel, timber and plastics.
- Architects and the School of Architecture of NTUA
- Foreign companies of raw materials, components and equipment
- EU projects and the partners involved

Other scientific areas that are involved (but not in the Greek case of wood furniture innovation activities) include use of new materials and design concepts (a suggestion could be that the relevant Schools or Departments of Greek Universities could get involved), chemistry and chemical engineering, Mechanical and Electronic engineering, forestry, metallurgy, global positioning systems (for the wood selection and traceability), safety systems, Computer systems and the wide range of IT applications (with a great focus on 3 –D design- CAD/CAM design systems) which rest on computer architectures and specific programming research and development.

Weaknesses

According to the above field research and sectoral experts, main weaknesses of the enterprises are the lack of specialised technical personnel, the quality of raw material, big lead times, lack of work organization, weak promotion of products, high expenses, and the misuse of subsidized programs, and the distribution networks. Introversion

and lack of vision and conscious strategy formation are weaknesses that were highlighted mainly due to the significant socio-economic crisis in Greece and the market suffocation.

A core problem for these companies is also the lack of general and specialized information. This can be considered among the main reasons that firms still fail to understand and adapt to the new business environment, as the later is henceforth shaped at a global level and is crucially marked by the explosion of new economy and the knowledge and information society (e.g. Karagouni and Papadopoulos, 2007; Trigkas et al. ,2012).

Excluding the new generation who start entering the sector, the medium entrepreneur's educational level is very low (primary or secondary education for a small percentage). More producing units occupy less than 1.000 s.m. with mostly conventional equipment besides a sharp rise of CNC machinery in the period 2000-2005. Quality control is totally unknown or mistaken even as a concept by the bigger percentage. However, the last five years the sectoral context starts changing by becoming more knowledge-intensive; new entrepreneurs or successors have a higher educational level, develop a more extrovert view and turn to innovative and knowledge-based strategies.

Furniture companies that have taken part in innovation activities pointed out decidedly negative political factors such as high costs, particularly labor costs and taxes, or an inflexible and restrictive state bureaucracy. Access to funding is rather difficult and there is mistrust for private consultants and governmental structures. Another problem that entrepreneurs with fresh innovative ideas confront is consumers' responsiveness to new products or services. The small size of Greek markets and people's mentality –all over Greece excluding Athens - is a very strong reason for their discouragement and holding back investments in innovation. However, surviving furniture manufacturers still think positively of the future and start seeking collaborations with institutions and individuals with specialised knowledge (although they do not trust the consulting companies) as well as new markets.

The national business environment together with global changes of the industry in the time period after 2000 seems to press the increasingly tightening market competition for the Greek W&F industry. Globalization caused fiercer competition as well as new challenges from both traditional rivals and emerging ones such as the development of

innovative materials that substitute the established ones[73]. Woodworking industry has embraced other technologies and sciences such as chemistry and biological sciences. Novel composite materials respond to ecological issues and natural wood shortage. Such developments strengthened the positioning of multinationals and imports while imposed pressures on the Greek relevant producers. Large established companies reacted with relevant innovations; yet they cannot assure competitiveness in today's vulnerable national and global hostile environment.

Trends such as demographic shifts, environmental awareness, and new lifestyles have also had a significant impact on the furniture industry spurring both product and process innovation such as the eco-design, the "intelligent" and "smart" furniture, engaging other industries as well (micro-electronics, ICT, nanotechnology etc). Once again Greek firms are just followers thus loosing the relevant advantages. Still pressures such as environmental restrictions and arising sensitivity have led to production methods restructuring. Incremental innovations including advanced CIM systems were eagerly adapted to enhance competitiveness causing a real revolution in product technologies to suit novel design trends in the first decade of the new millennium. Unfortunately, even in this area the Greek furniture sector has no reputation being overwhelmed by Italian, Spanish or Scandinavian design. *"Now that the domestic market is dead, we are not ready to go out, since we have not developed any capabilities to cope with our foreign competitors".*

Moderately paced changes at technologies, products, market development and competition combined to pressures for environmental sustainability by EU regulations, government and groups create a rather ambiguous environment for the Greek W&F sector. Easier transport, competitors with lower prices (economies of scale), faster deliveries (advanced logistics) and established design treat to share the Greek market pie while export numbers show major weaknesses of Greek producers. Environment is far from stable, especially when considering the Greek economic recession and its effects on furniture as durable goods and the collapse of building activity.

5.3.1.d. Foundation trends

[73] Wood based or just composite as mentioned above.

The last five years there is almost no tendency to create new wood and furniture ventures; this is mainly due to the severe socio-economic crisis and the dramatic decrease in furniture consumption since 2008. On the contrary, there was a significant shrinkage; indicatively in the 2009-2011 periods it reached a percentage of 36.8% causing a loss of almost 15.000 work positions. Among the firms that failed to cope with the crisis are also big ones, leaders in their sub-sectors with a long business history in Greece at local or national level.

It should be however mentioned that the number of furniture companies was too big for the Greek reality especially if we take into consideration the fact that exports were rather negligible. This had already caused a slight decrease of the total number of manufacturing companies, in absolute numbers, even in prosperity times; i.e. from 1999 to 2007. Registered new firms are actually due to changes to partnership types or when family businesses are aliened to descendants or even are split to more parts when the successors do not wish to go on together. Since most companies are family owned, there are also some cases of company takeovers, when the entrepreneur decides to retire.

Indicatively, in Attica 12% of the registered companies were founded after 2000, with the 50% of them to be individual companies and 25% of them to deal mostly with services and kitchen installation.

According to 2013 reports, significant leading companies such as Sato[74], Neoset and Uccello failed to restructure in time and were eliminated. Some other leading manufacturers or long history turned to exports such as Varangis, XL-furniture and Proteas, while some small companies took a better share of the middle market segment. Today (end of 2014) most wood and furniture companies "try to find their pace in the market" (Kefalas, interview, 2013). The Fourlis Group should also be mentioned which appears to gain a significant share of the Greek market as it manages the IKEA stores, further strongly supported by the mother multinational.

Mattresses constitute a sub-sector of the furniture sector. In this category the undisputed leader is COCOMAT. Established in 1989, COCO-MAT, with a growing network of stores in 13 countries, is a recognized leader for natural sleep products (e.g. mattresses, bed-mattresses, pillows,, bed linen and furniture for homes and hotel.

[74] It should be however mentioned that Sato present some recovery in the end of 2014

5.3.2. THE FOOD AND BEVERAGE SECTOR

NACE rev2.2 codes C10 (food products) and C11 (drinks)

The manufacture of ***food products*** covers a number of production, processing and preservation activities which add further value to primary agricultural and fishery inputs. Main product groups are registered the following: meat, fish, fruit and vegetables (including fruit and vegetable juices), fats and oils, dairy products (including milk-based drinks), grain mill products, bakery products, certain types of animal feeds and other food products including bread and biscuits, sugar, various pastas, cocoa, coffee and tea.

The manufacture of ***drinks*** includes the manufacturing of non-alcoholic drinks and mineral waters, of beer, cider and wines, and the manufacture of distilled alcoholic drinks.

A description of the general Industry structure, trends and markets in Europe and sources of information ares given in **Appendix C.**

5.3.2. a. Industry structure in Greece

The Food and Drink sector is the most important and most dynamic industrial sector of the Greek Economy. This could be explained partly because it absorbs the country's agricultural production, but also because of its significant contribution to aggregate economic variables, such as Gross National Product, External Trade and Investments, etc. The sector accumulates 25% of the GNP of the industrial sector, thus taking the first place amongst all the industrial sectors. In 2012 it had a turnover of around 11.2 billion Euros with a value added of 1.4 billions.

In 2014, the industry employed around 26% of the total employees in secondary sector[75]; it actually presented a small increase in employment compared to 2013 from 96587 to 108767 employees, contrary to tall other industries which presented significant decrease. It further accumulated 14% of total investments (including investments in trade and services). In 2013, foodstuffs and wine together make up 35% of Greek exports while according the 520 Barcode Hellas data basis, in 2014 F&B products using the 520 prefix counted for the 68% of the total. There was a constant production increase till 2000 and a decrease till 2004. In 2005 the negative climate changed and the sector flourished again till 2009 and presented significant

[75] In 2013 this percentage reached the 34% but this was due to the decrease of the total workforce in Greece.

resistance to the severe recession. Some indications of weaknesses appeared in 2013-2014 regarding production.

Historically, the Greek food sector is characterized by a very specific dual structure, i.e. the co-existence of a few multinational companies (such as Nestle, Unilever, Danone) which managed to buy out promising national firms (mergers and acquisitions during 1980-1995), the existence of a few large domestic companies (in the 90s) and a plethora of very small and small companies.

Despite its dynamic profile, the sector presents a traditional character and faces the problems that accompany it. It is dominated by SMEs, which are dispersed in the whole country and cover all sub-sectors of food processing and fisheries. There are about 17000 companies of food and drink production (2009), revealing a fragmented and mature industry. 21% of the enterprises were established in the decade 1971-1982, a 37% among 1983 and 1994 and the rest 42% after 1995. Many firms are basically local market oriented and are not able to reach larger scales and profitability because of limited internal markets. 84% of the firms occupy 0-5 employees half of which are only primary school graduates. There is a 9.7% with 6-10 employees, 5.8% with 11-50, 0.5% with 100-500 and only 18 enterprises with more than 500 employees. About 53% is occupied by seasonal employment in canned fruits and vegetables enterprises. The two larger companies are ELAIS UNILEVER HELLAS SA with a turnover of 451.332.132 in 2013 and COCA COLA 3E with 416.000.000. It should be mentioned that multinationals constitute a significant share of the large F&B Greek firms.

However, it appears that crisis affected F&B firms as well. In 2013 there are about 1180 companies of food and drink production which publish balance sheets (SA, Ltd) instead of 1467 in 2009. However, there was an increase from 2012 (1079 companies, ICAP, 2014)

Greek F&B enterprises try to benefit from the reduction in agricultural raw material prices and modernise so as to achieve lower production costs and high quality products. They also invest in innovation of all types and enter markets all over the world. They have benefited from the proximity of the Balkan ex-socialist countries by exporting to these markets and by undertaking investments there. Areas of particular importance for the Greek economy are: olive oil, edible olives and pickles, wine and ouzo, cheese and yoghurt, canned fruits and fruit juices, processed vegetables

(especially tomatoes), dried fruit (especially raisin) and nuts, fisheries and aquaculture and traditional desserts and honey.

5.3.2. b Market structure

The food and drink manufacturing industry is characterized by significant diversity; it is made up of a number of product sub-sectors:

- cereal products (biscuits, bread and bakery products, breakfast cereals, cakes, desserts and cake mixes);
- beverages (including tea, coffee, soft drinks, alcoholic beverages, fruit juices, mineral water and spring water);
- confectionery and snacks;
- fish and fish products;
- fruit and vegetable processing (jams and preserves, herbs and spices, sauces and condiments, and salads);
- meat processing and meat products;
- oils and fats, margarines and spreads;
- poultry and poultry products.
- Milk and its products (mainly cheese and yoghurt)

In 2013-2014, the top 5 sub-sectors were: bakery and farinaceous products, meat sector, dairy products, drinks and 'various food products' category. This group represents 75% of the total turnover (with the meat sector to own the 20%) and more than four fifths of the total number of employees and companies (Food-drink Europe, 2014).

Figure 5.5: Breakdown of the composition of the 'various food products' category (%)

Other products	turnover	number of employees
Cocoa, chocolate and sugar confectionery	30	32
Tea and coffee	13	11
Prepared meals and dishes	10	16
Sugar	10	5
Others	37	37
Various food products	100	100

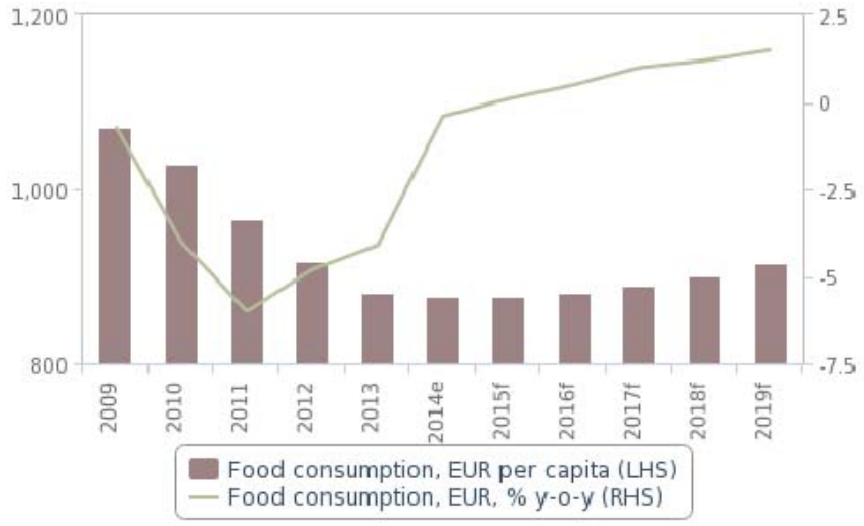
The industry also produces a range of specialist products for a range of dietary requirements, lifestyle, religious, cultural and personal preferences – infant formula and weaning foods, organic products, meat free meals, soya-based products, etc.

F&B products constitute a stable EU household expenditure, ranking second after housing, water and energy. Indicatively, the relevant share in EU was the 14.6% of a household's expenditure. Greeks spent a percentage of around 18% in 2012 on food and beverages.

There are 5 sub- sectors that cover the 74.5 % of the total food and drink production in Greece: canned fruits and processed vegetables (especially tomatoes), dairy products and ice cream, bread and bakery products, snacks and pasta, as well as drinks. EU -27 constitutes the basic commercial partner of F&D industry since the 67% of Greece's exports are directed to European countries and visa – versa; it is the main supplier of the relevant products. Italy with a percentage of 22,7% is the first export destination followed by Germany with 16,8%, G. Britain, the USA, Spain and Cyprus with less than 10% each. The 40% of exports comes from North Greece. The sector constitutes further the main exporting industry for the regions of Thessaly, Peloponnesus, Crete, W. Greece, Epirus, N. Aegean and Ionian Islands. The sector does not suffer from imported products as much as other sectors. In 2006, only the 33.8% of consumed food products were imported. Greece imports mainly from Holland (about 17%), France, Germany and Italy. Greek F&D Industry presents a commercial balance deficit with EU countries, while there is a surplus with other countries. Actually, Greece:

- is the Number one supplier of 43 agricultural products in 12 countries
- owns 28% of the world market in feta cheese,
- is the largest global producer of bream and bass,
- is among the top ten world producers of fruit, vegetables and oil

Figure 5.6: Food Consumption



Source: BMI Research, 2015

The market trends according to Mr Konstadinidis (speech on 2/11/2009, FING's conference, Industry 2020) at both global and national level are:

- Increase of demand in the developing economies, specifically in the Far East because of income increase and a new way of life based on the western models
- Turn of consumers in new and healthy products
- The markets function in an open world network of products, distribution networks and investments
- Increased opportunities in the EU market but also in the developing markets
- More powerful competition than developing countries become stronger competitors since they increase rapidly the added value of their products
- Concentration of research and innovation in the very large enterprises
- The economic crisis: opinions are conflicting since according to some recession affects negatively many innovative enterprises of the sector (e.g. the case of the Sarah Lee Company) and according to others F&B companies are now betting on innovation (Nicola Hardy, 2009)
- Private Label: it seems to change the F&D marketing landscape and it is empowered by the recent recession

Pressures in the sector internationally:

- Increase of cost because of demands for differentiating, high quality and healthy foods

- Increased requirements of both consumers and legislation on Hygiene, Safety and Protection of Environment issues
- Increase of Cost because of the Change of European CAP, and suppression of subsidies in the rural products
- World concentration and power increase of Distribution Networks
- Pressure on prices from consumers and networks
- The strengthening of euro equivalence.

Pressures especially in the Greek environment:

- The extremely high uncertainty: Greece's placement under the guardianship of the European Union, the socio-political and economic instability have created a very difficult environment for Greek producers and exporters and had a negative impact on the cost competitiveness of products
- the liquidity problem
- High costs because of the small lots and rural production driven by Subsidies
- Bureaucracy, lack of transparency and an overllay weak entrepreneurial environment
- Insufficient Operation of relevant Institutions (EFET, Committee of Competition, Justice)
- Unfavourable payment terms by the distribution networks and Greek state (VAT)
- Absence of National Brand Names and limited promotion strategy in the international markets
- Numerous shortcomings of the support system for Greek exports, such as the lack of a national strategy and a relevant framework to support exporting companies as well as the non-active role of various relevant institutions and bodies.

According to the sectoral expert, Mr Garofalakis, changes in the multi-faceted demand patterns comprise consumer perceptions, attitudes, preferences and behaviour towards new technologies, or dietary regimes. Co-operation between producers and retailers in the innovation process might create idiosyncratic success factors that are vital to firm growth, such as the ability to predict changes in demand immediately.

Yet, as food expert, Mrs Kalesi notes, collaborations are only possible in niche markets, perhaps where technology plays a major role, since large retailers often satisfy demand for new products themselves. Important components of competitiveness in the sector are product differentiation, marketing and packaging.

The fact that consumers (in Greece and worldwide) turn to *more healthy products* was pointed out by an example given by Dr Lalas: Greek consumers are turning away from carbonated soft drinks which are seen as unhealthy and instead drinking more juice based drinks, functional drinks and bottled water. Greece is a major European producer of fruit and the fruit juice segment has particular importance. Coca-Cola Hellenic owns Amita, the leading Greek juice brand, and in 2007 the firm launched new flavours and backed the brand with a new marketing campaign. This followed the launch of Amita smoothies in 2005 and a version with added anti-oxidants in 2006. These innovations that offer health and functional benefits, are likely to be one of the key reasons why the firm has returned to growth over the last two years.

Besides the above mentioned concerns, other **challenges that have been stated as quite important ones at global level** refer to availability of raw material, competition on prices, increased regulation, health and traceability and high costs of product and process innovation. The contradiction between taste and health constitutes a significant challenge regarding innovation. For example, *molecular gastronomy*, based on the scientific biochemical and physical dimension of cooking, has created totally new tastes.

Experts have also highlighted the fact that within the EU, the number of people aged over 80 years is estimated to increase by over 30% over the next 50 years. This suggests that the food and drink industry must produce innovative foods, high in nutrition and that will improve the quality of life and add years to life[76]. An interesting food section concerns "preventive food" such as *anti-aging* or *healthy-aging*. Children, ethnic groups and disadvantaged consumers constitute important target groups.

The growth of urban population against the rural one in 2010 worldwide[77] is predicted to lead to increased demand for F&B products that will reach an increase of 70%.

[76] This has led to the introduction of a new profession and namely the one of gerontological nutritionist.
[77] According to exert predictions, in 2050, two thirds of the world population will live in citis.

Furthermore, China is projected to surpass both Europe and the USA by 2030, becoming the largest economy in the world (Food-drink Europe, 2014).

5.3.2. c Innovation trends in Greece

The OECD classification classifies the food and drink industry as "low tech" because of its low R&D expenditure, the mediocre number of patents[78] and the low share of turnover from new-to-market products. However, the strong links with down- and upstream sectors from agriculture and packaging, to logistics, robotics and life sciences offer a wide potential for innovation.

> "The sector is caught between novelty and tradition. In contrast to all other products, foods and drinks are ingested, healthy or unhealthy, from infants to old age, which calls for rather unique requirements for safety and health. But also other dimensions like taste, consistency, olfactory properties play a role along with ethical, religious and psychosocial aspects. The product palette from the food and drinks manufacturing industry ranges from niche and traditional specialty products to highly innovative and modified ones like convenience and functional foods and drinks. Also the customer preference for foods and drinks spans a very wide spectrum that ranges from fast food to slow food, from vegan to meat specialties, and from innovative "organic" drinks to the latest alcoholic cocktail innovations."
>
> *(Europe INNOVA, 2011)*

Till the mid-nineties the Greek F&B firms and mainly the group of the small ones, did not own any specific capabilities to survive in global environments, showing almost no propensity to innovate. In the late 90's cheap sales of major agro-material in combination to the intensifying competition caused the industry to focus on value-adding perspectives. The past 15 years have seen **a marked increase in the number and variety of products trying to cover all tastes and dietary trends and to offer more nutritional benefits**. However, in the IOBE's sectoral report of 2004 the sectoral introversion together with the fact that products were intended for the domestic market was marked as a major concern; the very small size of the Greek market, besides the large share of the native producers, was also dominated by powerful multi-nationals with lower prices, better-organized promotion and marketing, more R&D and other privileges.

The new millennium finds Greek F&B industry in a restructuring orgasm; small firms turn to knowledge, innovation, niche market creation and extroversion. Entrepreneurs

[78] However, there is a considerable use of trademarks and design registrations.

realize the potential of the Greek agri-products, their nutritional value, complementarities to other sectors and their products, the power of modern marketing and design and so on. However, relevant empirical research (e,g, Manthou et al., 2005; Matopoulos et al., 2007) revealed that Greek F&B companies were rather late adopters of new technologies including Internet and ICT-based applications. Among them, "hidden champions" would present innovation along the whole value chain (e.g. Voudouris et al, 2000)

Even today, while the great majority of Greek companies involved in F&D sector are SMEs with a dynamic profile and various technological and R&D needs, they have not yet familiarised themselves with the idea of initiating, or simply participating in R&D activities. It is worth mentioning that the great majority of these companies do not have a dedicated R&D department mainly due to their small size. Furthermore, these enterprises have presented a rather cautious attitude towards the adoption of innovations that prerequisite research for adaptation in their manufacturing procedures, as well as towards the participation in EU's RTD programmes that prerequisite co-operation with research organisations or other similar enterprises. However, according to Mr Garofalakis this status is beginning to change and an increasing number of enterprises, especially the bigger ones but new firms as well, are interested in carrying out research and implement innovations while they are usually interested in global niche markets. The critical areas for innovation in the Greek food and drinks sector could be summarised as follows:

- Food Quality and Safety
- Implementation of new technologies in order to improve quality, extent product shelf life, increase productivity and minimise cost
- Development of new products to cover a wide spectrum of niche markets as explained in detail such as nutrition, pleasure, highlight of the Greek origins, value added through design, marketing and special properties etc.
- The "Mediterranean diet" increasing trend worldwide
- Environmental issues
- The creation of "boutique" and "niche" markets

According to Dr Garofalakis, the drivers of innovation in Greece are the needs of market and least the technology. The significance of the food safety, the prevention of food crisis and the emerging hazards push food industry to adopt new production technologies as well as new organisational schemes. Innovation is "pushed" by

consumers either directly in very small companies or through retailers, special sector press and trade shows. Consumers demand quality, safety, health and differentiation. It is also driven by legislation and needs for production improvements. Up to 2005, the trends of innovation in the Greek F&D sector concern mainly organizational innovations, renewing processing lines and equipment, adoption of control technologies in processes and contaminants. Today they involve development of new products as nutritional improvements, functional genomics and nutracetical, development of technologies in tracking and tracing and adoption of Information Technologies for food chain management. Greek firms invest in our past (retro-innovation) and the variety of nature-given products (e.g. the "Tuvunu" product[79] which is nothing more of the well-known to Greeks mountain tea).

Development and implementation of obligatory systems (i.e. HACCP – ISO 22000) and other Quality Management Systems have also a very positive impact on companies' ability to adopt innovation and technological changes. Regarding non technological innovation, companies change their organizational structure since they need to follow concrete requirements when they try to enter new markets or when the young generation with fresh culture take over a company's management.

Issues about 'quality and manufacturing', 'food safety' and 'food and the consumer' are seen by far the most important ones in terms of a strategic vision of the sector's companies, suggesting innovation challenges related to technological competition, both what kinds of technologies needed and where such technological competition will happen. The priorities also express the importance of the vital relationships towards the consumer and of the credibility of the sector.

All experts agree that competition and legislation are the most important determinants for innovation, while high costs, bureaucracy and time consuming processes hinder it. Greek F&D companies are rather reactive than proactive. They are engaged in some innovative action to solve an important problem, confront a new competitor or react to a legislation that can hamper the company's further development. Environmental protection, information systems, storing and distribution technologies are some of the most common innovative steps of medium and small companies in the sector.

In the Greek Food and Drink enterprises, the **restrictive factors** for the development of innovation are the traditional forms of administration that are not familiar with

[79] I t was introduced in 2012. Within a year its demand increased rapidly in the USA, Australia, Japan, Sweden, France, Germany, England etc.

innovation and its needs and the small margin of profit of enterprises. Actually there is limited will of the smaller companies to develop and apply innovations, since there are also limited resources (human and financial) for its application. Innovation and relative funding programmes are considered to be the privilege of large companies of the sector such as Vivartia, Giotis, Elais – Unilever etc. Other obstacles mentioned by the experts are the difficulty in consolidating the patents that concern new processes or new products, the apparent limited effectiveness of the research related National and European programs and the distance between Universities and Research Centres to the needs and demands of the industry. Lack of information, funding sources and specialized personnel, time-consuming processes and cost of innovation are also referred as important problems. According to Dr Kouretas, professor of biochemistry and biotechnology, the sector is faced by several regulatory and legislative constrains, which is also a hampering factor for innovation.

When it comes to product innovations in the sector, consumers are increasingly looking for organic, high quality, healthy and life style products, suggesting innovation challenges for the industry. In order to satisfy customers' further needs, producers are compelled to interact with consumers to a larger degree suggesting an intensive use of communication. This direction has been followed by many Greek producers according to Dr Garofalakis who give to consumers new flavours (e.g. lemonoil by Biolea), new concepts (e.g. "fresh salads" by Barba –Stathis), fructose chocolates (Kohyli), products with low fats or enriched in Ω3, Ω6, bread without crust and new products to Greek markets such as ostrich and bison delicatessen.

Companies usually seek to improve quality and lead times, product differentiation, productivity rates, flexibility, environment protection and health and safety. Non-technological innovations related to communication, training, distribution etc., are similarly important for the sector in order to cope with prospective innovation challenges. There has been argued that a challenge for the food and beverage industry is how to optimise linkages to the technological developments within chemicals, biotechnology, pharmaceuticals and electronics industry. In order to meet this challenge the sector must engage actively in research networks and pan-European initiatives especially with the health and technology sector. Large F&D companies are

already using EU programs for such purposes, while the small ones are rather suspicious and negative, especially when there are no direct financial benefits.
According to Dr Lalas, ICT (as a generic technology) is an important part of food distribution and is increasingly being used to improve efficiency in all steps of the production, processing and distribution of food. The use of ICT and e-business is opening up new channels for marketing and distribution of niche products. ICT are increasingly being used to improve efficiency in all steps of the production, processing and distribution of food. In particular, food retailers are able to gather vast amounts of information about consumer preferences that can be used to determine the kinds of foods that the food manufacturers produce. Similarly, both retailers and manufacturers will exert increasing influence over farmers.

According to the experts **conservatism of food consumers** is seen as an innovation challenge by the sector. Consumer unwillingness to accept highly innovative products, makes food and drink companies unwilling to exploit the opportunities offered by radical technologies such as biotechnology. However, if radical innovations are followed by proper conditions related to price, branding, information and health benefits and sensory qualities of foodstuff, the consumers are not that critical. Dr Kouretas talked extensively about the three very innovative fields in the food industry in the area of genetically modified organisms, functional food and organic food, which although experiencing different obstacles and drivers, represent market opportunities.
Dr Kouretas refered to 'functional foods' which have ingredients (or 'nutraceuticals') incorporated within them to give specific medical or physiological benefits, e.g. spreads that reduce cholesterol or pro-biotic yoghurt drinks. The 'functional' ingredients positions Functional Food in a transitional zone between food and pharmaceuticals and, as such, to differing regulation regimes. Due to the novel character of functional food, questions arise concerning the safety and efficacy of such products and - their impact on consumers' nutritional behaviour. Myloi Kaplanidis in Serres has already launched flours without glouten and presents as a global innovation biofunctional flours. Research is going on with Vivartia (the second spin off is going to be very soon established) referring to innovative yogurts, while a research project is going on with Wine Cooperative of Tyrnavos.

Agriculturally-oriented companies are usually interested in process innovations that minimize energy costs or reduce the waste of raw materials. On the other hand, consumer-oriented firms manufacture more highly processed ***convenience foods***, such as breakfast cereals, biscuits, chocolate and sugar confectionery, from inputs that are typically produced by agriculturally-oriented firms. Such companies are likely to be interested in innovations connected with new preservation or packaging techniques that extend shelf-life.

Dr Gemtos, talking about **genetically modified organisms** (GMOs) and derived novel food products as new developments in the area of food production and food processing, referred to the intensive public debate on proceeding globally concerning the safety of genetic engineering and derived novel foods. Besides traceability, Dr Gemtos referred to innovations regarding package, innovative production methods and sensitive food life prolonging, underlining the fact that these innovation gave birth to many knew knowledge-based companies (Terra Creta, Georgein), two spin – offs and extensions of existing companies.

Organic food represents another market opportunity for Greek food producers and is highly supported by Dr Gemtos. The conversion to organic agriculture includes high technical, market-related and financial risks for farmers, suggesting the need for additional financial incentives – as have been implemented in the EU. There is a fast-growing demand for organic products in the USA and EU with organic bread, bakery products and vegetables to hold a dominant share in the relevant markets. The organic market is actually considered to be the fastest developing and highly competitive market.

Dr Gemtos is the one to mention the mistrust[80] among producers and retailing and believes that the mean Greek F&D company are not interested in exporting. Referring to the lack of communication among universities and production, he claims that technology diffusion and exploitation should be realised by intermediate specialized agents, since research personnel invents technology and makes it known in many ways but has no resources (time, money and human capital) to deal extensively with it. On the other hand only large food companies turn to experts for innovative movements.

[80] It should be mentioned that trust constitutes an essential element in F&B business. Trust gaps in the sectors are particularly large in Spain, the UK and France (F&B report, 013-2014)

Dr Govaris points out that the agro-food industry recognises its role in the prevention of life-style related diseases (obesity, coronary and heart diseases and type 2 diabetes) and thinks that the regulations relevant for the introduction of new products in the food sector have more negative and less positive impacts. According to him, process innovations are only one element in guaranteeing safe food; the total value chain of food processing must be taken into account.

All experts underlined the limited networking and cooperation amongst the R&D infrastructures relevant to the sector, as well as the limited coordination and planning for the opening of new markets and the development of common industrial projects.

Indicative efforts to boost innovation mentioned are the large-scale European Technological Platform "Food for Life" (May, 2009) and the CAPINFOOD (March, 2011) or smaller and more focused ones such as LACTIMED which regards dairy products and the Greek partner is Thessaly.

In sum, innovation has been driven by both crisis and unexpected events. For instance, failures in safety and quality systems supported process innovation via the implementation of quality and production standards. The industry had to face all new restrictions and norms of EU directives; a non-eligible number of regulations for specific food-groups, plant safety and even quality and safety of raw material. These would be rather often be followed by a considerable number of amendments imposing the need of fast changes and adaptations.

In addition, social changes and the severe crisis caused further pressure for more advanced, differentiated products as well as increased sensitivity in environmental care. For example, a Greek response was the development of "retro-innovations" confronting the paradox of innovating based on traditional products, targeting at the same time global niche markets. This effort embraced quality, innovation and environmental respect and met success in many foreign markets.

In parallel, rapid technological advances and science engagement in all sub-sectors mainly of large multinationals enhance competition and cause further technological pressure to Greek food producers as well. With the dawn of the new millennium, a small but constantly increasing number of new firms make themselves known globally with novel products and the opening of niche markets or transcend sectoral borders and enter new areas such as "nutraceuticals", pharmaceutical and cosmetic industries next to bio-functional and super-foods or eco-friendly production methods

and eco-innovation. The firms belong mainly to young, well-educated and extrovert entrepreneurs who devoted substantial amounts of money to R&D (in house or /and through co-operations).

The Greek F&B industry operates within a dynamic environment with changing markets, high competition and constant changes in demand and regulations[81]. Besides the incremental innovation which is still the norm in the industry and the safety of line extension, Greek F&B firms invest in the creation of new areas (which in turn need new regulations) mainly due to science (such as the "biotechnology revolution") or technological (such as the revolutionary technologies in packaging) advances, more rapid rates of product turnover and the internationalization of markets. The F&B industry is one of the most dynamic sectors in Greece which presents a rather positive evolution throughout the years and seems capable to follow the amazing development of the relevant industry at global level. We would claim that the industry is operating within a rather healthy and positive type of environmental dynamism offering quality, innovation and international branding.

It should be mentioned that according to the Invest in Greece Agency (January, 2011), leaders in R&D, innovation and food technology in Greece today, are:

- The Food Industrial Research & Technological Development Company (ETAT)
- The Institute of Agrobiotechnology
- The Institute of Aquaculture
- The University of Thessaly

5.3.2. d Foundation trends

According to the Foundation for Economic and Industrial Research (IOBE), F&B Sector Annual Report 2009 of Eurostat, in the time period 2004 – 2007 there were around 600 new firms established per year. In 2008 there was an investment reduction in the sector due to the expected demand decline.

In the new millennium and within the crisis context investment in the Greek F&B industry is encouraged; in the last ten years new SMEs in Greece target mainly global markets, while many of them export almost all of their production. This is due to a

[81] Demand refers both to new tastes and to further consumers needs for safety (e.g. in terms of microbiology and toxicology), health and well-being (nutritional and health-enhancing properties)

series of reasons, such as the access to the emerging growth markets of Southeast Europe and Eastern Mediterranean through the established production and sales network of Greek enterprises and the well-developed domestic retail / supermarket networks (e.g. Carrefour, AB-Basilopoulos, Lidl). Globalization played a significant role too due to cheaper transport, as a result of the fourth industrial revolution, very cheap information transport and low transaction costs.

Strategic alliances appear to be a key industry priority in the sector either joining forces with the primary sector[82] or as a strategic choice of multinationals. Collaborations are today evident in R&D efforts too. New entrepreneurs are innovative and extrovert; they cooperate with highly specialized research centers and Universities to develop new up-market and high quality products. Innovative business opportunities in order to create value added have been recorded in many product categories in the Greek F&B sector. Indicatively, innovative products (including branding and marketing innovation that are exported are:

- Olive oil in mixtures with lemon or orange juice and marketing innovation
- Honey and nut based snacks
- Macaroni products (e.g. innovative product with snails)
- Marmalades and pickled goods (biological, organic)
- Seafood
- Healthy Mediterranean ingredients

Boutique and niche market goods including: Mastiha, herb products, superfoods, sprirulina and saffron, known for their therapeutic attributes, unique sauces (innovative products or organic products); chocolates and confectionery; cheeses; herbal beverage products

[82] Agriculture accounts for 6% of GDP in Greece (compared to 1.5% of EU-15) besides the fact that its share in total economy diminished in the previous decade.

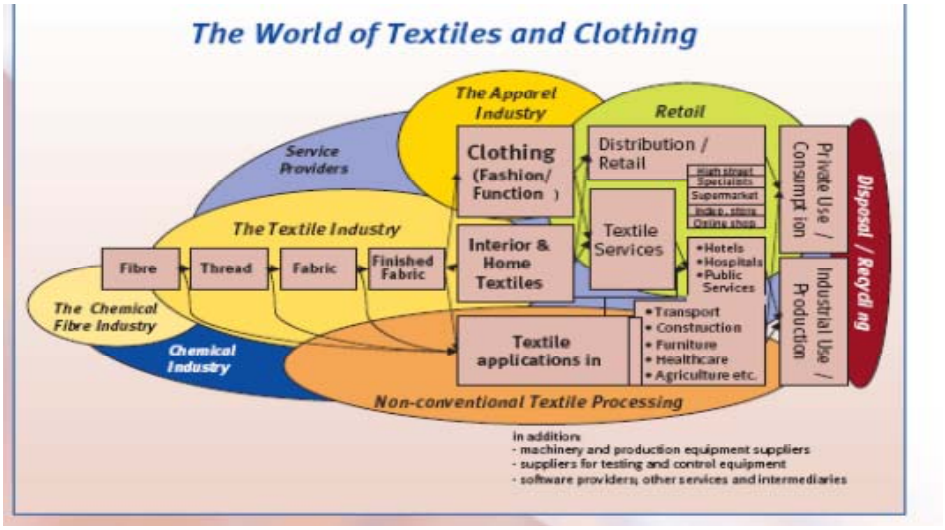
5.3.3 THE TEXTILES AND CLOTHING (T&C) SECTOR

NACE rev2 codes C13 (textiles) and C14 (wearing apparel)

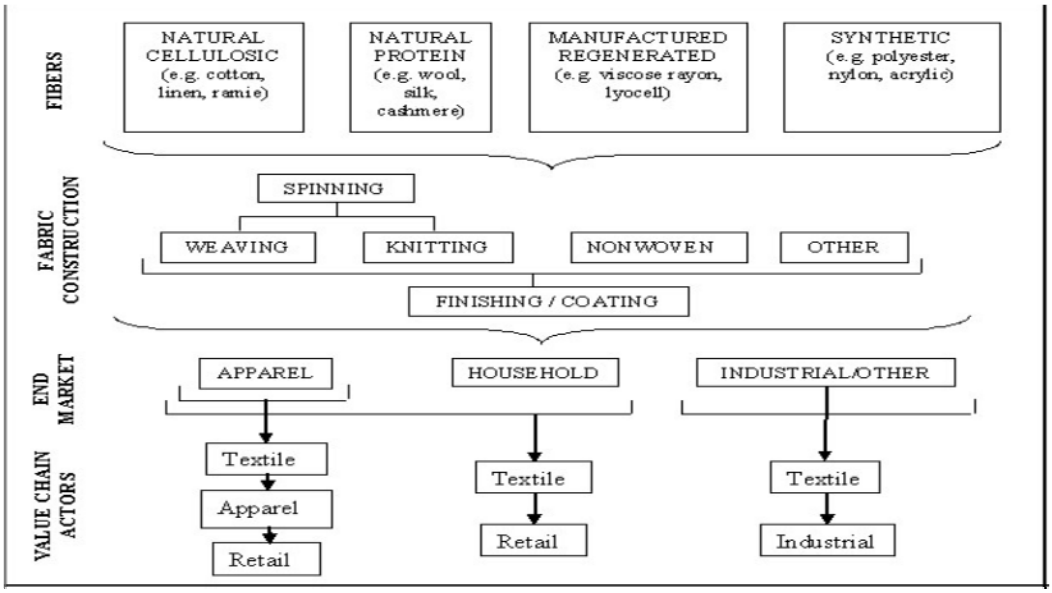
The **Textiles and Clothing (**T/C) sector is meant to comprise the textiles industry as well as its most important downstream 'customer' – the clothing industry. The industry can be considered as a 'value chain' of activities that span from the treatment of raw materials (cotton, wool, artificial fibers) to final consumption of textiles and clothing goods (Figure 5.7)

A description of the general Industry structure, trends and markets in Europe and sources of information ares given in **Appendix C.**

Figure 5.7: The textiles and clothing industry value chain



Source: Tex-Map project (2001-2003)



Source: Gereffi, G. (2005), *North Carolina in the global economy.*

The T&C industry defined here is narrower, following the usual definition of relevant research and sectoral reports and encloses the following economic activities:

a) the treatment of raw materials, i.e. the preparation or production of various textile fibres, and/or the manufacture of yarns (e.g. through spinning).
   - 'Natural' fibres include cotton, wool, silk, flax, jute, etc.
   - Man-made' fibres include cellulosic fibres (e.g. viscose), synthetic fibres (i.e. organic fibres based on petrochemicals, such as polyester, nylon/polyamide, acrylic, polypropylene, etc), and fibres from inorganic materials (e.g. glass, metal, carbon or ceramic).

b) the production of knitted and woven fabrics (i.e. knitting and weaving);

c) finishing activities – aimed at giving fabrics the visual, physical and aesthetic properties which consumers demand – such as bleaching, printing, dyeing, impregnating, coating, plasticising, etc;

d) the transformation of those fabrics into products such as:
   - garments, knitted or woven (= the so-called 'clothing' industry);
   - carpets and other textile floor coverings;
   - home textiles (such as bed linen, table linen, toilet linen, kitchen linen, curtains, etc);
   - technical, or 'industrial', textiles.

e) Manufacture of wearing apparel, leather, leather products and footwear.

Table 5.10 Classification of activities: the textiles and clothing industry, NACE Rev. 2, 2-digit level

NACE code	Activities
13	**Manufacture of textiles**
13,1	Preparation and spinning of textile fibres
13,2	Weaving of textiles
13,3	Finishing of textiles
13,9	Manufacture of other textiles
14	**Manufacture of wearing apparel**
14,1	Manufacture of wearing apparel, except fur apparel
14,2	Manufacture of articles of fur
14,3	Manufacture of knitted and crocheted apparel

The T&C industry is highly related with the agricultural sector for raw material (such as cotton or wool) as well as with the chemical and biochemical industry (e.g. man-made fibres such as nylon or polyester). Design and retailing build a common bracket mainly over the clothing and fashion value chain. However, there are a number of industrial activities and products that are intertwined mainly with the technical textiles, such as filters, optical fibres, ribbons and tapes, insulation and roofing materials, etc.

The protection regimes: The T&C sectors are widely being viewed as the first industrial base from which countries develop economically and thus it was protected in several ways: .first action was taken back in July 1961 known as the Short Term Agreement (STA, June 21, 1961, 19 countries) followed by the Long Term Agreement (LTA, 1962-1973, signed by 29 member- countries). MFA, the new regime implemented on January 1, 1974, provided the rules and regulations for the imposition of bilateral and unilateral quotas. All MFA-phases lasted from 1974 till December 1993. in 1994 ATC (1995-2005) (Agreement on Textiles and Clothing) requiring member countries to gradually release 51% of existing quotas by the end of 2004. The remaining 49% were to be released, all at once, as of 1/1/2005. During the ATC each country was free to choose which product quotas were to be released. Export quotas were to increase at three phases lasting two years each (Dadakas and Katranidis, 2011). The adjustment period was not effectively capitalized either by European governments or by producers. In the summer of 2005, Europe was flooded by Chinese imports of T&C products. A new set of temporary quotas against Chinese products was set for a more gradual transition towards free trade, until the year 2008.

5.3.3.a Industry structure in Greece

The T&C industry developed mainly around cotton cultivation and ginning and has constituted one of the main manufacturing sectors in Greece in terms of production, employment and exports. Greece has been an important textile and clothing region in the European landscape for almost half a century. Especially the Greek textile sector was for almost 60 years the dominant productive industry that offered significant profits to the Greek state. It had a rapid development in the 70s and 80s while it was the main consumer of national raw materials such s cotton and wool. As a major

European producer of cotton[83], the country has enjoyed a high degree of self-sustainability in natural raw materials that countries such as Portugal do not possess. Furthermore, behind protective barriers, firms had built up broad product lines, with no concerns for comparative advantages or market shares. Clothing companies were in their majority established the decade 1971-1982 and occupy 1-9 employees (micro- and small firms). There are no big clothing firms in Greece.

In that period, T&C companies strengthened significantly their position and became mostly exporters to the European markets. For example, T&C firms around Thessaloniki and Naoussa[84] evolved towards a mature cluster, the most important one in Southern East Europe in the 90s with around 150000 employees and 15000 registered relevant companies. It consisted of an integrated cotton textile chain including: fibre production (ginned cotton), spinning mills (yarns), weavers (fabrics), dyers, finishers, clothing manufacturers and a significant endowment of horizontal services. Products were exported mainly to Germany and other European countries, with large global clients either retailers or product brands.

In 1995, the 20-year old quota regime, Multi-Fiber Agreement (MFA, 1974-1994), that provided the rules for the imposition of quotas for T&C products, was replaced by the Agreement on Textiles and Clothing (ATC, 1995-2005), the ten-year plan for the gradual transition towards free trade. Producers in Greece were amongst those affected. Actually, according to Dadakas and Katranidis (2011) they were more affected compared to Portugal, Spain and Turkey because they were more dependent on the MFA quota regime than their counterparts. The beginning of the new millennium was also the beginning if a significant recession for the industry. Substantial decreases in revenues, production, exports and market share led many SMEs, out of business. Producers had to struggle against imports from low labor-cost countries.

The quite catastrophic impact of the liberalization could be explained by the fact that the Greek T&C industry was mainly oriented to its most vulnerable part: clothing and textiles for the clothing industry. The majority of firms were subcontractors and co-makers while few firms had established brands with an export base. Most companies

[83] Greece is among the first 10 raw cotton producers in the world and almost the only one in Europe

[84] Naousa is also known as the "Manchester of the Balkans" since the first textile factory in the Balkans was built there in 1874.

found themselves squeezed between price leaders (Asia) and quality and fashion leaders (Italy). On the contrary, the only long term advantage i.e. local fiber supply seemed to deteriorate due to quality and price of imports. The cases of Hellenic Fabrics and Varvaressos are rather exceptions in adopting a specialization business model focusing on quality and flexibility strategy (Andersen and Scheffer, 2012).

Greek clothing manufacturers were quick to delocalize labour intensive productions in Bulgaria for low-cost labour and favourable tax systems. Initially, Greek garment producers continued to use Greek-made fabrics for the delocalized clothing units; however they soon turned to cheaper imports mainly from Turkey. Greece reacted further with investment in equipment updating and complete automatization in order to increase productivity, advance quality and reduce personnel. At that time a number of EU programs were funded to support the Greek T&C sector mainly with major upgrading of technology. There were also many mergers and acquisitions, while a big number of companies closed because of too high debts. These strategies paid back presenting a peak of 2,5 billion Euros due to exports to EU markets in 2003. Since then and besides the important investments in automation and upgrading, the manufacturing production declined at a continuous rate.

In accordance with the situation in Europe, major declining factors have been:

- The competitiveness of China and other Asian low cost countries including Turkey as a major competitor.
- The increasing disintegration of the local cotton chain. According to some experts, subsidies were catastrophic for Greek cotton growers since they were not followed by requirements on maintaining quality standards.
- Production delocalization of the global leaders to Asian countries
- increase in labour costs as Bulgaria moved closer to EU membership
- Increasing market competitive pressures and lower margins
- the euro – dollar parity

Besides the above factors, main reasons for the significant decline include also:

- The lack of any strategic plan for the industry in contrast to other European countries which designed new frameworks to apply in the newly formed global business landscape.

- The lack of any policy regarding cotton, "the white gold" of Greece, Cotton's quality deteriorated during the last 20 years mainly due to subsidies to cotton growers. Moreover, the Greek Organization for Cotton was abolished and never substituted by any other form of institution.
- The illegal import of textile and clothing products in Greece.

The financial crisis exerted significant impact on the industry. The global crisis of 2008-2009 affected the companies in the same ways as the European ones: decrease of international demand, stronger price competition and tax evasion. Because of its export orientation the industry suffered significantly from the drop of demand in Europe. However, the financial crisis that started in 2009 in Greece put additional stress on the local economy; for example, increasing prices of cotton and other raw material; no long-term loans are given in times that companies are required to pay cash, in advance, for purchasing raw materials and other inputs such as fabrics and yarns from foreign suppliers. Competitiveness is limited by the hard hitting credit crunch and is also threatened by the mounting pressure of other low-cost countries in the Balkans. Indicatively, Serbia attracted the Benetton investments besides its long tradition in Greece..

Table 5.12: Greek T&C industry data

	2006	2007	2008	2009	2012
Number of companies	16500	9000	4,094	3,530	5500
Number of employees	300000	120000	65,865	57,57	30000
Turnover (billion €)	3	3			2.5
Exports (mil €)		800	1,547	1,388	1,300
Share of Northern Greece		90	83%	84%	85%

Source: SEPEE

The decline percentage was almost 40% for the time period 1995 to 2009 shrinking the number of companies to 9.000 from 14.420 and the number of employees from 120.000 to 99.000. The Sectoral Industrial Index presented a total decline of -68,4% (IOBE, 2011). Today, the 50% of production is located in Central Macedonia (mostly Thessaloniki) and the 33.5% in Attica. North Greece holds also the 90% of exports.
All the segments of the T&C chain are still active; from cotton crops to the final products through capital intensive operations of spinning, weaving and finishing and

in advanced services such as design, CAD/CAM and marketing. Companies that survived till 2011 were mostly well established ones which had foreseen the need of innovation and structural changes. Yet, none (according to experts' narrations) could foresee the lethal cocktail of the China entrance in WTO consequences and the severe fiscal and economic shock in the Greek business ecosystem.

2012 approved to be a year of hope; spinners who, during the last 3 years, have worked an average of only 2 to 3 days a week are presently working 7 days a week trying to meet the new orders received. Furthermore, the clothing sector presented the smallest production drop after the crisis; production volume fell by 10%. The relative drop was 25.4% in 2011, 23% in 2010, 23.6% in 2009 and 16.9% in 2008. However, this recovery is considered temporary due to the highly unstable situation. In 2012, the spinning industry relies on four spinners left in Northern Greece, of which two are integrated with the ginning phase (Hellenic Textiles and Selected Textiles), while Varvaressos and Nafpaktos are independent spinners. T&C exports constituted the 13% of total manufacturing exports.

Yet, the industrial culture of the sector remains traditional in its majority. Greece has been traditionally a production country due to former low wages and human capital quality which had led to FDIs and subcontracting with a concurrent know how transfer. Consequently, it was quite hard to invest in fashion creation and branding which appeared to be the major strategy of European high-cost countries (see above). On the other hand, many of the companies are small family-run ones with a past-oriented entrepreneurial culture where changes in markets, processes or products are still not easily accepted even if improvements are occurring. Innovation lacked their culture, while introversion was a significant hampering factor. Descendants of entrepreneurs are often lacking a mission and a vision on the future of the sector. According to Tseklenis "No one had taught Greek producers how to make fashion, while there was no direction from the relevant Greek authorities for the obligation of all companies to place the "Made in Greece" label on all exported products" Since it is difficult to find adequate managerial skills for this sector, SMEs do not have new intake of staff able to bring with them new ideas and take decisions as well as to manage organisational change.

Therefore, the increasing speed of both customer preferences and product changes found Greece stuck in the middle. Reflecting sectoral historical legacies, the "Made in Greece" label while still an assurance of certain quality and production criteria has

never managed to gain global reputation regarding design. On the other hand, besides Asian, new multinational competitors, with "fast fashion" and "medium-to-low cost" apparel have entered the Greek market, blurring the well-formed structures of clothing –categories. Ii should be, however, mentioned that during the last decade, there is an effort of survivors to develop fashion and branding while textiles and dyeing invest in innovation as it will be discussed in the Innovation Unit.

Competitiveness of the Greece textile sector has also been hampered by increasing labor costs; high tax wedges insurances and social security costs. The Greek public debt crisis in 2010 affected the whole Greek economy and made very difficult and expensive for all industries to access bank credit to finance working capital. Additional problems constitute the delayed payments from the public administration: exporting companies are required to advance the amount of the Value-Added Tax (23% in 2012). Delays in VAT reimbursement increase the liquidity problem of Greek companies. According the experts, the risk of insolvency for internal market accounts is quite significant, since credit insurances stopped covering these. They also reported problems with foreign existing or potential customers due to the high instability of the Greek economy.

5.3.3. b Market structure in Greece

The socio-economic crisis since 2008 had a major impact on consumption since it led to a severe shrinkage of income and employment. Furthermore, difficulties in financing and the provision of raw and supplementary materials, high energy costs, increase in taxes and the overall instable business and political environment in combination to decreasing sales and prices led many firms to shut down,

Besides the really difficult situation, the Greek business is still important for foreign big clothing companies, since Greek firms undertake all complicated and demanding work that the Asian competitors are not capable to manage. On the other hand, the Greek consumer, although economically pressed, still disposes a considerable amount of money for clothes, compared to the mean European.

Competition is fierce for the domestic production due to imports. There are two big categories that refer to price (cheap textiles and clothing) and fashion / quality. Cheap clothes come mainly from China especially after 1.1.2005. Trade marks, very cheap Chinese clothing, big clothing chains and supermarkets and large stores strain the

competition and the viability of Greek small producers. A strong competitor is also Turkey, since it targets the same markets inside and outside Greece.

The Greek production claims a market share of 1.2% (about 3 billion euros) of the European textile and clothing market, which according to the experts can be maintained. Greece exports mainly in Germany, France, England, Italy, Cyprus, Bulgaria and Holland, but there is a constant declining which reach the 47% in the time period 2000 to 2008. On the contrary the imports have increased about 140%. The most important supplier countries are France, Italy, Germany, China and Spain.

Referring to cotton as raw material, a strong advantage of Greek spinning mills is proximity which enables the ability to select qualities and low transfer costs. Yet, there is a plethora of cheap textiles that are imported and due to their price gain a considerable share in Greek market.

The market trends on the distribution side of the textile and clothing sector are today towards: a) increased product specialization; b) Market segmentation and c) Brand-name products

Referring especially to clothing, Greek companies are divided into two big categories:

a) Private Label: their most important competitive advantage is the cost reduction which was the main reason for moving to neighbor countries with cheaper labor and better taxation. 8 out of 10 moved initially to Albania, FYROM and Bulgaria. They combine low price, quality and on time delivery.
b) Greek brand names: they turn mostly to trade. Economies of scale and promotion strategies are their main concern.

Market areas considered to have the highest potential (lead markets) are in the field of technical textiles and include:

- intelligent personal protective equipment;
- medical and health-care textiles;
- light-weight, high-strength construction and transport related materials.

Table 5.14: Clothing in Greece (Aslanidis, 2013)

	2009	2010	2011	2012	2013
Production	-21,6%	-23,1%	-25,4%	-7,0%	-3,5%
Domestic Turnover	-6,8%	-27,7%	-21,0%	-21,9%	-2,3%

Exports	-18%	-5,5%	-8,4%	-5,5%	+1,0%
Imports	-10,1%	-11,6%	-13,9%	-16,4%	-4,5%

5.3.3.c Innovation trends in Greece

Referring to innovation, Greek T&C sector has a relatively small share of innovating firms and most of these innovators innovate through diffusion. There was some important effort to turn the clothing sector into a creative one. The fashion week is an excellent example of such efforts. Still the sector remains one of the most important exporting Greek industries.

The last decade was marked by an intense transfer of technology, technological knowledge and ICT applications while, on the other hand, competition was becoming fiercer and market structures were dramatically changing. However, this appeared to be a case for the few. Furthermore, Greek Textile firms innovated mainly by means of buying advanced machinery and equipment and by training their personnel. Efforts in Greece focused mainly on treatment-finishing methods, eco-fabrics and novel, ICT-based production methods. There were also some isolated cases of more advanced innovations such as functional fibers and multi-functional clothing. The sector seemed rather reluctant to turn to technological advances such as technical fibers and yarns which although seem to constitute the future (applications in the medical sector and other industries) could not cover domestic market and were not direct wishes of their large international customers.

Product innovation referred further to creative application and combination of textile materials and chemicals, skilful selection and combination of materials and processing options and unabated creation of new designs, styles or product functionalities. A major part of these types of innovation activities should be considered as non-technological innovation in which textiles and especially clothing companies invest heavily.

Clothing, on the other hand, is rather fashion dominated. A limited number of Greek firms which produce their unique design connecting knowledge with creativity. Innovation is supported by design, fast changes and finishing differentiation. While there is high innovation intensity in the textile industry, the clothing industry relies on sewing techniques that have barely changed over the last century (OECD 2004, p. 14). The technological innovations used in the sector are developed in other industries – the chemicals (man-made fibres) and machinery sectors (computer-aided design

systems). According to the experts in the clothing sub-sector, there is a clear need of services, time to market high quality of products as well as of logistics oriented towards distribution. In this respect, the small size of companies could be an asset since they can be more adaptive and flexible to the market. Companies should adopt a "forward strategy" ("towards the market") instead of the "backward integration" that has not proved to be successful in the last twenty years. That could be done by for example, producing knowledge-intensive products (intelligent textiles) or by strengthening the links to fashion and the design industry (moving down the value chain).

There is no strong tradition of joint research and product development between companies and company and research institutes in the textile sector, suggesting an important area of public policy intervention. Actually, Greece with a 12.2% owns one of the lowest total collaboration rates following Italy (9%) and Romania (11.2%).

Yet, cooperation should not only take place within the textile industry but also with other sectors like biotechnologies or information and communication technologies in order to reach higher steps of knowledge. Technology adopters are indeed common in the textile industry. Companies often rely on innovation in chemicals or engineering to innovate internally. The panel of experts highlighted that the gap between universities and industry is broad. There is a necessity for academic and industrial worlds to work stricter together even if they are still speaking different languages.

ICT is used along the whole value chain in order to gain this type of competitive advantage. Actually, according to the experts, ICT has been used by both types of Greek clothing companies. The ones dealing with private label have used ICT for production management and logistics, while the companies with a brand name for the order management, new productions, stock transports, networking of all selling points etc. This second type of companies presented the most significant innovations referring to marketing.

Indeed, experts pointed out that the Greek textile industry, because of the size of its firms (mostly SMEs), is seen as flexible, adaptable and able to respond to market needs quickly. Shorter product lifecycles require not only high flexibility but also high productivity and creativity, which apply for both textile and clothing industries.

According to the experts, Greek companies have to put more effort into environmental considerations and to extend the life cycles of products. In the branch

of technical textile, “eco textiles” thus play a great role (i.e. synthetic fibres, new low water-consuming technologies – already adopted by the remaining dyers), not only in the sense of their environmental usefulness but also with regard to the competitiveness of the branch. Towards the ecology-bases competitive advantages a small number of firms obtained the Oeco-tex certification (70 companies), the Ecolabel (78 companies) in 2009. A bigger number of T&C firms have adopted the environmental management system ISO *14001* and the Eco-Management Audit Scheme (*EMAS*). Furthermore, many T&C firms have responded to the high cost of energy by producing their own energy (from sun or biomass).

On the technical textile side, it has also been noted by the experts that most people have traditional expectations on textile, which undermines innovation. Greek spinning mills stick to the cotton and have never considered the area of technical textiles, although ETAKEI has given too much information on it. In the development of fibres, yarns and fabrics, functional aspects (such as anti-bacterial, anti-static, UV protective, thermal, or biodegradable functions) are indeed playing an increasingly important role. As underlined by the experts, since the main challenge the sector faces is the acceptance of the population of new products, companies should be increasingly taking into account how they can help their customer to be successful in their respective markets and they should ask them to be involved in the design of the product.

As discussed above, the development of new materials for "functional and multifunctional textiles” and the "intelligent clothing" constitutes a significant area for innovation; production of fabric and clothes to protect people from extreme weather conditions and new bullet-proof materials for military uniforms are two core sub-niches. The Greek company K. SIAMIDIS S.A. is such a case; collaborating with DuPont de Nemours Int'nal SA, W.L. Gore και 3M, and running its own R&D department, specializes in manufacturing special use and high performance fabrics, garments and protective systems, suitable for armed forces, public services, fire brigade and industry.

In fact, a very small number of T&C industry invested in differentiation and innovation. Such examples are Hellenic Fabrics; the company invested in novel strategies of “changing role in the value chain”, and vertical integration in the niche of high-end denim. Mass customization was developed in order to satisfy the new and increasingly more demanding needs for flexibility and modularity in combination to

time-factor[85] advantages. On the other hand, Varvaressos invested on "specialization and niche products", the development of organic cotton cellulosic fiber and special blends of fibers. The group further adopted a policy of probing innovation generated in other industries even at experimental stages,

The Greek T&C sector was supported with the Retex Program around 2000 and a budget the equivalent of €85 million which regarded funding for R&D and innovation; access to finance and to exports; modernization of equipment; health and safety; and vocational training. All measures were well taken up by the industry. The ESF Program as well as the Orientation fund of the CAP was also applied for the cotton farming and processing industry.

Innovation Barriers and Drivers: Greece's unfavorable and instable socio-economic situations together with the rather hostile entrepreneurial climate constitute the major hampering factors for innovation and performance. Financing restrictions reduce the volume of innovation activities of firms. Most companies complain for too high innovation costs. Secondly, suppliers on financial markets, especially banks, are reluctant to finance innovative activities of firms, resulting in a low supply of loans for innovation financing. Competition and labor cost from outside the EU is seen as a big obstacle to innovation.

Other obstacles have been the lack of qualified personnel, the lack of information on technology or the lack of information on markets as well as difficulties in finding cooperation partners, the time-consuming processes and the overall negative entrepreneurial climate and the financial situation in Greece. Still, they are relatively small impediments to innovation activities. Interestingly, these obstacles are more pronounced for firms that do not innovate at all. However, according to the experts, market factors and competition pose greater problems for firms in the sector. Uncertain demand for innovative goods or services increases economic risks related to the acceptance of innovation by different user groups. Many companies name problems predicting consumers' responsiveness to new products or services exactly as a reason for their discouragement and holding back investments in innovation.

[85] Very short turnaround times in fashion sensitive consumer markets which depend on the individual firm, transit time for shipments, the efficiency of port infrastructure and customs services

Human capital is a further encumbrance, followed by other barriers to innovation such as regulation and taxation. Thus, scarcity of specialist knowledge and skills, competence of forecasting technology and markets, scarce resources available for evaluating and testing new ideas as well as access to top-level human resources may reduce innovation intensity of T&C companies.

Greek T&C sector can be competitive again according to Mr Kitsikopoulos (president of SEPEE, 2009) if the companies succeed in: product differentiation, shorter lead times (delivery time), technology acquisition and exploitation, training, creation of strong distribution channels, exports increase and cooperation.

5.3.3.e Foundation trends

According to the narrations of Mr Aslanidis, a study of the association in 2007 revealed that among the companies that registered as new after 1997 only one out of four were really new ones while the rest continued a family business or were takeovers. Among them, 64% showed no innovation, 12.8% believed that they bring entirely new products in their markets and a just 5.4% created a new market niche (in Europe the relevant percentage was 9.7%). Yet, according to Hellastat Data there are only 45 companies registered as new in the period 2002 – 2006. These regard mainly sub-contractors in the clothing industry. There were only two new spinning mills, which merely replaced older existing ones and were equipped with the most high tech equipment in order to gain in productivity and quality; yet, these two efforts seemed to be stuck to cotton as raw material, instead of moving in technical fibers.

The decline and de-vitalization of the sector in Greece has led to a further depreciation which drives new undertakers away from it. According to the experts it is rather difficult to innovate in the clothing sector, while till now there does not seem to be any new movement towards modern and innovative design or new ways of promoting the products offering a value added.

Furthermore, the foundation of a company is both costly and time consuming. There are complex administrative procedures and is rather difficult to get information about starting up a business. Greece is characterised by an unfavourable entrepreneurial climate which gets more and more turbulent due to the deep crisis and the increasing import of both cheap and expensive clothes (China, Italy, etc). The situation seams to

get even harder and there is already a considerable number of very small industries that decide to close down.

Indicative Projects: NetFinTex, funded by the European Union's 6th Framework Programme for Research ZEW, SPRU,MERIT, LABEIN, INNOVA Watch, ITMA, are some of the projects with relevant proposed policies and recommendations

5.4 Description of the thirty cases

The main purpose of this section is to develop comprehensive case descriptions by following the guidelines suggested by Yin (2003). This general analytic strategy uses a descriptive framework covering the three key areas (venture formation, survival and growth) to identify primarily the formation, growth patterns, and underlying factors that influence the creation and early growth of LT-KI firms.

The description includes:

- formal data of the case (i.e. products, type of entreprneurship, year of foundation and similar)
- description of the entrepreneurs
- description of the entrepreneurial and the innovation processes as well as the introductory knowledge-based innovation
- resources and capabilities mentioned or detected
- environmental factors
- knowledge bases
- linkages and co-operation

Due to the significant number of cases, descriptions present the most important evidence related to each case and the most important milestones. For the very same reason, descriptions are included in Appendix C.

It should be also mentioned that for confidentiality reasons, the descriptions are at some parts superficial while the company names have been removed, as well as interviewees' names, and some other parts from direct quotations.

Chapter 6

Development of the KIE conceptual framework

Chapter Objectives

- To present the building blocks of the conceptual framework of this study.
- To establish the research hypotheses of this study.

6.1. Introduction

The present research began with no *a priori* theoretical framework under consideration, nor did it force any particular *a priori* specification of constructs. This allowed the constructs and their relationships to be induced from the empirical data. Eisenhardt (1989a) encourages the researcher to allow "the unique patterns of each

case to emerge" (p. 540). The first round of within-case analysis focused on developing an outline of constructs and relationships within the low-tech but knowledge intensive case in an inductive way; these emerged from the data through case write-ups, coding and pattern coding (Graebner & Eisenhardt, 2004).
Qualitative interview data proved to be of great importance in gaining an understanding of emergent relationships. As particular patterns started to appear, some first networks were formed in order to understand and pose explanations behind them: from the "what" and "how" to the "why" (Miles & Huberman, 1994, p. 90). This procedure led to a general conceptual framework of LT-KIE (displayed in Figure 6.1) which being "at the heart of building theory" would become the "roadmap" showing initial connections and influences (Miles & Huberman, 1994, p. 91).

More precisely, as mentioned at the previous chapter, at the time of the first round of interviews' data analysis the research had the following general objectives:
1) gaining a *background* on the firms and entrepreneurs and a knowledge on the current positioning, performance and strategies of the firms
2) studying the *entrepreneurial (foundation) process* of each LT- KI case (from idea to implementation and market)
3) studying the *innovation process* of each LT- KI case during venturing which is intertwined with the creation and use of new knowledge, and
5) studying the unsolicited insights on the research topic provided by the interviewees looking for new patterns
These distinct objectives are evident when the reader delves into the case study descriptions in Appendix C. .
However, during the first within case analysis some further objectives attracted the interest of the researcher, and namely:
a) Critical events of the firm up to the date of the interview (e.g. innovations, exports, changes such as new spin-offs etc.) regarding the new firms' boldness, creativity, and innovativeness up to the date of the interview
b) The firm's current positioning, internal organizational factors, existing linkages and co-operations
c) The firm's product portfolio management up to the date of the interview
The first analysis therefore established the background of the case firms in this study and also raised three major themes: 1) the way that Low-Tech but Knowledge-

Intensive venture creation takes place seemed to depend on quite specific capabilities. Actually, many of the a priori and inductive themes such as tangible and intangible assets[86] (e.g. knowledge, human and social capital) and entrepreneurial "actions" (e.g. networking, knowledge seeking, idea building, choice of business strategy, type of innovation etc.) seemed to be harmonically grouped and linked constituting the specific capabilities to *partly* explain success and failure of new LT-KI ventures. 2) Production technologies were always present and seemed to be at the heart of LT-KI venturing and 3) elements of dynamic capabilities were evident and traced in almost all cases appearing to play a significant role in the new firms' growth.

More specifically, results from the first data analysis confirmed certain literature on venturing, innovation and knowledge related to recent KIE literature, but further suggested that a capabilities' approach could actually trigger answers to the research questions. On the other hand, the indications of the existence of dynamic capabilities and the role of the competitive advantage could further provide answers to the last research question. The production technologies issue emerged from the analysis as of major importance during the implementation phase of the novel business idea. Actually, production technologies seem to be of major concern to low-tech but knowledge-intensive ventures, since the novelties are almost always connected in direct or indirect ways to new production lines, novel processes, techniques and methods. There is little extant literature on this topic especially under the lens of venturing.

Furthermore, although the topic of dynamic capabilities was not directly related to the LT-KIE main research, it did seem to have a significant effect on the creation and development of the new ventures and thus deserved further investigation.

Therefore, the findings of the first data analysis shifted the focus to a capabilities' approach of the LT-KIE topic, which did not appear to be strange at all; after all entrepreneurial capabilities (ECs) were developed in order to explain the resources and skills required for effective entrepreneurial activity and new firm creation (mainly on the basis of the resource-based view; see, for example, Alvarez and Busenitz, 2001; Chell and Allman, 2003; Steffens and Burgers, 2009). Moreover, whereas the approach of entrepreneurial capabilities tried to answer questions about the identification of new opportunities and the subsequent investments, the dynamic

[86] Assets have been called the "bones and muscles" of the firm's capabilities (Winter, 2000).

capabilities (DCs) approach is growing rapidly to answer questions on the creation and sustainability of competitive advantage or otherwise the adjustment and reconfiguration of the resource bases, within the arms of strategic management (Arthurs and Busenitz, 2006). The fact that dimensions of dynamic capabilities were traced even since the very first data analysis indicated the possibility of existing linkages among the two types of capabilities and a strong impact on production technologies (an element of operational capabilities according to literature).

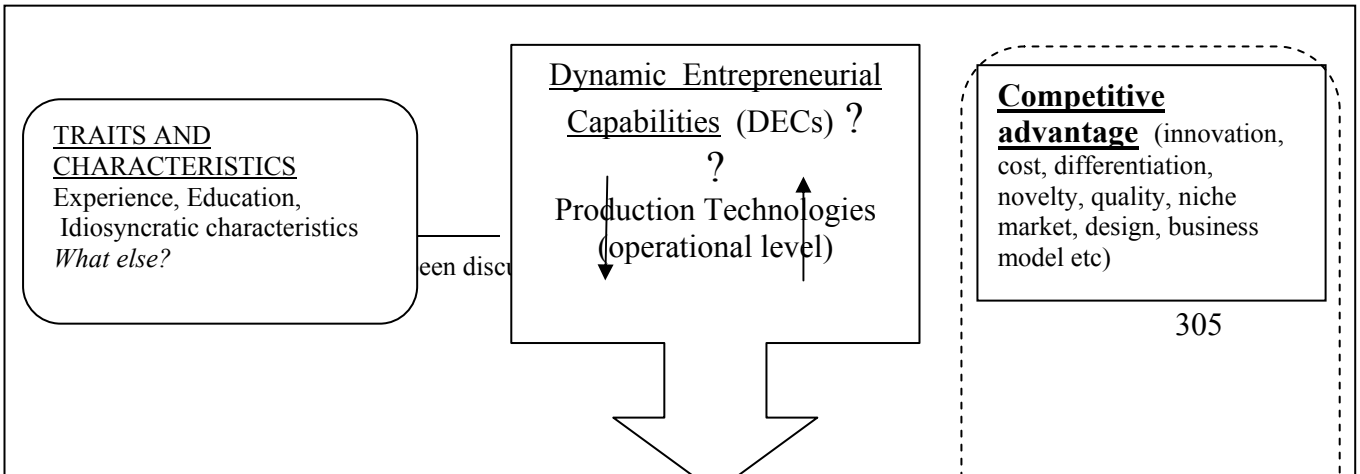
In sum, the first data analysis indicated a new positioning of the research. The following KIE framework was prepared in order to provide insight and direct the subsequent second data analysis.

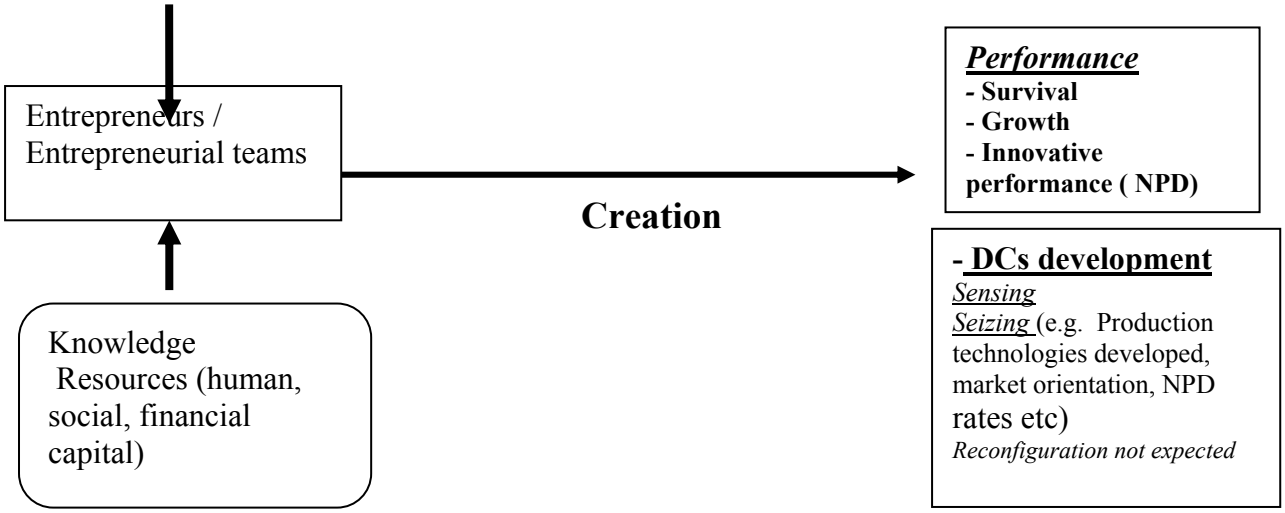
6.2. Conceptual Framework

Figure 6.1 presents the LT-KIE conceptual framework of the present research. The proposed framework will enable the exploration of low-tech KIE as a process involving individuals, ventures, knowledge and other resources within their business ecosystems and through a capabilities' lens. It responds to calls for research in this direction by investigating the LT-KI venture creation as well as possible links to its success and future competitiveness.

According to the figure, the study seeks to explore *how* low-tech but knowledge-intensive ventures can survive early death and prosper within mature ecosystems, taking into consideration the non-R&D-focused KIE development in low-tech industries. More specifically, based on extant literature covering a quite significant number of entrepreneurship and strategic management-related fields[87] and under the lens of the first data analysis, it endeavors a capabilities-based approach of new KI low-tech venture creation.

Figure 6.1: General conceptual framework





The purpose therefore is to extend the existing research on KIE and more precisely on LT-KIE in terms of ways of achieving and sustaining success. According to the first analysis of the data we suggest that this can be a capabilities' matter. This is in line with the limited research on KIE in low-tech industries[88] which indicates certain connections of KIE processes to capabilities *of a firm or an individual entrepreneur;* "A bundle of firm-specific capabilities is a crucial precondition for this (i.e. low-tech KIE)" (Hirsch-Kreinsen and Schwinge, 2011).

The suggested framework reflects views at the broad nexus of the entrepreneurship and the strategic management literature, focusing on the area of LT-KIE. **The following section will explain the core elements of the suggested framework and the shaping of the hypotheses.**

6.2.1. New venture creation and Dynamic Entrepreneurial Capabilities

As already mentioned, KIE refers to new, innovative and knowledge-based ventures and it has been considered a special type of entrepreneurship. Drawing on the theories of the RBV, DC and KIE (e.g. Penrose 1959; Helfat & Peteraf, 2003; Teece, Pisano, & Shuen, 1997; Teece, 2007), entrepreneurial start-ups have been regarded as **sets of specific resources.** The concept of resources includes both tangible and intangible

[88] As referred in the relevant chapter

ones such as physical assets, capabilities, organizational processes, firm attributes, information and knowledge (Barney, 1991; Daft, 1983). Furthermore, a new firm is endowed with knowledge and prior experience of the founders, as well as their social and human capital or the parent company (Adner & Helfat, 2003; Alvarez & Busenitz, 2001; Dencker, Gruber, & Shah, 2009; Helfat & Peteraf, 2003). Unique and difficult-to-imitate resources are the answer to performance requirements (Foss, 2011) and competitive advantage (Penrose, 1959; Barney, 1991, 1994, 2002). They impact (with their combinations) the development of capabilities (Grant, 1991) and continue to hold a core role within KIE as well (Malerba and McKelvey, 2010). Yet, Penrose emphasizes that it is not the possession of the resources but their *use* that causes value creation. In addition the significance of created value depends on how these resources are deployed, i.e. how they are combined. She also argues that firm growth is highly related to entrepreneurial skills

In consequence, the literature on **capabilities** has massively accepted the notion that capabilities' task is the combination and transformation of a firm's resources, 'assets that it owns, and that are externally available and transferable' for the attendance of certain goals. As McGrath, MacMillan, and Venkataraman (1995) suggest, 'virtually every definition of competence in the literature refers to some purpose the firm is able to achieve . . ., preferably in a manner superior to that employed by other firms . . ..' . More precisely, so far, regarding successful creation of resource bases, a broader view of relevant literature indicates two specific areas: entrepreneurial and dynamic capabilities (e.g. Arthurs and Busenitz, 2006; Helfat et *al*., 2007 respectively). Actually, entrepreneurship literature is overwhelmed with both theoretical and empirical work on the significance of entrepreneurial capabilities on new ventures' performance and success. **Entrepreneurial capabilities (ECs)** flow from the astute bundling or orchestration of resources (e.g. Arthurs and Busenitz, 2006) and skills required for effective new firm creation (see, for example, Alvarez and Busenitz, 2001; Steffens and Burgers, 2009) or corporate venturing (e.g. Wright and Marlow, 2011), mainly on the basis of the resource-based view. ECs can provide the resource foundations for competitive advantage contribution to firm performance (e.g. Eisenhardt & Martin, 2000; Sirmon, Hitt & Ireland, 2003) and constitute a key factor in KIE firms' growth (Malerba and McKelvey, 2010). However, besides a limited number of relevant research regarding mainly the significance of resources (e.g. Autio

et al., 2009; Davidsson et *al.*, 2003; Vanhoutte et *al*., 2010), there are hardly any studies to connect capabilities to initial competitive advantage.

On the other hand, the **DCs** framework investigates how firms go about to match their resource bases with opportunities in the marketplace (Boccardelli and Magnusson, 2006; Helfat and Lieberman 2002) and explains change processes within firms in several industrial settings and at different moments of a firm's life cycle (see for example, Helfat and Peteraf 2003; Teece, Pisano, and Shuen 1997). There are some efforts to explore DCs in founding stages and entrepreneurial settings (e.g. Dess et al. 2003; Liao, Kickul, and Ma 2009; Newbert 2005; Sapienza et al., 2006), since conceptual research acknowledges that DCs can be used entrepreneurially to create (Eisenhardt and Martin, 2000) or shape markets (Teece, 2007). Furthermore, limited but gradually increasing research regarding newly-founded firms indicates that new ventures need DCs in order to survive, grow and innovate (Protogerou and Karagouni, 2012). However, to date, the widely acknowledged framework of Dynamic Capabilities has been mainly focused on large-sized firms operating in high-tech sectors (Teece et *al.,* 1997; Teece, 2007; Helfat et *al*., 2007; Protogerou et *al.*, 2012; Zahra et al., 2006). Therefore, it seems that the DC approach has ignored, in its large majority, both entrepreneurial settings in general and the huge importance and potential of low-tech industries. Regarding new ventures, Zahra, Sapienza, and Davidsson (2006) find *this gap in the literature to be puzzling.* The authors consider that "*new ventures need unique and dynamic capabilities that allow them to survive, achieve legitimacy, and reap the benefit of their innovation*".

That gap is even more evident in cases of new LT-KI firms with no more of a handful relevant research works. While scholars of KIE have discussed the nature and role of knowledge resources as main drivers for enhancing performance and innovativeness, not adequate attention has been paid on the emergence of capabilities needed to start viable KI ventures or the explanation of how individual-level competencies are transformed into higher-order capabilities necessary to new ventures.

In sum, growing stream of empirical studies highlights the impact of entrepreneurial activities on creation, survival, growth and performance (Newbert, 2005**;** Grande, 2011) while a recent strand of literature argues on DCs impact on new-venture performance and innovation (Tsekouras et *al.,* 2011). However, so far, most definitions and studies have viewed entrepreneurship from a strictly individual level

of analysis producing a *panspermy* of properties arbitrarily named 'entrepreneurial capabilities'. On the other hand, there exists this puzzling gap in research on dynamic capabilities in emerging ventures and entrepreneurial settings in general and more precisely in low-tech and knowledge-intensive fields.

Yet, the dynamic capabilities perspective includes **the capacity to create a resource base** and not just to modify and extend it, providing a sound conceptual framework for understanding competitive dynamics (Helfat 2007). Based on this fact that DCs help firms not only react to, but also create market changes, Zucchella and Scabini (2007) compare dynamic and entrepreneurial capabilities in their thorough study on international entrepreneurship. The authors conclude that the latter concept is broader including individual-level capabilities necessary to take initiatives within the firms. Zahra et al., (2006) has also commented on the provision of a framework for exploring dynamic capabilities in the new venture context. These tendencies although not clearly stated, have prepared a more unrefined view of dynamic capabilities, where new terms have been so far proposed such as dynamic managerial capabilities (Adner and Helfat, 2003) and dynamic marketing capabilities (Bruni and Verona, 2009). Bocardelli and Magnusson (2006) suggest that earlier proposed dynamic capabilities frameworks need to be modified, by taking into account the single entrepreneur as a source of dynamic capabilities. Teece (2007) also recognizes the power of human beings and that no all are processes: "In regimes of rapid technological innovation, it is clear that making investment choices requires special skills not ubiquitously distributed amongst management teams". Augier and Teece (2009) provided a conceptual lens that focuses on the importance of the "***entrepreneurial" dynamic capabilities*** of top managers, while Teece (2012) discusses the differences among dynamic capabilities and "enterprise-level dynamic capabilities"

Next to the extant literature on resources and their impact on new venture, **knowledge** and differential knowledge sources play a focal role in entrepreneurial and innovation fields in general and more precisely in the area of KIE (e.g. Garavaglia and Grieco, 2005; Agarwal et *al.*, 2004, 2013; Ihrig et al., 2006; Guadamillas et *al.*,2008; Stam, 2009). Furthermore, recent literature focuses on knowledge as one of the most valuable resources that provides sustainable competitive advantage (e.g. Caloghirou et al., 2004). Authors also agree that knowledge sources contribute positively to firms' innovation performance, in spite the fact that this relationship has been empirically

tested only to a limited extent (Capello 1999; Caloghirou, Kastelli, and Tsakanikas 2004; Capello and Faggian 2005). Technical, science, market and business knowledge have been identified as critical in new firm formation cases (e.g. Agarwal et al., 2004; Chatterji, 2009) especially within the field of academic entrepreneurship, when firms are founded by scientists who innovate in the context of universities or institutions (Audretsch and Feldman, 1996; Feldman et al., 2005; Lockett et al., 2005). In fact, in most cases, founders are researchers and their own tacit knowledge is the critical element of the knowledge embodied in their ventures (Bercovitz and Feldman, 2006; Scott, 2008; Stuart and Ding, 2006).

However, this is true in low-tech KIE as well. Firms in low-tech sectors are increasingly engaged in complex knowledge activities (Morrison, 2011; Hirsch-Kreinsen and Schwinge, 2011), even including (weak) appropriability regimes such as in cases of fashion design, consulting and wineries (Campbell et al., 2012; Carnahan et al., 2012; Phillips, 2002; Simons and Roberts, 2008; Wenting, 2008). According to Hirsch-Kreinsen and Schwinge (2011), **KIE processes are based precisely on the orchestration and mobilization of knowledge and other resources at the disposal of actors. This can be analyzed in terms of capabilities**: *A bundle of firm-specific capabilities is a crucial precondition for KIE in low-tech sectors). The use, the combination and the creation of new knowledge depend on the described stocks of knowledge and the respective opportunities. However, whether and how this process takes place depends in particular on the existing capabilities of a firm or an individual entrepreneur (Hirsch-Kreinsen and Schwinge, 2011).*

Building therefore on these specific streams of literature regarding low-tech but knowledge-based entrepreneurship and management, and after the within-case data analysis, we expect that the "bundle of firm-specific capabilities" which is "a crucial precondition for low-tech KIE" (Hirsch-Kreinsen and Schwinge, 2011) regards *specific dynamic entrepreneurial capabilities (DECs[89]).* Treating knowledge as core-resource bases for LT-KIE, DECs may refer to ways of collecting and establishing knowledge assets and asset combinations in order to realize novel business ideas, together with the identification and reconfiguration of multiple other kinds of

[89] We should mention here that the specific definition of DECs was actually shaped later than the first data analysis. The first analysis indicated the need of a set of LT-KIE explaining capabilities. This will be explained in detail in a subsequent section.

resources, transcending sectoral, low-tech boarders. Therefore, DECs are needed to select and build unique knowledge-based strategies for a new low-tech but knowledge-intensive firm in order to differentiate from competitors. According to Penrose's (1995) suggestions on EC significance, DECs will determine the direction of expansion as KI firms grow.

Therefore, we expect that DECs will enact mechanisms and processes of selection, association, elaboration and combination of different and complementary information, technology and tacit and codified knowledge. Such knowledge can be borrowed from various sectors, disciplines and regions and will result in innovation. Consequently the emergent innovations will be both the media of applying successful LT-KIE and the results and outputs of LT-KIE. DECs will entail to a great extent the role of the firm's entrepreneurial team in the new LT-KI venture context. They will capture the capacities needed for the creative process of converting raw ideas into innovative knowledge-based businesses (cf. Audretsch and Keilbach, 2007) in low-tech industries. Therefore, DECs will provide ways and resources for innovation and in parallel create new markets where uncertainty of product attributes and customers' preferences is extremely high (Santos and Eisenhardt, 2009). However, this risky uncertainty is desired; new low-tech ventures should help shape markets and competition in order to survive in their mature and highly competitive business ecosystems. Therefore, they need to invest in becoming dynamically competitive instead of just building defenses against competition as in cases of cost leadership.

Another factor that was included in the LT-KIE framework research regards **entrepreneurial traits and characteristics.** Since DECs entail to a great extent the **role of the founders / entrepreneurial teams,** we expect that besides the types and significance of resources, entrepreneurial traits will be related and play a certain role to DECs' development. Many of such traits and characteristics have been viewed in the first data analysis. These have been also extensively explored in entrepreneurship literature and found of significant importance (e.g. Ihrig et al., 2006; Shane and Venkataraman, 2000; Knight,1921; Schumpeter, 1934; Kirzner, 1973; Zahra and Dess, 2001; Shane and Venkataraman,2000; Ireland *et al*, 2001; Langlois, 2005; Peneder, 2006; Henrekson, 2007). Strands of literature extended to pre-entry experience, the personality, background, individual characteristics and other traits of the founders, as well as the specificities of entrepreneurial teams (e.g. Picot et al., 1994; Marcati et al., 2008; Skuras et al., 2005). Lately, Teece (2007) started

incorporating these views in his theory as well[90]. These can further underline the importance of the human-centric role of DECs. Taking into consideration the above analysis, we expect that:

Hypothesis 1: **KIE in low-tech sectors can be related to specific dynamic entrepreneurial capabilities (DECs).**

The first efforts to approach the view of "dynamic entrepreneurial capabilities" (DECs) have just started to emerge together with the present thesis. More precisely, Lanza and Passarelli (2013) view DECs as peculiar higher-order capabilities in small business settings, with limited resources, which enable product innovation and technological change. However, they do not describe or operationalize their DECs. Corner and Wu (2012) try to define DECs considering venture creation as a number of phases but within a high-tech context again. Both efforts - developed in parallel with the present research - are based on limited empirical research (one case study) and reflect rather *very specific* cases. Furthermore, in both works, DECs lack precise definitions and measures. However, they are to our knowledge, the very first efforts to connect entrepreneurial to dynamic capabilities and explain their genesis and impact on venturing.

6.2.2. KIE, DECs and performance

Entrepreneurship characterized by knowledge intensity has been suggested to have a certain impact on the firm's performance, which is really the major criterion of KIE's evaluation and justification (Audretsch, 2005; McKelvey and Heidemann Lassen, 2013). Within the Aegis project, KIE has been found keen to support growth and strengthen competitive position not only in high-tech cases but also in cases where established technologies and production regimes constrain the ways of competing (Protogerou and Karagouni, 2012; Kastelli and Caloghirou, 2012, Del., 1.3.5).

The second round of data analysis confirmed to a large extent the relevant literature. It actually indicated the importance of a significant initial competitive advantage which was usually related to the initial knowledge-based innovation of the new

[90] See relevant chapter.

venture both in cases of new-to-the world and corporate venturing. Performance was measured in terms of survival, sales, employee number and innovativeness.

In parallel, there is quite extensive literature regarding the exploration of the entrepreneurial capabilities' contribution to firm performance (e.g. Kimberly, 1980; Eisenhardt & Martin, 2000; Barney & Arikan, 2001; Sirmon, Hitt & Ireland, 2003). Actually, a growing stream of empirical studies highlights the impact of entrepreneurial capabilities on creation, survival, growth and performance in general (Newbert, 2005**;** Grande, 2011). Furthermore, there is some limited research regarding the links between CA and new venture performance (e.g. Chen, 1996; Zahra et al., 2002). Penrose (1995) proposed that the nature of firms' pre-entry capabilities determines the direction of expansion as firms grow, an approach also taken by evolutionary economic theory (Nelson and Winter, 1982). ECs are needed to select the strategies for a firm; if they are unique, they can help the firm differentiate from competitors. Quite significant relations have been found in empirical research regarding KIE as well (e.g. Radosevic and Mikhailov, 2012; Protogerou and Karagouni, 2012)

On the other hand, a growing body of empirical research highlights the way dynamic capabilities relate to the performance, survival and growth of new firms (e.g. Tsekouras et *al.,* 2011; Protogerou et al., 2012; Arthurs & Busenitz, 2006; Stam et *al.* 2007), although they involve high-tech sectors in their grand majority or cases of internationalization (Sapienza et *al.*, 2010; Jantunen et *al.*, 2005; Stam et *al.,* 2007) A quite limited number of studies have further analyzed the association between D and new firm gsrowth in low and medium-tech firms (e.g. Telussa et al., 2006).

Some authors have even tried to connect entrepreneurial to dynamic capabilities by considering ECs as micro-foundations of DCs (e.g. Woldensenbet et al., 2012; Zahra, 2011). DECs seem to be a natural development of the new shift to "entrepreneurial management" (Teece, 2012). It is therefore expected that DECs will exercise certain impact on new KI-LT venture performance and more precisely survival and growth, while they will be related to the development of the competitive advantage, entrepreneurs/ entrepreneurial teams base their new vision on. In accordance to both theory and the relevant findings of the thirty cases, we expect DECs to be related to successful venturing in low-tech but knowledge-intensive cases, where success is described in terms of survival, new venture growth and the provision of strong initial competitive advantages.

Furthermore, we expect that DECs will be related to the introductory innovation of the new venture as well as their innovative behavior. The relationship that exists between KIE and innovation seems to be straightforward as this form of entrepreneurship is by definition innovative. KI entrepreneurship implies the introduction of innovative activities, new to the firm-specific knowledge but also new to the sectoral knowledge base or technology field (Hirsch-Kreisen and Schwinge, 2011). In the same vein, both dynamic and entrepreneurial capabilities are interwoven with innovation and firm's innovativeness (e.g. Galunic and Eisenhardt 2001; Helfat and Winter, 2011; Lichtenhaler, 2012). A small but quite significant stream of empirical research has also shifted focus on the role and impact of DCs on innovative performance in mature traditional industries in both cases of start-ups and established firms (Evers, 2011; Kuuluvainen, 2011; Quentier, 2011). Sapienza et al. (2006) for example, assume that SMEs and new ventures need unique and dynamic capabilities in order to survive grow and reap the benefit of their innovation. For Lanza and Passarelli (2013) dynamic entrepreneurial capabilities enable product innovation and technological change. It is expected then that DECs will have an effect on the new ventures' innovative performance. Therefore, we suggest that

Hypothesis 2: **DECs have a positive impact on new LT-KI ventures' performance**
Hypothesis 2.1.: DECs have a positive impact on new LT-KI ventures' competitive advantage
Hypothesis 2.2.: DECs have a positive impact on new LT-KI ventures' survival
Hypothesis 2.3.: DECs have a positive impact on new LT-KI ventures' growth
Hypothesis 2.4.: DECs have a positive impact on new LT-KI ventures' innovativeness

6.2.3. KIE and DCs

As mentioned above, only lately research effort has been put to relate the concept of dynamic capabilities to low-technology sectors, new firms and founding stages[91]. Protogerou, Caloghirou and Karagouni, (2013) reviewing the relevant literature claim that low-tech industries are far more dynamic than usually believed as *they have to confront the instability of global markets, the fast pace of inter-sectoral technological advances and the high probability of environmental shocks, i.e. major elements of*

[91] For a detailed analysis, please refer to the literature Chapter

environmental dynamism. Thus, although not dynamic by definition (Sciascia et al. 2009), low-tech traditional industries are nowadays characterized by environmental hostility and are also subject to major changes. Thus, the need to change the firm's resource base can also occur in low-tech sectors (Teece, 2010).

To date, the empirical studies trying to capture the nature and role of DCs in low-tech sectors are still rather limited. Helfat (1997) was perhaps one of the first scholars to confirm R&D as a dynamic capability in the U.S. petroleum industry. Since then a stream of both qualitative and quantitative empirical research has been slowly emerging trying to capture the impact of dynamic capabilities in LMT sectors (e.g. Abro et al*.,* 2011; Borch and Madsen, 2007; Chirico, 2007; Telussa et al., 2006; Jones et al., 2013;) mostly in cases of internationalization (Evers, 2011; Kuuluvainen, 2011; Quentier, 2011) and within the crisis context (Karagouni and Protogerou, 2013; Makkonen, et al., 2013). Although limited, the above empirical studies have laid the basis for further exploration of LT industries through the lens of the DCs approach.

In the same vein, a small but growing body of empirical research relates DCs to the performance, survival and growth of new firms[92] (e.g. Arthurs & Busenitz, 2006; Grande, 2011; Stam et al., 2007), or to the evolution and successful entry and survival of new firms in international markets (Sapienza et *al.*, 2010; Jantunen et *al.,* 2005; Zahra et *al,* 2006). Most research regards however mainly high-tech sectors. There is hardly any evidence from traditional sectors. Among the extremely limited efforts, Telussa et al. (2006) analyzed the association between dynamic capabilities and new firm growth, using a sample of mostly low and medium-tech firms. Ren et al (2010) explore how new village firms within a cluster, apply the DCs framework to convert their resources into performance, occupying a sample of 127 cutlery firms that belong to a cluster.

The notion of dynamic capabilities (DCs) has been also related to the concept of knowledge management (e.g. Easterby-Smith and Prieto, 2008). Yet, despite the increasing research interest, there is limited empirical and theoretical work on dynamic capabilities and their role in knowledge-intensive entrepreneurship.

[92] Thus far, the literature on dynamic capabilities and their development has been mainly focused on large and established firms (McKelvie and Davidsson, 2009). Please refer to Chapter 2.

Karagouni and Kalesi (2011) building on qualitative data from knowledge-intensive firms active in the food industry, showed that low-tech companies basing their strategy on knowledge intensiveness and innovation develop relatively strong dynamic capabilities in order to gain competitive advantage. Protogerou and Karagouni (2012) show that new entrepreneurial ventures *do develop* specific dynamic capabilities but their degree of development appears to be sector-specific and to depend on the firm's knowledge-intensiveness and their sector of economic activity. This is perhaps the first study relating knowledge-intensive newly-established firms to dynamic capabilities. Furthermore, Protogerou, Caloghirou and Karagouni (2013) using extensive survey data have empirically shown that the concept of dynamic capabilities clearly applies to young entrepreneurial ventures in traditional, mature industries. Additionally, the authors used case analysis to show that **DCs are present in knowledge-intensive low-tech firms**.

However, regardless the technology level, there is an ongoing debate on whether DCs exist, assist or are absent during venture creation. Additionally, the relation between dynamic and entrepreneurial capabilities during venture creation is far from clear. Arthurs and Busenitz (2006) draw a clear distinguishing line between entrepreneurial and dynamic capabilities. Helfat and Peteraf (2003) argued that an organization in the founding stage cannot have any DCs, to admit some years later that "Creating, adapting to and exploiting change is inherently entrepreneurial" (Helfat et *al.,* 2007).
Yet, **there are certain indications of potential relationships between the two categories of capabilities.** The literature review reveals that the interest of researchers on the interrelations of DCs and entrepreneurship which started in the mid-2000s is growing quite rapidly. Aramand and Dave (2012) contacted three case studies on three software entrepreneurial firms in Canada and found a bidirectional–causal relationship among DCs and entrepreneurial capabilities. Lanza and Passarelli's (2013) DECs constitute the integration of entrepreneurial orientation and dynamic capabilities at firm level. Augier and Teece (2009) provided a conceptual lens that focuses on the importance of the "*entrepreneurial" dynamic capabilities* of top managers, while Teece (2012) discusses the differences among dynamic capabilities and "enterprise-level dynamic capabilities".

According to Boccardelli and Magnusson (2006) while dynamic capabilities have constituted a fruitful vitalization of the resource-based view of strategy, there are features of entrepreneurial processes that "make it necessary to consider at least a few other aspects, which in turn, begs the introduction of further concepts". Several scholars try to highlight the entrepreneurial capability as a new category of DCs (Teece, 2012) or the entrepreneurial element of DCs (Aramand, 2009; Zahra, 2011; Boccardelli et *al.*,2006). Teece (2010) called for studying 'entrepreneurial management' to understand how sensing and seizing opportunities arise. In 2007 the author had already recognized the power of human beings and that no all are processes; "In regimes of rapid technological innovation, it is clear that making investment choices requires special skills not ubiquitously distributed amongst management teams" (Teece, 2007)[93].

Several scholars try even to specify the **origins of DCs.** Boccardelli and Magnusson (2006) in an empirical study of 59 start-ups in the Swedish mobile Internet industry define bricolage as a potential form of early-stage dynamic capabilities. Stam et al. (2007) examining the impact of DCs on high-tech start-ups' growth, conclude that capabilities at first take the form of trial and error efforts instead of routines. Some authors, such as Corner and Wu (2013) and Zahra et al., (2006) claim that their studies advance the understanding of the birth and evolution of new ventures' DCs. However, the majority state the need of more research on the genesis of DCs (e.g. Ambrosini and Bowman, 2009; Hart and Dowell, 2011; Maritan and Peteraf, 2011).

Therefore, existing theoretical and empirical research suggests that dynamic capabilities can also exist and be of value in less dynamic contexts and namely low-tech industries and play a role in the creation and evolution of new ventures especially within the area of knowledge-intensive entrepreneurship. Furthermore, the first data analysis revealed significant indications of the existence of dynamic capabilities in the investigated newly-established firms, as evidenced by the frequency of referring to various DC elements discussing the life-course of the firm, **despite the fact that only one question asked in the interview probed this area in a direct way.**

[93] For more detail please refer to the literature chapter

Consequently, based on the first findings and in our effort to explore deeper the potential ecologies between DECs, DCs and LT-KI new venture long-term survival and growth, we propose that:

DECs can provide the knowledge-based resource foundations for competitive advantage and can be the media to transform human-centric skills, entrepreneurial features and capabilities to firm-based processes which will constitute the core of the new firm's dynamic capabilities. Following the quote of Casson[94] (2000), DECs provide the "rules" (and are therefore "entrepreneurial") while DCs provide their implementation (and are therefore dynamic "routines").

This DEC-DC evolution in the new LT-KI venture context may help to explain heterogeneity of new LT-KI ventures survival and development while it can illuminate DCs' genesis (Corner and Wu, 2013; Hart and Dowell, 2011; Maritan and Peteraf, 2011). Suggested DECs will be measurable and patterned as well as simple, idiosyncratic and iterative with certain of their dimensions to be able to be embedded in DC micro-foundations. Furthermore both DECs and the subsequent DCs will enable the creation of competitive advantages which will be constructed on a knowledge-creation basis instead of relying on existing structures and knowledge.

Hypothesis 3: DCs exist in new LT-KI firms and DECs constitute their entrepreneurial side

6.2.4. Production technologies

The commitment to physical creation is a significant transition point in venture creation. Certain businesses require considerable tangible and intangible resources for the setup of production technology since most of them, besides the use of standard equipment and technology develop production technology novelties (Thompson 1967; Bhave, 1994). Even since Schumpeter (1934) the creation of a new firm has been connected to technology and new products' production while literature has so far examined the dependence of firm formation on technology regimes (e.g. Winter, 1984) and technological resources (Shane, 2001; Rasmussen et al., 2012). Parker

[94] Casson (2000), "rule making is entrepreneurial, but rule implementation is routine".

(2008) views "entrepreneurs as producers" and claims that entrepreneurship is an effective way of bringing new ideas *and* production processes, while Naudé and Szirmai (2012) relate industrial revolution to the introduction of radically new production technologies. Tan et al. (2009) highlight the need of a theory on the interrelationships between technology and entrepreneurship especially for the pre-firm formation stage. Technological resources are important for industrial competitiveness and firm performance (Protogerou et al., 2008; Huang, 2011; Malerba and Marengo, 1995; Helfat 1997).

Furthermore, within the notion of knowledge-intensive entrepreneurship a venture creation is tightly connected to knowledge-intensive innovation (Malerba and McKelvey, 2010). Knowledge is mainly incorporated into production via investment. When referring to low-tech industries, the transformation of an innovative business concept into a marketable product presupposes the choice and set up of the suitable production technologies and the function of investment is precisely to implement new knowledge in production technology regarding know-how, processes and methods, new machinery and equipment (e.g Knell, 2006). Entrepreneurs, entrepreneurial teams or managerial teams try to identify and acquire advanced production technologies to combine and create the technologies they need. Much of the knowledge intensity enters as embodied knowledge incorporated into machinery and equipment or as intermediate inputs (components and materials) into production processes (Lichtenthaler & Ernst, 2007). "Embodied flows involve knowledge incorporated in to machinery and equipment" (Hirch-Kreinsen, 2006). Scientific knowledge and new technologies are indeed indispensable for low-tech innovations, but they are always resorted to in a targeted and selective way to solve practical problems (Hirch-Kreinsen and Schwinge, 2011).

Furthermore, low-tech industries are known mainly for producing process innovations (e.g. Hirsch-Kreinsen et *al.*, 2006) or for the fact that product innovation cannot meaningfully be separated from process innovation (e.g. Bender, 2004). However, process innovations are results of technology development or change and thus depend highly on technological resources (e.g. Borch, Huse and Senneseth, 1999; Lin, Vassar and Clark, 1993; Raymond and St-Pierre, 2005). Ritter and Gemuenden (2004) claim that such distinctive resources can enhance the innovative organizational performance. Many studies have integrated innovations with market and technology

dimensions (e.g. Danneels, 2002; Abernathy & Clark, 1985; Garcia & Calantone, 2002; Van de Ven, 1986; Brown & Eisenhardt, 1997; Renko et al., 2009). In cases where the output of innovation constitutes the initial competitive advantage, planning and installing the suitable production technology entails a great amount of creativity and trans-sectoral knowledge combination (Karagouni et al., 2012). Advanced production technologies enable "the firm to capture lucrative and more value added markets for growth" (Evers, 2011). On the other hand, production technologies refer to operational capabilities and have been used to analyze capital investments to build and maintain capabilities (e.g. Baldwin and Clark, 1992; Winter, 2003).

In strategic management, abilities to understand, use, and exploit relevant state-of-the-art technology internally are built-up by relevant tangible and intangible resources and have been assigned as technological competencies (Ritter and Gemunden, 2003). Figueiredo (2002) suggested that technological capabilities focus on the capacity to utilize and apply technical knowledge and skills in order to create new products and processes. Such technological capabilities are very useful and need to be sought in multiple technology fields by new ventures or in cases of technological change (Bell and Pavitt, 1993; Granstrand, 2000; Garcia-Vega, 2006).

Virginia Acha (2000) in her thesis suggests that technological capabilities are the knowledge and skills required to identify, appraise, utilize and develop technologies and techniques relevant to the upstream petroleum industry. Leonard-Barton's (1995) famous case-study of Chaparral Steel Company revealed that it was the development of a highly innovative casting production technology that became the core technological capability of the firm. The author argues that technological competence does not accumulate only in the heads of people but in the physical systems that they build over time such as machinery, processes and software programs. She actually shows that it is the creative combination of various technology sources and multiple knowledge bases that leads to competitive advantage, confirming the relevant recent observations on low-tech innovation and KIE. She further confirmed the significance of production technologies.

Production and operations are included as core elements of technological capabilities by many scholars (e.g. Danneels, 2002). Westphal, Kim and Dahlman (1985) focus these capabilities on efforts to "make effective use of technological knowledge in production, investment and innovation. Lall's (2002) technological capabilities are tightly related to production technologies:1) investment (pre-investment and project

execution) covers technology search and product design, 2) production refers to process, product and industrial engineering and 3) linkage within the economy is translated as the ability to receive information, skills and technologies.

It is quite evident that production technologies and in a more general manner the management of new technologies are lately receiving increasing attention in strategic management research (Greve, 2009) either as important factor of innovative efforts and firm performance (e.g. Danneels, 2002) or as core elements of technological capabilities (e.g. Lee et al., 1997; Sampath and Oyeyinka, 2008; Lall, 1992). Therefore, the important role that production technologies appear to play in almost all thirty cases of the research cannot be considered as unexpected and it surely deserves further exploration. Accordingly, in order to capture the technical aspect of the low-tech-knowledge-intensive venture creation problem, we expect that

Hypothesis 4: Production technologies play a significant role in LT-KI new ventures creation and as operational capabilities are related to DECs.

6.3. Epilogue

The literature review clearly indicates that the central focus of this thesis i.e. low-tech KIE exploration is still early on its theoretical development. There is little empirical support for many of the constructs and propositions, and there are several grey areas that need clarification. Furthermore, although the research started with a broad interest on LT-KIE in terms of exploring how such ventures can survive and grow successfully, the initial data analysis indicated a shift towards a capabilities perspective. A comparison of these initial findings to literature proved that a capabilities approach is actually in accordance to the general entrepreneurship literature and the latest insights of relevant scholars and researchers (e.g. the call for the entrepreneurial management by Teece). However, it also showed that little work has attempted so far to tie together the theory of entrepreneurial and dynamic capabilities, or the importance of production technologies with venture survival and growth both in cases of LT-KIE and in KIE literature in general.

Thus the main research hypotheses as presented in Table 6.1 emerged from the review of relevant literature and the first insights of the discussions with the interviewees of the thirty low-tech cases. In order to investigate and operationalize the suggested

dynamic entrepreneurial capabilities, analyses have been developed from the respective data sets, and then combined in order to induce propositions using methods for building theory from case studies (Eisenhardt, 1989; Glaser & Strauss, 1967) as extensively narrated in the relevant chapter.

Table 6.1: Main research hypotheses

Hypothesis 1: KIE in low-tech sectors can be related to specific dynamic entrepreneurial capabilities (DECs).
Hypothesis 2: DECs have a positive impact on new LT-KI ventures' performance
Hypothesis 2.1.: DECs have a positive impact on new LT-KI ventures' competitive advantage *Hypothesis 2.2.: DECs have a positive impact on new LT-KI ventures' survival* *Hypothesis 2.3.: DECs have a positive impact on new LT-KI ventures' growth* *Hypothesis 2.4.: DECs have a positive impact on new LT-KI ventures' innovativeness*
Hypothesis 3: DCs exist in new LT-KI firms and DECs constitute their entrepreneurial side
Hypothesis 4: Production technologies play a significant role in LT-KI new ventures creation and as operational capabilities are related to DECs.

Chapter 7 - Results and analysis

Chapter Objectives

- To present the building blocks of the conceptual framework of this study.
- To establish the research hypotheses of this study.
- To establish the propositions of the study

7.1. Introduction

Utilizing the results of the within-case and cross-case analysis of the thirty case studies, this chapter addresses the four hypotheses as formed above. A principal aim of cross-case analysis is to derive conclusions, moving beyond initial impressions of individual cases. Key findings across cases are discussed within the context of the conceptual model as deployed in Chapter six. Actually, this chapter purports to give some answers to the *how, what*, and *why* of findings emanating from the case study analysis in relation to current literature.

More precisely, the inductive nature of qualitative research propelled the deeper consideration of the above hypothesized framework by the development of a) specific conceptualizations of the dynamic entrepreneurial capabilities in relation to competitive advantage (CA), survival, growth and innovativeness in LT-KI new ventures, b) the specification of the role and the significance of production technologies and their relation to DECs, c) the existence of DCs and the way they are related to DECs.

Data analyses and literature reviews were carried out concurrently in order to support findings and build theory around them in a more concrete way avoiding in parallel the danger of "reinventing the wheel". Constant iterations helped to shape the direction and refinement of initial hypotheses as well as the need of subsequent information collected such as balance sheets, important facts and shifts in the new firms' life up to now. This process provided opportunities for increasing the *density* and *saturation* of recurring categories, as well as following up unexpected findings. Interweaving data collection and analysis in this way is held to increase insights and clarify parameters of emerging theory (Glaser & Strauss, 1967; Strauss & Corbin, 1998).

A significant issue in LT-KIE regards the creation and adaptation of the new venture's resource base (Protogerou and Karagouni, 2011) with knowledge assets to be a significant part of them. Therefore, an important basis on building theory was the focal **role of distributed knowledge bases and the capability of LT-KI entrepreneurs to collect and combine that knowledge** (Bender, 2004; Hirsch-Kreinsen and Schwinge, 2011; Robertson and Smith, 2008). Low-tech but knowledge-intensive entrepreneurs were found indeed keen to set specific problems, question existing knowledge and seek different and complementary information and knowledge within other sectors (both high and low-tech ones). Consequently, emergent innovations due to new knowledge appear to be the vehicle but also the results and outputs of applying successful LT-KIE.

In accordance, the development of DECs turns around this core issue of concept creation and knowledge and other resources search, assimilation, combination and novel knowledge creation. In this chapter, we establish, define and discuss the nature of DECs and outline their core dimensions within the context of KIE in low tech sector. DECs have been proposed as dynamic entrepreneurial capabilities which seek and leverage new LT-KI ventures' necessary resources in order to establish them in the markets. They are responsible for forming mismatches between entrepreneurs' aspirations and visions, opportunities and resources followed by transcendental matches between them in order to shape novel business concepts. Knowledge acts as both the mediator and moderator on a constant interaction with the external environment. In advance, the examination of the new DECs' impact on performance measures can further question the significance of the new framework proving or rejecting the second hypothesis.

The examination of the third hypothesis is based on the fact that the conversation with the entrepreneurs and CEO of the interviewed firms gave satisfying material on the existence of dynamic capabilities in their lifespan. This was later strengthened by a new, very small and just arising stream of literature which argues that DCs can be also found in low-tech companies. Meanwhile, another small but much like increasing stream of research suggests the single entrepreneur or the entrepreneurial team as a source of DCs indicating that these capabilities can exist at the outset of the venture (Helfat et al., 2007; Boccardelli and Magnusson, 2006) and calls for a further exploration of their entrepreneurial side, focusing on the analysis of "non-routine activities and leadership skills" [quoting Teece in Felin et al. (2012)]. This view stimulated the exploration of potential relations among DECs and DCs.
Last but not least, the importance of production technologies and process innovation in low-tech industries triggered the fourth hypothesis which seems to be verified by the data analysis. It also offers further evidence on the role of knowledge on production technology formation and advance and production technologies' relationship to DECs as operational capabilities and technological assets. However, this is an additional proof that DECs can be assigned as higher order capabilities.

Besides the relatively high importance given to both new venturing and the strategic capabilities views, relevant theories are surprisingly dispersed and maintain an ambivalent relationship. Boccardelli and Magnusson (2006) state that the important seed and start-up phases are not sufficiently covered by the resource-based theories, since they rarely have considered the early stages of firm development. DC theory suffers the same deficiencies. Therefore, the present research endeavors to offer some new insights in these issues, even if the hypotheses address a very specific but quite important area of entrepreneurship and namely, the knowledge-intensive, low-tech entrepreneurship.

7.2. Sub- Section 1

Hypothesis 1: **KIE in low-tech sectors can be related to specific dynamic entrepreneurial capabilities (DECs).**

7.2.a) Some Explanatory notes

For the purposes of the present research, the entrepreneurial process is conceived as "the process that takes place between the intention to start a business and making the first sale" (Gatewood, Shaver, and Gartner 1995; Newbert, 2005) or as "the process, from the venture idea to the newly formed business's strategic success, in terms of the development of knowledge", according to the broader view of Ihrig et al. (2006) who attempted a knowledge-based approach to entrepreneurship. Yet, knowledge is not simply acquired within "a static system" but as "a whole dynamic process" (Boulding, 1966). That means that the acquisition of knowledge is itself a part of the process and that knowledge is in the core of all relevant activities as stated in KIE definition.

The analysis regarded both the individual level (entrepreneurs/ entrepreneurial teams) and the organizational level (potential formed processes, emerging routines, and formed linkages) in an attempt to capture those capabilities that enable and enact LT-KIE under the aforementioned conditions. It further considers people, ideas and resources as three critical factors of success. However, in all instances knowledge is the mediator for all activities.

Accordingly, the second round of the within case analysis and the cross-case analysis of the qualitative data as presented in the previous chapter, pointed to a rich fabric of processes and competencies which were further grouped and analyzed according to certain specificities. More precisely, following Eisenhardt's suggestions for "looking for and listing similarities or differences across categories, dimensions by data sources" (Eisenhardt, 1989a, p.540), the analysis turned initially to find answers to the first two questions.

a) How do LT-KI entrepreneurs/teams create innovative knowledge-intensive business concepts?

b) How do LT-KI entrepreneurs / entrepreneurial teams locate the new sources of knowledge, manage access to these sources and use knowledge in order to produce innovation and how do they transform the innovative result into production lines, products and market success?

In order to answer the first "how" of the second question, patterns were first grouped regarding the ability to discern and appreciate the value of loosely pieces of information, knowledge and technology, novel or not, dispersed in several industrial sectors. Selection criteria would take into account

- the significance of "distributed knowledge bases" for low-tech innovativeness (Robertson and Smith, 2008),
- the trans-sectoral character of such efforts (Hirsch-Kreinsen and Schwinge, 2010) and
- the fact that besides knowledge, founders / teams would have to confront the rather normal shortage of basic resources such as people and finance too (Shane and Venkataraman, 2000).

In order to collect precisely the piece of information that would reflect the above, existing resources, acts of refusal to limitations of industry rules and regulations and cases of innovation under scarcity were further taken into consideration.

In the same line, **trying to find answers for the second "how"- part of the second question**, i.e. how ideas are implemented and result in products / services in the market, two facts known by entrepreneurship literature but also emerging from the first round of data analysis were taken into consideration:

a) The periods of concept-forming and founding are the most ambiguous periods in a venture's life (Baker et *al.*, 2006; Boccardelli and Magnusson, 2006; Moorman and Miner, 1998).
b) it was quite evident from within-case analysis that design and execution converged substantively. According to narrations the initial concept had to be many times reconsidered and reshaped due to several reasons such as arising technical problems, inspiration of the moment or unexpected laboratory results, as it will be thoroughly explained later in this chapter.

Answers should enable the development of a specific set of capabilities which in turn would be able to satisfy the general terms of *capabilities*. Consequently, according to relevant literature on capabilities, they should be able to

a) be developed through knowledge, experience and learning processes (e.g., Nelson and Winter, 1982; Zollo and Winter, 2002; Lichtenhaler, 2009).

b) derive from the skills and capabilities of the people of the venture (firm) as well as distinct formal or/and informal processes and structures (Helfat and Peteraf, 2003; Makadok, 2001; Sanchez and Mahoney, 1996;) and therefore entail non-entrepreneur-based dimensions which could be carefully planned, developed and deployed.

Therefore the new capabilities should enable the achievement of repeated performance of activities (regarding the same venture or different ones) in contrast to *ad hoc* activities with no patterned behaviors (Dosi et al., 2000; Winter, 2003; Helfat and Winter, 2011) and should be also able to lay the foundations for initial competitive advantage. Thus, the new capabilities should refer to *precise and measurable constructs.*

According to Eisenhardt's method for theory building, the tentative concepts emerging from the above categorization should be sharpened so that they would be well defined and evidence would be built to measure them. (Eisenhardt, 1989, p. 541). As Eisenhardt and Graebner (2007) explain, the "theory-building process occurs via cycling among the case data, emerging theory, and extant literature" (p. 25). Ferreira and Merchant (1992) also see the need to "explicitly link the observations to a pre-existing body of knowledge". In this vein, the emergent patterns and competencies as prefigured by the first grouping became subjects of research within existing literature.

After a subsequent detailed multi-disciplinary investigation in the wider field of entrepreneurship and management and research across disciplines, we noted that the traced patterns matched descriptions of the phenomena of bricolage and improvisation. The two first DECs then were built on the relevant theory. This will be discussed and explained in detail later in this chapter.

However, it was not the same with **the first question.** Both the formation of literature-based criteria to group patterns and competencies and the circulation among the case data, the emerging theory and the extant literature" **(**Eisenhardt and Graebner, 2007) proved to be of significant difficulty**.** The within-case data analysis showed that actors of all cases (even of the ones considered as failures) tried to challenge the very nature of their low-tech industries and their strong path-dependencies in order to come up with innovative knowledge-based business concepts. Actually, across the cases,

almost all innovations were results of mismatches of common and transcendent ideas (Table A2, Appendix A). But, ***how did they do it***?

This step involved a quite long iterative tabulation of evidence for patterns to be traced in order to find answers to the above question. Since there was no relative KIE literature, insights should derive again by the broader relevant entrepreneurship literature. The review indicated that new venture creation regarding idea development is related to either special talents such as 'imagination' (Ulrich Witt, 1998, 1999), abilities to act with foresight, behave creatively (Goleman, Kaufman and Ray 1993), use intuition, employ heuristics and be alert to new opportunities (Mosakowsi 1998; Arthours and Busenitz, 2006), alertness and judgment (Foss et *al*., 2008) or specific entrepreneurial capabilities such as Sun et al.'s (2011) opportunity identifying, interpersonal skills and organizing. Hans Hinterhuber (1992) speaks of the "feeling of a mission". Boccardelli and Magnusson (2006) through empirical work underline the importance of flexibility, experimentation and improvisation from the founding of the firm. Another quite small stream of literature has dealt with the process of new venture creation[95] (e.g. Bhave, 1994; Lichtenstein et al., 2006) irrespectively the novelty or the knowledge-intensity and definitely not from a capability's view. Finally there is another small group of scholars who support the idea that idea creation can be approached in deliberate and systematic ways (Vesper, 1993; Faltin, 2000). Faltin (2001) actually describes a series of techniques for entrepreneurial idea generation such as "discovering something existing", "(Re) integrating Functions", "Taking a Problem and Turning it into a Business Opportunity", "Bringing Visions to Life". However, the authors conclude that systematic idea development and refinement are rarely ever found in the syllabus of entrepreneurship education. In the same vein, Ihrig et al. (2006) comment that in cases of opportunity exploitation most scholars explain the "why" and the "when" shedding hardly any light to the "how" question.

Thus, all the above could not answer the "how" question, since the core of the question did not actually intent to address only individual-level capabilities, traits or

[95] This sub-stream is somewhat smaller compared to the rest of relevant literature, but it has received attention on par with the latter over the last 7 years (Davidsson and Gordon, 2012). The authors following Davidsson (2004) and associating ''discovery'' with the conceptual side of venture creation-identification, refinement and elaboration of a business idea - whereas ''exploitation'' refers to the tangible actions of resource acquisition, resource coordination and market making – have actually traced only 9 relevant articles in their review of panel studies of new venture creation

mere implementation mechanisms, such as Boccardelli and Magnusson's (2006) experimentation and improvisation for example, and practical techniques. Although it *is* a common acceptance that "entrepreneurs think differently and see new opportunities where most others see either a benign environment or even emerging threats" (Alvarez and Busenitz, 2001), the focus of the research was quite different; the big question in general and more precisely for the LT-KI venturing was **the "how they do it" question, based on a capabilities approach.**

The within-case study analysis revealed that LT-KI entrepreneurs come up with innovative opportunities beyond the simplistic combination of pieces of knowledge which may derive from any point of the value chain and any industry. They refuse limitations and transcend sectoral and national borders engaging the well-known *thinking outside the box*[96], where the "box" here is actually the mature, saturated markets of their industries. Therefore they create novel knowledge as a basis for their LT-KI business ideas, and the how question can be put on a "knowledge-business concept" relationship.

In order to decode this relationship, inspiration came from a quite different area: the philosophical field. The Prussian philosopher Immanuel Kant (1724–1804) in his monumental *Critique of Pure Reason*[97] explains the relationship between knowledge and things-in-themselves. He actually attempts a logical designation of two varieties of knowledge: *a posteriori,* the knowledge acquired through experience; and *a priori,* thus knowledge not derived through experience. Kant practically asks what we can know, and how we can know it. In parallel, the research question regards the same subject: *what entrepreneurs are able to know* (in order to form KI business ideas) and *how they can do* it (i.e how they *can* know). Kant's theory and several of his terms and definitions have been taken into consideration to form the novel concept of *Transcendental Capability,* which purports to "decode" the way KI-LT entrepreneurs/teams create novel knowledge-intensive business concepts and to

[96] Thinking outside the box (also thinking out of the box or thinking beyond the box) is a metaphor that means to think differently, unconventionally, or from a new perspective. This phrase often refers to novel or creative thinking. The term is thought to derive from management consultants in the 70s-80s.

[97] Kant argues about knowledge and "things per se": "I entitle transcendental all knowledge which is occupied not so much with objects as with the mode of our knowledge of objects in so far as this mode of knowledge is to be possible a priori." (B25, Kant, 1781)

outline “principles that underlie and guide choices of (*these sort of*[98]) entrepreneurial acts” (Teece, 2012).

After consulting Kant’s ideas, a parallelism was attempted between **the observed patterns,** i.e.

- *The case innovations* as results of mismatches of common and transcendent ideas, and the overcoming of sectoral, national and other limitations,
- *the role and types of knowledge*, experience and learning processes in the formation of these novel ideas,
- the time and resources spent on search for idea background, and
- any related processes that could be traced from narrations which would present remarkable similarities

and

Kant’s thoughts on the knowledge origins (observing the real world), the conscious cognition of the world individuals live in (knowledge of sense-perception), the non-passive act of space cognition, the conscious selection, order and interpretation of “things-in- themselves”, methods and rules for this activity, the "sense data", a priori and a posteriori knowledge, space and time, and mechanisms of reaching the “things-in-themselves” through knowledge.

This step involved again a quite long and painful iterative tabulation of evidence for patterns to be traced in order to find answers to the above question. The data were looked at in many divergent ways to force the researcher beyond her preliminary impressions (Eisenhardt, 1989a). Rival explanations for patterns were tested within and across-cases to allow new insights and to “improve the likelihood of accurate and reliable theory” with a close fit to the empirical data (Eisenhardt, 1989a, p. 541). Three translations of Kant’s Critique of Pure Reason (first edition, 1881) were used. Paraphrasing Pettigrew (1997), this cross-case pattern and concept comparison represented one of the greatest inductive challenges of the process and an area of intellectual challenge “which is even now as difficult to describe as it is to publically justify”.

The final outcome is presented in Tables A9 to A12 (Appendix A). Transcendental Capability will be delineated in detail in a subsequent section.

[98] Replacing the word “the” of original text

In addition, the data analysis confirmed the relevant KIE theory on the substantial impact of the combination of personal abilities and traits, culture, existing business ecosystems and technological skills and competencies on stimulating research and open innovation even in low-tech sectors. Actually, such elements are present in most new knowledge-intensive ventures of the sample as evident by the companies' presentations of the first round analysis and the cross-case analysis tables.

Furthermore, the review of new venture literature justified the assumption that venture creation is a dynamic process (e.g. Agarwal and Audretsch, 2007; Sarason et al., 2006; Shane and Venkataraman, 2000) characterized by multiple modes of activity that occur simultaneously and interdependently (Low and MacMillan, 1988). In order to prove and measure emergence in the dynamics of new venture creation, Lichtenstein et al. (2006) used a single, in-depth case study interviewing a nascent entrepreneur every two weeks for two years. Change is pervasive in entrepreneurial dynamics (Bhave, 1994; Lichtenstein et al., 2006; Stevenson and Harmeling, 1990). Consequently, with dynamic processes to be at the core of the new venture creation, the new set of *entrepreneurial capabilities to satisfy LT-KIE* should also be *dynamic.* In other words, they should be able to involve renewing skills, add resources and evolve and enhance competences all along the stage of the new venture creation as well as the first stages of the new firm's life. These would be deployed to either create or capture markets under the ambiguity of the new business conditions due to the novelty offered as well as the common risky uncertainty that escorts any new undertaking. **This insight gave birth to the term of "Dynamic Entrepreneurial Capabilities"**. It further posed the question of potential relationships among DECs and DCs since DCs had already been traced even in the first within-case analysis.

Therefore during the new iteration of with-in and cross-case analysis, attention was further paid on specific characteristics which would allow for the term "dynamic" to be used, such as indications that:

- the new capabilities are difficult-to-imitate combinations of organizational, functional and technological skills, or that
- they enclose the potential to continuously reform these skills and competencies at the founding stage as well as the early phase of the new venture, matching the demands of the new and often ambiguous environment.

- They support the production of strong initial competitive advantages through novel ideas which are not necessarily patented 'out of the lab' technology but could refer to effective results of open innovation, effective technology transfer, new business models, novel design or the shaping of new markets.

The following section depicts the development of the LT-KIE related capabilities in detail illuminating the 'how' of LT-KI new venture creation and building a DECs conceptual framework. This has been achieved by following the suggestions of Eisenhardt (1997) on the theory-building process. The present effort relied on past literature and empirical observation, while the process was a strikingly iterative one. It actually seemed that the process itself caused a constant iteration backward and forward between the steps; "from cross-case comparison, back to redefinition of the research question, and out to the field to gather evidence on an additional case" as Eisenhardt so accurately states. However, the process, intimately tied with empirical evidence, converged on construct definitions, measures, and the DECs framework for structuring the findings regarding the first hypothesis.

7.2.b) The concept of Bricolage capability

How do LT-KI entrepreneurs / entrepreneurial teams locate the new sources of knowledge, manage access to these sources and use knowledge in order to produce innovation and how do they transform the innovative result into production lines, products and market success?

7.2.b.1) Nature of the capability

As already stated shortly above, the first part of the above question is actually a matter of resource seeking, selection and fruitful allocation which regards mainly knowledge issues within the context of LT-KIE; it also regards other tangible and intangible resources such as human and social capital, physical and technical assets and finance in order to reach the implementation stage.

Even since the first within-cases analysis it was evident that knowledge was the most valuable resource in all cases. As it can be seen in Table 4.2.b, almost all cases

confronted **a significant shortage of knowledge** needed to realize their novel ideas (ranging from limited to extremely limited, with the only exception to be the corporate case WCo2 with an adequate knowledge basis). On the other hand, **the resources** regarding human, social and financial capital presented a significant range between extremely limited and rich, with most cases of corporate venturing to enjoy an abundance of them. Furthermore, physical and technical assets were extremely limited in most cases of new-to-the-world cases and limited or adequate to the rest.

Therefore, all cases confronted more or less significant knowledge and other resource constraints in accordance with literature (e.g. Senyard et *al.*, 2010; Shane and Venkataraman, 2000; Shepherd et *al*., 2000). However, knowledge resources, incorporating technical, functional and social skills, as well as other types of resources are based on the entrepreneurs / entrepreneurial teams or are accessed through networks such as personal contacts (Oswald et *al.*, 2011; Witt et *al.*, 2008). On the other hand, LT-KIE literature focuses on the abilities of LT-KIE entrepreneurs to select knowledge from "distributed knowledge bases". Based on these streams of literature, the new iteration of the data analysis focused on

- Resources at hand and
- Ways of knowledge selection, tracing, acquisition and combination.

This intermediate iteration indicated the broad categories of resources at hand as well as the first rough differences between new-to-the-world and corporate ventures as shown in Table 7.1.

Table 7.1: Resources at hand

Type of resources	**Type of venturing**	
	New-to-the-world	**Corporate**
Human capital	Entrepreneurs themselves	Entrepreneurs themselves Selected members of parent company Selected collaborators
Social Capital	Family Former business contacts Friends	Current business contacts Suppliers
Financial capital	Private capital Family support	Parent firm's financial capital
Knowledge assets	Academic background Experience from previous work / business Experience from family business	Activity knowledge bases (internal firm knowledge) Human capital's knowledge (Tacit knowledge), codified knowledge
Technical assets	Non-existing base for "taking-off"	Existing base for "taking-off"

Table 7.2: Ways of knowledge selection, tracing, acquisition and combination

Ways	Type of venturing	
	New-to-the-world	Corporate
Networking	Usually (but now always) limited initial pool, friends, potential customers, family contacts	Extended, international, mainly business contacts
Participation in collaborations	Usually timid	Robust with suppliers of all kinds, academia
Search for knowledge	Sector-specific (e.g. food sector engages a wide area of search)	Sector-specific(e.g. food sector engages a wide area of search)
New applications for existing technology	Sector-specific	Sector-specific
Learning processes	Dynamic but not organized	Dynamic but mainly organized

In all cases the ability **to mobilize, transform and absorb external knowledge** proved to be of utmost importance for almost all actors in order to follow the advice of Teece (2007); "interpret new events and developments, which technologies to pursue, and which market segments to target". This presupposed the ability to discern and appreciate the value on loosely pieces of information, knowledge and technology, novel or not, dispersed in several industrial sectors. This **trans-sectoral knowledge**-base expansion is evident in Table A2 (Appendix A) although it is somewhat sector-specific as it will be later detailed. Especially new ventures of the food sector seem to expand to areas well-outside their own, such as chemistry, biotechnology, packaging etc. This is however, in line with KIE literature; transcending industrial borders to gain knowledge regarding technological, market or even institutional opportunities seems to be a condition *sine qua non* for low-tech KIE[99] (Hirsch-Kreinsen and Schwinge, 2012) while **"distributed knowledge bases"** are significant for low-tech innovativeness (Robertson and Smith, 2008). Knowledge is a composite and complicated phenomenon, communicated, acquired, exploited and created through dynamic and complex processes. Knowledge and information have no limits today, while on the other hand entrepreneurs and organizations suffer certain limits and are terribly finite actors.

Across our samples, founders made use of an extraordinarily broad **variety of means and resources at hand** (Tables 7.1 and 7.2) during (and after founding) involving suppliers, family, academia and even customers among others. Still, they did not rest on their specific sectoral knowledge; instead in their effort to sense and capture both

[99] Kreinsen (2010) states: "*Firms cannot be the drivers of KIE processes if they only rely on their specific sectoral knowledge, instead they have to build up relationships with actors, resources and opportunities from outside the sector*".

tacit and explicit knowledge, they created and nourished linkages with actors out of the sector and out of the Greek nation as well. The knowledge engaged was of many kinds:

- Scientific: FCo5, FCo6, TCo7
- Technological: all WCo-cases, all FCo-cases, all TCo-cases
- Technical: all WCo-cases and especially WCo5, all TCo-cases
- Of practical knowledge: all cases entailed practical knowledge to a great extent
- Design competence: WCo1, WCo10, TCo1, TCo3, TCo8, TCo10 or
- Expertise in logistics:WCo3, TCo5

In all cases it was a mixture of codified knowledge and knowledge incorporated in humans and in technical artifacts.

LT-KI entrepreneurs of the cases seemed to create new ventures out of loosely pieces of knowledge, which alone could be hardly anything in terms of novelty or differentiation. Considering for example the case of **FCo1**:

> *Pieces of knowledge at hand* regarded fruit processing (composting), the agri-food environment and suppliers and advanced studies on food marketing. *Pieces of knowledge collected* regarded olives and feta cheese processing technology (quite different from previous knowledge), knowledge to develop novel technology and processing techniques, packaging (novelty produced), and chemical treatment of various components (novel knowledge). The initial idea of combining pure and traditional agricultural products, focused on olive-feta matches in the beginning to be refined and extended to a whole range of gourmet products, adopted cultural dimensions and opened a completely **new niche market globally** which soon found fanatic imitators and a welcoming acceptance. The success was bigger than expected.

How was this achieved?

> A lot of search in the internet, study of relevant literature, expert consultation, collaboration with a chemist (who is later engaged by the firm), much travelling to meet international tastes (mainly in Europe and USA), different ethnic recipes' reading and other collaborations to create machinery and equipment for the physical implementation of the novelties.

> Suppliers and manufacturers are engaged to offer knowledge, chefs advise the entrepreneurs through their books, health and taste issues for different countries have to be explored and properly translated.

Networking, the identification and deployment of sometimes unconventional means, recombination of resources in creative ways and a focus on learning were the ways used by **FCo1** and by most cases as can be seen in Tables A3 to A5 Appendix A.

Furthermore, the actors of all cases seem to defy more or less conventional assumptions about the role of the environment and knowledge in determining the success or failure of their novel ideas. They seem to just create problems posing unconventional questions, disregarding technology and standards' limitations, trying out solutions, collecting knowledge from diverse areas and combining resources for new purposes:

> "Who can ever define the quality of milk? (**FCo8** disregarding the standard of fresh milk quality and refusing technology limitations)
>
> "Of course no-one would ever deny that rice is more than rice, but there are still novelties to be derived from rice, won't they?" (**FCo6** disregarding conventional thought on rice as an industrial product and refusing technology limitations)
>
> "I had developed my boxing concept; then I needed to develop the technology to realize it" (**WCo8** refusing technology limitations).
>
> "One-piece dying; to what cost? OK, we would definitely *not* sell it at the Asia price, but it would be worth its costs! All we needed was novel technology!" (**TCo3** refusing technology limitations)

These observed patterns and competencies involved idiosyncratic combinations of heterogeneous **resources** applicable to new problems and opportunities. Our literature research matched most of the above observed patterns that entrepreneurs would use with efforts of *tapping distributed competence and knowledge, reemploying and reframing them, and recombining them creatively* (Bender, 2004). This has been known as the capability of "*Making do with current resources, and creating new forms and order from tools and materials at hand*" or otherwise **"bricolage"** as defined by the anthropologists Levi-Strauss (1966). In resemblance to the bricolage phenomenon, the actions of the entrepreneurs/entrepreneurial teams of the cases enclosed a conscious refusal to limitations defined by knowledge, institutional or

cultural settings (as suggested by Baker and Nelson, 2005 for example) and delineating a frame where the processes of discovering opportunities and enacting resources are one and the same (in accordance with e.g. Baker and Nelson, 2005; Oswald et al., 2011). The matching of the observed patterns of the research cases with Baker and Nelson's (2005) view[100], indicates that they entail the three key parts of bricolage: a refusal to enact limitations of any kind, the creation of combinations of resources for new purposes (thus "entrepreneurs do not start from scratch") and the action of collecting together 'bits and pieces' or otherwise loosely connected information, knowledge and other resources.

The notion of bricolage has been already used in entrepreneurship, innovation and knowledge management research (Duymedjian & Rueling 2004; Garud and Karnoe, 2003; Baker et al., 2003, Michaud & Thoering, 2001) as it has been narrated in the relevant section of Chapter 2. Bricolage capability has been treated as an individual activity (Weick, 1998), an organisational process (Ciborra, 2002) and a form of inter-organisational dynamics (Garud and Karnøe, 2003). Duymedjian and Rüling (2010) have explored bricolage as a challenging path for analyzing everyday action in organizations. It has been studied even as a dynamic capability (Boccardelli, 2006[101]; Jones et al., 2010) which can sustain the renewal and reconfiguration of the resource base. In 2013 the term of "bricolage capability" was further adopted by Hirsch-Kreinsen (2013) in a DRUID paper on the Typical Patterns of Knowledge-Intensive Entrepreneurship in Low-Tech Industries: "This specific capability of the actors can be termed as "bricolage" capability, i.e. the ability to synthesize knowledge from many fields and hence to derive long-term company goals". For the bricoleur the environment does not determine the future, but rather needs to be actively engaged in order to create opportunities. Therefore, bricolage capability can explain why the knowledge-intensive entrepreneurs of the samples disregard the limitations of commonly accepted definitions of science, technology and standards, insisting instead on trying out solutions as mentioned above.

[100] This is considered the most developed view of entrepreneurial bricolage (Phillips and Tracey, 2007)

[101] "The early-stage dynamic capabilities reveal themselves as bricolage, that is, the capacity to re-interpret and re-combine already existing resources and thereby improve their fit with the demands of the market environment. (Boccardelli, 2006, on dynamic capabilities in early-phase (high-tech entrepreneurship)

Entrepreneurship - says Timmons (1994) - means the ability to set up and build something out of practically nothing. The bricolage concept has been used to describe such low-tech but knowledge-intensive entrepreneurial activities i.e. activities that led to the creation of new ventures seemingly out of nothing through various processes of recombination and transformation of existing resources (e.g. Ciborra, 1992; Venkataraman, 1997; Baker, 2000). This is evident from the research cases, if one focuses on the "extremely limited" - to "limited" knowledge assets that cases had in order to produce knowledge- based innovation (see Table 4.2 b).

There seems to be a good patterning between bricolage and the proposed *LT-KIE capability*: confronting resource constraints as sources of creativity and innovation, they both help firms explore and exploit new opportunities that might otherwise be too expensive to investigate by more traditional means (Baker and Nelson, 2005; Miner et al, 2001). Furthermore, the fact that LT-KIE is tightly related to innovation is not of irrelevance to the bricolage theory. According to Senyard, Baker and Davidsson (2009) bricolage involves the creation of novel solutions to problems and opportunities, and therefore, its products will be typically innovations, in the sense of an innovation as simply the introduction of something new and potentially useful (Gopalakrishnan & Damanpour, 1994). Hence, existing resources are manipulated and recombined to create the firm on an innovation basis, adapt to market opportunities and environmental shifts (Wagner, 2000; Steffens et al., 2012; Fisher, 2012). Such decisions are shaped in accordance to literature (e.g. Senyard et al., 2010) by various contexts and can lead to novelties. Contexts are not always favorable but regard always mature markets. If not for adopting LT-KIE, most cases would not have many chances to succeed. Examples of the cases regard:

-***social contexts***, such as

- **WCo10**: the increasing sensibility towards environmental issues ***which led to*** a unique business model worldwide based on a pure ecological profile and enhancing the firm's economic performance ***by selling ….mattresses***
- **FCo5**: the shift to more healthy foods, the focus of medical therapies to nutritional issues, ***which led to*** innovative world-level patented wheat-based products. Things would not be that good in terms of normal entrepreneurship and production of ***conventional wheat flour*** (as it was the initial business idea).

- **TCo8**: the shifts of underwear from "white and healthy" to "colorful", trendy and fashion, the creation of special series for teenagers and the shifts from "underwear" to "outwear" ***which led*** to the development of unique design capabilities and a series of changes in production and the whole business model. This maybe not appear that spectacular, but it has to be considered within the course of the clothing industry in Greece and globally. With the production transferred to Asian countries and the invention of really cheap (even if no-name) products from these countries, most companies of the clothing sector was (and still is) in great danger of bankrupt[102]. The environment was (and still is) extremely benign. However, the company manages to survive up to now (corporate venturing case).

-environmental contexts, such as

- **WCo9:** alternative solutions to deforestation and world wood shortage ***which led*** to the use of innovative technology and the further improvement of world-level innovative material and products. The case is one of corporate venturing. The new plant with the innovative technology purported to offer the alternative solution furniture companies sought to survive against China's invasion[103].
- **FCo10:** the new norms on CO2, water consumption and the energy footprint in general together with the increasing sensibility towards environmental issues (social context) which led to a globally successful company with a series of innovations all along the value chain (e.g. low-energy and emissions oil production which was an innovation at global level, novel marketing, etc). The company started by selling …olive oil and olives which alone cannot to be considered as competitive products to bring superior profits and global success. Yet, a strong motivation was the fact that the competition was hard; "1995 was quite easy. There were no competitors. Now we should add innovation and differentiation next to quality and authenticity. This was exactly the message and the target."
- **TCo6:** the need for more ecological yarn production as alternatives and complementarities to cotton production and ***which led*** to patented yarns and novel

[102] Please refer to the relevant overview

[103] However, today (2014) the group did not manage to survive. This was not the case in 2010, when the interviews were held. By then the group enjoyed a turnover of around 88 million euros with the new plant to present spectacular performances. The reasons of the failure would be an interesting research topic within the crisis context.

production technologies. As already mentioned above, the environment was rather negative for new investments regarding both sectoral and national aspects.

-institutional contexts such as

- **WCo2:** a positive political and economic environment for investments, the Olympics 2004 and the flourishing of the construction field together with the fact that there was no direct competitor (besides imports) ***which led*** to an impressive combination of world top-class relevant technologies resulting in world-level process innovation, accompanied with parallel complimentary innovations regarding mainly environmental issues.
- **FCo3:** Subsequent laws against the use of egg powder in massive food production and mass catering which led to further development of transferred innovative production technology and was the case that was extremely soon replicated by two followers (more to be discussed later). In this case, a quite normal question in the framework of conventional thinking would actually be *"sell eggs in Greece?"*

Therefore, entrepreneurs (as bricoleurs) do not see the environment as the moderator of the future but as a means to create opportunities (Phillips and Paul Tracey, 2007). For Baker and Nelson (2005) the environment is actively engaged in the entrepreneurship process in order to create opportunities and entrepreneurial bricoleurs collect together 'bits and pieces' that may come in hand at some future point. We should also mention that the fact that bricolage capability seems to be present even in cases of corporate venturing does not conflict with relevant literature. According to Campbell (1997), the concept of bricolage gives prominence to how organizations may prepare the ground for evolutionary changes. Halme et *al* (2012) suggest the notion of *intrapreneurial bricolage*, which takes place in large organizations characterized by creative bundling of resources at hand replacing rationally conceptualized business development processes (cf. Keil et *al*., 2008; Miner et *al.*, 2001; Sarasvathy, 2008).

Therefore, following the literature and our findings, it seems that LT-KIE is characterised by a complex connection of different parts of knowledge, as the actors need to connect new ideas and existing knowledge to solve new specific problems hitherto unknown since they emerge in the form of new business ideas. Contrary to

science-driven knowledge of high tech sectors which advances through marginal extensions of abstract knowledge and logic or mathematical thinking, LT-KIE requires "combinative" knowledge or original combinations of different "specialized knowledge", which can be represented by complementary information, science, technology, tacit and codified knowledge, in the framework of an iterative process of experimentation of failure and success (Cappellin, 2009). Such "bits and pieces" can be "borrowed" from various sectors, disciplines and areas in the solution of these specific idea-based problems, which are set to stimulate action and which usually require the joint contribution of various actors interested to them. They are actually the result of a process of selection, association and simplification ("pattern making") even if sometimes it starts with financial restrictions and ends up with the sacrifice of significant resources in order to realize the innovative ideas. In this way, LT-KI entrepreneurs can produce novel knowledge without the need of "out of the lab" technology and products. In fact, processes of recombination are a primary driver of innovation (Ciborra, 1996; Henderson and Clark, 1990; Kogut and Zander, 1992; Nelson and Winter, 1982; Schumpeter, 1934). Cappellin and Wink (2009) have relatively stated: *"the combination of the three basic colours: red, green and blue, creates all other colours, thus the pre-existing pieces of knowledge, whether combined in an original way, give origin to new knowledge*". Accordingly, building on specific patterns of our thirty cases and matching with literature, we propose that

Proposition 1: Bricolage can constitute the basis of a distinct type of dynamic entrepreneurial capability in knowledge-intensive low-tech ventures and namely *bricolage capability.*

7.2.b.2) Dimensions of the Capability

The literature on entrepreneurship emphasizes the importance of opportunity discovery and creation. Actually within the terms of KIE and high-tech sectors or academic entrepreneurship this has been tightly connected to research and development activity. However, this ability to recognize and synthesize opportunities seems to depend in part on the individual's capabilities and knowledge (or the knowledge and capabilities of the organization in cases of corporate venturing) particularly about ways to pose questions and find novel solutions that fit market demand. This requires specific knowledge and the ability to seek for it together with

other resources, combine them in creative ways and practical wisdom (Nonaka and Toyama, 2007) in low-tech knowledge-intensive cases. It involves shaping the resource environment (Baker and Nelson, 2005), interpreting available information and seeking for new, through all types of contacts, to create a conjecture or a hypothesis about new needs, alternative potential of existing opportunities in combination with the evolution of technological developments of other sectors and science. The above abilities and competences form distinct dimensions of the bricolage capability as a dynamic entrepreneurial capability and in line with the bricolage theory and namely the following:

"Repertoire synthesis": The notion of 'repertoire' is at the core of Lévi-Strauss's (1968) idea of bricolage. Relevant literature regards bricolage as a problem-solving situation relating repertoire to defined problems and thus with a more or less expected output and temporal finality (Loarne, 2005). The present research treats bricolage capability more as problem creating than problem-solving, reflecting a relevant stream of literature which regards the "innovative process of bricologe" (Campbell, 1997). Entrepreneurs seem to create problems posing questions on several issues such as standards (WCo6), new needs (FCo7), novel methods (FCo2) and models (TCo9), and thus challenging the existing business ecosystems.

"Repertoire building" concerns the ability to collect tangible and intangible resources, such as available materials (Garud and Karnoe, 2003), financial capital (Lee, Lee and Pennings 2001), human capital (Brüderl, Preisendorfer, & Ziegler, 1992), technical assets (Stuart, Hoang, & Hybels, 1999) and social capital and networks for building new ventures (Baker, Miner and Easley 200; Baker et al., 2003). However, for the purposes of the present research repertoire engages also knowledge. New knowledge creation deriving from the combination of knowledge elements has been considered as the most significant issue in LT-KIE (cf. Kreinsen and Schwinge, 2011), as well as in general entrepreneurship and management literature as well (Galunic and Rodan, 1998; Henderson and Clark, 1990; Nelson and Winter, 1982; Tsai, 2001; Yayavaram and Ahuja, 2008).

All cases (Table A3, Appendix A) indicate that actors follow more or less the same procedure

- They pose a problem which outlines their business idea (Here one can pose the question how this business idea is created. This will be answered later in this chapter).

- They consider resources and knowledge they will *probably* need
- They try to find the resources
- They try to combine the resources in creative ways

Therefore, in almost all cases there is a **problem to be solved** which actually has been created in order to start a new business. On the other hand, knowledge forms an important asset in creative problem solving (Andersen, 2008) although it is not simple to internalize and combine new elements of knowledge with what is available (Dougherty, 1996). Cognitive limitations prevail regarding the capacity of both individuals and organizations to discover and manage available information and pieces of knowledge, to be able to consider all alternatives, and to decide which options should be preferred (Andersen, 2008; Simon, 1957). Furthermore, besides this difficulty, other obstacles might include ambiguity (WCo4, WCo5, FCo9, TCo6, TCo10), the degree of novelty (WCo5, FCo5, TCo2) and its subsequent requirements, conflicting demands and severe lack of resources (D' Zurilla et al., 2008). Within bricolage literature, bricolage is considered as a problem-solving situation with a more or less expected output and temporal finality (Loarne, 2005, 2010). The present research confronts bricolage capability more as problem-making than problem-solving, since it allows for challenging the existing ecosystem and confronts the subsequent obstacles.

> In **WCo1** case, the entrepreneur "creates" his problem by questioning the acceptance of the raw surface of veneers under the common acceptance that it is a natural deficiency since veneers are natural products. However, this question generates multiple "knowledge-based" problems since there is no relevant technological approach; problems regard materials, machinery, know-how and relevant process problems together with the ambiguity and uncertainty of market acceptance, as well as the quite significant financial constraints. The entrepreneur copes with complex and unfamiliar situations (even the obstacle of the limited knowledge is not that minor as it may seem at a theoretical basis for a new entrepreneur), transcending sectoral and local limits, in order to answer provocative questions and satisfy unconventional conditions which he had created himself. In adapting this strategy, he was among the few of the

sector (at least within Greek borders) to refuse the rather easy well-worn, traditional low-cost path, which is too familiar in low tech industries.

In any one of the thirty cases the intensity of the problem making situation depends on many parameters such as the complexity of the problem set, the variety of resources needed or finally engaged, and the sectors where knowledge was asked and required, the diversity of the sectors and the relevant agents used, as well as of the relevant background, the cognitive and other capabilities the actors own.

Then **the environment for problem-making** seems to depend *on the number of imbalances or discrepancies* that are created during the idea formation but the founding period as well (e.g. in WCo2, FCo1, TCo10) *together with the number of responses,* in line with D' Zurila and Nezu's (in Donson, 2009) and the ability to codify these and formulate problems. It is further accompanied with *the ability to anticipate obstacles* to goal attainment (e.g. the level of cognitive limitations as stated by Simon, 1957) as in the above case together *with the ability to generate alternative solutions* by conceptualizing the sequential steps or "means" that are necessary to achieve the particular goals (Chang et al., 2005). This draws on stocks of knowledge, know-how and social capital (Andersen, 2008) among others. This is evident in almost all cases: For example, distance is a major obstacle for WCo3 which the actors solve with the development of the modular design, no technology available to realize the boxing concept becomes the challenge for WCo8, FCo9 and TCo4 and leads to the chain involvement of suppliers and co-development of innovative technology (as in the case of WCo1 as well).

However, "the transformation of an idea into an organization requires that entrepreneurs acquire resources" (Aldrich and Martinez (2001), p. 45). In order to address the above emerging challenges and address the problems, actors seemed to develop an ability and readiness to identify and deploy sometimes *unconventional means "at hand"* (i.e. material, knowledge, skills, human capital), counting different uses of available resources (in line with Ciborra, 1996; Garud & Karnoe, 2003 among others) such as existing processes (e.g. WCo3, FCo5), physical resources (e.g. FCo2, WCo7) technical assets (e.g. WCo1) and social and human capital (e.g. FCo5). This is known in relevant literature as **'resourcefulness'** (e.g. Di Domenico, 2010; Garud and Karnøe, 2003; Halme, 2012; Miner et al., 2001). The bricoleur is said to be ready to deploy whatever strategies are required under various circumstances, such as new

organizational combinations, in response to unpredicted activity (Ciborra, 1996). The process of bricolage thus denotes a dynamic assembly of ongoing transformations and reconfigurations (Di Domenico, 2010; Lanzara & Patriotta, 2001).
Across all cases there were certain stories told on overcoming key-resource disadvantages such as the case of **WCo1** (mentioned above) where there were significant limitations of both financial capital and available technology, or where new applications of existing technology led to novel methods and concepts such as the boxing concept of WCo3 and the novel products of FCo7.

'Resourcefulness' has been measured by *the number of uses of available resources* (Cuhna and Cuhna in Rahim, 2007)**,** and the *level and type* of (pre-existent) material, cognitive and affective resources (Eisenhardt, 1997; Ciborra, 1996; Pina and Cuhna, 1999, Cuhna and Cuhna, 1999). *"Resources at hand"* are also firm processes, structural mechanisms, forms and routines as resources to construct new ventures (Ciborra, 1996), routines from prior employees (Gong, Baker and Miner, 2006), physical resources e.g available materials (Garud & Karnoe, 2003: 277), human capital (Brüderl, Preisendorfer, & Ziegler, 1992), technical assets (Stuart, Hoang, & Hybels, 1999) and social capital and networks for building new ventures (Baker et al., 2003), acquiring (purchasing) resources, developing resources internally (accumulating) and divesting (shedding or selling) resources (Sirmon et *al.*, 2007)

Yet, resourcefulness alone cannot provide novelty and innovation. In her seminal work, Penrose (1959) argues that a firm is "a collection of productive resources" (p. 24) but not only human, "but also the material resources of the firm can be used in different ways, which means they can provide different kinds of services" (Penrose, 1959). This highlights the fact that resources alone cannot lead to innovative entrepreneurial activities. Furthermore, Boccardeli and Magnussen (2006) argue that start-ups need the capacity to re-interpret and re-combine already existing resources and thereby improve their fit with the demands of the market environment. Lichtenstein and Brush (2001, p. 41) suggest that for new firms to become established or self-sustaining, "a series of resource acquisitions and combinations might be necessary". Smith et al. (2005, p. 335) argue that the "existing and accessible knowledge in a firm affects the rate of new products and services entirely through the firm's knowledge creation capability". Furthermore, it is once again reminded that

knowledge recombination is of great significance for LT-KIE (Hirsch-Kreinsen, 2011). This dimension has been defined as ***Creative Resource Recombination*** according to relevant references of Baker and Nelson (2005) and Baker (2003).

Creative Resource Recombination was searched in the cases as:

- ***ways to overcome key resource disadvantage*** (Stephens and Saneyard, 2009), such as the combination of experience in veneer stitching, know-how of material providers, technology development together with machine suppliers, design by designers who further contributed to the opening of the new niche market by inserting the new products in their projects to overcome technology and financial constraints of **WCo1**
- ***new applications for existing technology*** (Baker and Nelson, 2005) such as **FCo6** that developed an innovative process technology (patented) by using existing technology or **TCo4** that excelled existing technology to produce innovative high-value products and resist the world competition due to low-costs from Asian countries
- ***new products based on existing technologies*** (Gong, Baker and Miner, 2006) (i.e. based on conventional science and technology) such us a) he innovation of **WCo2** which managed to cut down costs dramatically without negative impact on quality; b) the shift of **WCo10** to a novel business model of completely eco-friendly products which were simultaneously of top quality (leading company worldwide in promoting "eco-bedding" and "sleep awareness" and thus changing the architecture of the mattress-subsector).

The cases mentioned above, as well as the others of Table A3, Appendix A, indicate that dynamic resource recombination can lead to resource advantages that are difficult to copy (Ciborra, 2002) although they do not entail patented technology, or scarce assets. They can further build unique capabilities as in the case of WCo10. Yet, it should be further observed that in all cases **knowledge** is in the core of all entrepreneurial activities instead of physical assets and other resources.

Most of the cases required few resources beyond founders' own capabilities in order to shape the initial startup idea. However, all of them turned to ***a hunt of knowledge*** in order to realize and implement this idea, including the case of WCo2 which had stated adequate initial knowledge assets. The ability to hunt pieces of knowledge

depended on the acquaintance and easiness of access to external non-sector-specific knowledge: therefore, all corporate cases as well as start-ups of actors with certain former relationships to the sector (mainly. from the family business milieu, as in the cases of WCo1, WCo4, WCo8, FCo1, FCo6, FCo8, FCo9, FCo10 presented a broader and easier approach of different actors involved in research, design and production, which transcended sectoral limits. On the other hand, efforts of nascent entrepreneurs with no former experience in the sector were not always successful; WCo5, WCo7, FCo2, FCo3 found significant difficulty in both merging and adjusting knowledge and other resources.

In accordance, knowledge seeking depends on the acquaintance and easiness of access to external not sector-specific knowledge (e.g. market information, developments in the sciences and the advancement in machinery, equipment and processes originating from other industries). This is in line with literature; Robertson and Smith (2008) emphasized the particular relevance of the "distributed knowledge base" for the innovativeness of companies from LT sectors. Besides networks (which will be soon after analyzed), knowledge can be acquired in a variety of ways such as experiences (Bahrami and Evans 1989; Politis 2005) and even imitation (Zahra et al., 2006) which "can actually be a reasonable source of innovation" according to Aldrich (1999). In the last case, entrepreneurs rather than "re-inventing the wheel" in intermediate stages, they may look to copy ideas from competitors and reproduce them with differentiated elements; **WCo3** tried to reproduce the Italian mode of clustering disregarding the obstacle of distance by introducing the modular design in kitchen furniture. **WCo5** used the innovative honeycomb technology for walls and other parts of constructions in order to produce tables and other furniture[104].

The actors usually were found with a "repertoire" of heterogeneous knowledge sources. Parts of them were collected on purpose and parts of them were unplanned and selected although they did not correspond to the initial plan. Some of them suited better a solution *on the fly* such as the case of the **WCo2** where emerging knowledge led to innovative process technology; or produced emerging innovative ideas well outside the initial vision which however led to brand new shifts of the new company such as the case of **FCo5** where a mixture of wheat, a "try-and-error" product proves

[104] The case is not a successful one as it will be later explained. Yet, the idea was much later developed by German companies and honeycomb tables were presented in the most significant international show in 2012 as innovative products (while WCo5 tried to launch them in Greece in 2001)

to be of excellent tolerance by cancer patients opening a new area of medical food products. Bricolage capability (as bricolage) encourages the gathering of information and knowledge for later use, while enables the promotion of "bits and pieces" of desired knowledge in order to match uncertain and changing needs (Baker, 2003; Kincheloe, 2005). In such cases, one can even claim that entrepreneurs sought knowledge silenced in dominant research narratives as they seem to be according to Kincheloe's (2004b, p48) "dedicated to questioning and learning from the excluded".

Creative knowledge recombination constitutes then a sort of dynamic puzzle; the initial concept becomes a creative collage of existing and acquired resources sometimes in ways they were not originally intended to be used; different types of different sectors and an enormous variety of information that is constantly enriched over time, while pieces are accepted or rejected for direct use. Original combinations of different "specialized knowledge" may be represented by information, technology, knowledge, in the framework of an iterative process of experimentation of failure and success (Cappellin, 2009). This dimension of bricolage capability engages the ability of arranging and re-arranging the accepted pieces while at the same time apply degrees of freedom to add new inputs[105]. Core pieces appear to be the intimate knowledge of human, material and immaterial resources. Thus, the capacity to make use of new knowledge is contingent on what agents know and what they can do (Cohen & Levinthal, 1990).

TCo7's entrepreneur describes this "hunt of knowledge" in a very vivid way:

> "This innovative treatment was not by then applicable at conventional dying plants. Such innovative procedures had appeared in Italy. So we went there and **found ways to acquire such knowledge elements**. They were the pioneers in specialty value addition washings and treatment. Then **we approached the chemical industry** – they were the ones who actually opened our eyes. Besides, they wanted to sell the ideas and then sell the products to implement the ideas. At that time such techniques were at the stage of R&D in Europe but totally unknown in Greece. Therefore, **we hired an Italian team** who had transferred the Italian novel know-how in Japan and they were real experts in this innovative technology. We were pioneers in Greece and we took the lion's share in the Greek market. We then made a contract with the **Italian designers**

[105] This is further enabled by the second DEC and driven by the third one as we will later see

who knew how to apply this innovation on the jeans patterns. *We contacted them through Fabiani* the Italian denim manufacturer, a leader worldwide. Of course we were buying from Greek companies as well… but the Italians would share their knowledge with us. Imagine that even the chemical industry that produced the raw materials that we needed would consult them since they were their main consumers. And this is how we actually met them…"

*(**TCo7's** entrepreneur)*

Therefore this bricolage capability dimension facilitates the detection of "bits and pieces", the novel combination of the selected elements of knowledge, technology and other assets but also the link-up of actors who possess the relevant pieces of knowledge, technology and competence for the formation of innovative knowledge-based business opportunities. This **"repertoire synthesis"** composed of particular sources can give specific meaning and content to the gaps entrepreneurs discover or invent.

The dynamic perspective of knowledge exploitation demands distinctive capacities of sensing latent connections as well as **interactive learning** to access the offered repertoire. The target is to fill in the gap between vision and reality. In order to achieve the desired results, an important part refers to learning through feedback from collaborators, suppliers, machine manufacturers, competitors and other parts of the business ecosystem. Even small failures and mistakes are treated as sources of knowledge that can be directly useful or kept in mind for later use (**FCo4, WCo1**). More specifically, all cases revealed a rather strong exchange and sharing of knowledge resources mainly among the new ventures, their machine and raw material suppliers and sometimes even customers in formal or informal ways.

For example, **WCo1** develops interactive learning with the Spanish raw material producers building a lost-lasting relationship based precisely on learning. The same happens to **TCo1** and **TCo2**; they started by receiving knowledge by suppliers and transferring their experience in using the novel raw material technology. Interactive learning was soon embedded in their processes, developing a constant learning routine of pilot using of novel raw materials.

A significant observation here is that all thirty cases confirm how the products and processes of high technology sectors feed into and support the LT sectors in a "close

and reciprocal relationship" (Robertson and Patel, 2007; Santamaria et al., 2009). Design and production of many components regarding both machinery and products were undertaken in collaborative network settings that encouraged and created interactive learning in the cases of WCo1, WCo2, (using the impressive number of 20 different manufacturers from seven countries), FCo1, FCo8, FCo10, WCo6, WCo8, WCo9, FCo2. FCo5, FCo6 (the last six cases used or produced even patented technology) in line with relevant literature (e.g. Karnøe, 1991; Lundval, 1992; Kamp et al., 2004). However, cases mostly in the food industry have also developed "learning by search" (i.e. R&D) in collaboration with academia (FCo2, FCo3, FCo5, FCo6), public or private research institutes and individual scientists such as the cases of FCo1, FCo4, FCo5, FCo9. Thus learning seems to embrace design, production and process technologies, R&D, uses and all activities along the firm's value chain (e.g. Hendry and Harborne, 2011; Pavitt[106], 1998; Rosenberg, 1982).

A momentum for learning was maintained in both product and process developments in all cases, as well as in cases of building novel business models as in the cases of WCo10, TCo5 and TCo9. It is important to mention that in many cases of the above, learning-by-doing and using that occurred in the beginning formed the basis for the gradual design and formation of distinct production and innovation capabilities of the growing firms. Furthermore, in all cases interactive learning would take place through any possible way; instances of descriptive or procedural knowledge, planned / scientific knowledge, practical knowledge, tacit knowledge, formal or informal, comprehensive or partial knowledge, learning through feedback from collaborators, suppliers, machine manufacturers and other links of the business ecosystem. Interactive learning regards then the specific contents of the transferred knowledge that supplement the new venture's knowledge base (Dodgson 1993) and augments the range of its potential behaviours (Huber 1991; Jin and Stough 1998) and this can constitute the *learning dimension* (Hendry and Harborne, 2011) of it. This regards further the extent to which suppliers, field agents and customers actively contributed

[106] Pavitt (1998) recalls Nelson's (1998) detection of two complementary components of firms' knowledge: a 'body of understanding' and a 'body of practice'. The former is "[…] based on competences on specific technological fields, and reflected in the qualifications of corporate technical personnel and in the fields in which they patent and publish" (Pavitt, 1998). The latter is "[…] related to the design, development, production, sale and use of a specific product model or production line" (Pavitt, 1998).

either by active participation or by their contribution of ideas, as well as the type of contracts among the stakeholders (e.g. formal, informal).

In most cases, interactive learning in start-ups seems to become a continuous and highly dynamic process over the entire lifetime of the organization. This is in line with literature (e.g. Asheim and Gertler, 2005; Cope 2005; Lundvall, 1988; Lundvall et al., 2002; Meeus et al., 2001). Politis (2005) argues that learning facilitates the development of knowledge necessary to start, grow, and manage a new venture. In order to produce an effective and dynamic 'knowledge puzzle', actors pointed to synergies and certain processes of interactive learning, transcending sectoral limits. Learning would come from any piece of the value chain including advice from suppliers, feedback from customers or market information. In cases of corporate venturing, the established learning culture played a significant role in the creative recombination of new knowledge as well as the avoidance of failure due to persistence to existing routines and strategies (e.g. WCo9, FCo6).

Concentric Cycle Networking (CCN): As discussed above and as it can been observed in Table A4 Appendix A, across our case studies, founders had to contact knowledge providers, suppliers, customers and consultants in equally formal or informal ways. Stories of borrowing knowledge, know-how, equipment, space and money from friends and prior fellow workers were very common in the sample. Indicatively:

> **WCo10'**s entrepreneur used a friend's workshop to produce his first products, his wife's property as a first product storage room and borrowed money from friend as venture capital.
>
> **FCo10**'s entrepreneur - in his first attempt - was supported by different friends to access initial "means at hand" and to start his new venture: he borrowed space and money from a Greek friend, knowledge from an English gourmet guru (friend of his) and relevant assistance for his first sales. However, things are quite different in corporate venturing; the already strong network and the fame of the firm attract significant human capital with huge experience, world leading manufacturers, and important investors.
>
> **TCo10**'s entrepreneur approached a friend from childhood to act as his business angel, while his first collection was hosted at a friend's atelier.

Across all cases, actors narrated that they started with familiar and close pre-existing networks such as friends (e.g. FCo10), former business contacts (e.g. WCo1) and family (WCo8) whatever their limitations, in line with literature (e.g. Cassar, 2004; Jones et al., 2011; Manolova et al., 2006; Witt, 2004; Wu, 2007). Baker et al. (2003) claim that networks shape the trajectory of a firm strongly, since they are the resources 'at hand' used to problem solving and label dependence on pre-existing contact networks as the means at hand *network bricolage.* Based on this **initial network pool**, they soon turned to other networks within or out of sectoral borders.
As the young founder of **FCo9,** a rapidly expanding innovative exports F&B company, put it:

> "You cannot have all necessary knowledge. You need knowledge and technical support by many areas and sectors, mostly in the beginning but that goes for ever… We didn't have the necessary networks in the beginning – they were not in our close networking if I may say so… Now we have created extensive networks with co-operations with Universities and relevant research institutes".
>
> *(FCo9's entrepreneur)*

In accordance with the findings of Baker et al. (2003), founders generally approached someone they knew or sought an introduction to the selected actor from someone they knew rather than a more formal approaching; e.g. a known banker instead of a more prestigious bank or other financial intermediary in order to raise money for seed capital. Entrepreneurs narrated that former family business made initial founding steps and subventions easier due to former relationships especially in Greek cities outside Athens and Attiki. They also admitted that they had engaged friends for research and consulting refusing sometimes to turn to more dedicated specialists on the subject under investigation. On the contrary, corporate venturing of well-established organizations known at national level, met some trouble in areas well far away (in terms of Greece) from the parent company; the case of **FCo6** is a perfect example of it. Therefore, at the very basis of the initial network pool there is a strong interpersonal dimension.
A worth-mentioning pattern observed in all cases regards the ways knowledge was developed among the partners especially at the initial stages; in most cases the initial business concept would become a type of "project" for all members who were

actually deeply involved in the "project", instead of just offering pieces of information, knowledge, know-how or any other type of resources. Network members develop close relations, as well as common planning and decision making on certain activities such as experimenting, equipment manufacturing, knowledge or other resource development and sharing.

The network expansion seems to be of a **concentric cyclic way** and that's why it is named **concentric cycle networking (CCN)**; starting of interpersonal relations, close personal and business networks during foundation (*initial network pool* regards an aspect of "resources at hand" of bricolage literature) actors try to be embedded in broader contact networks towards multiple directions. Initially this is managed by selecting partners and employees (especially the closer ones and there is always a team to trust), former business collaborators and personal acquaintances that can be useful in offering any kind of resource from knowledge to money (first concentric cycles). Furthermore in all successful cases, the actors presented a significant ability to manage and effectively co-ordinate network relations *well across* sectoral and market borders with agents within or even out of their value chain, who could be equally formal or just informal contacts (expanding concentric cycles).

However, although mentioned above, it is quite evident, once again, that in start-ups and corporate venturing, a major criterion for selecting the next links of the chain or even trust the sources and the quality of knowledge is the acquaintance cycle instead of fame, specialization or other characteristics.

> "Let's take fire-resistant products for example: we have developed a fine collaboration and a high level of communication with a lab in England, a leader in its area. So we trusted them and sometimes during an informal chat we could collect useful pieces of knowledge in more effective ways than if we chose a formal collaboration with some consultant. (**TCo2**)

Furthermore, it seems that concentric cycle networking starts with the entrepreneurs applying for contacts, but later, as the concentric cycle grows, the new firm may accept applicants as well (e.g. FCo4, FCo9, TCo7). In such cases and in accordance with Guy Peters (1998), the process presupposes that the partners have something to gain by participating; this regards mainly instrumental effects (Pierre, 1998) instead of direct prospective benefits. As CCN expands, trust, general reputation and former

experience become important criteria. Concentric cycle networking becomes then a constantly developing process within the new company. The relevant LT-KIE literature has also commented on the significance of the external ties for low-tech cases as well as the importance of networking with actors outside the specific traditional industry as crucial in accelerating technological change (e.g. Hirsch-Kreinsen, 2010; Hirsch-Kreinsen and Schwinge, 2011).

The cases revealed a wealth of collective actions such as R&D (e.g. FCo5, FCo6, TCo2), machinery development (e.g. WCo1, WCo9, TCo4), production technologies (WCo2, FCo4, TCo6). In most cases partners would work closely mostly using the partners' basis, since in most cases the new ventures did not own physical assets at the time of the development. However, it should be mentioned that in the cases of corporate venturing most co-operations would take place mainly within the plant. This was further translated as a sign of power; especially machine manufacturers presented a different behavior towards former customers than newcomers as well as different levels of trust.

Therefore, **CCN** describes actually a process in which pre-existing contacts (in the form of an initial pool) are considered as a basis to expand networking in order to select, elaborate and combine resources in creative ways (in accordance with relevant bricolage literature, e.g. Baker et al. 2003; Duymedjian and Rüling, 2010) and a special focus on knowledge networks (e.g. Ciborra, 1996). *Networking has gained an* important part of the interest of researchers of both entrepreneurship and strategic management literature. Network relations are essential because they are links to potential sources of knowledge, new capital, the capturing of novel technologies and production methods, the access to skilled human capital, strategic alliance partners, and service providers (from researchers and consultants to lawyers and accountants). Thus, networking provides LT-KI entrepreneurs a means to reduce uncertainty, manage knowledge flows, and access the complementary business assets available.

R&D networking has been found to affect the early life course of high-tech firms (Stam and Wennberg, 2009; Yli –Renko et al., 2001). Furthermore, CCN approaches some aspects of the sectoral and national innovation systems concept as described in KIE literature (cf. relevant AEGIS deliverables) as it pertains to the dimensions of knowledge, entrepreneurial entities and networks. Networks are well suited for transfer and integration of tacit knowledge: they provide flexibility and relative speed

in knowledge transfer, critical to the establishment of first-mover advantages in dynamic markets (Grant, 1996).

Therefore, CCN seems to be the precursor of the dynamic capability of networking. The dimension regards the progressive opening-up to suppliers, customers and skilled labor as well as actors of other industries and even scientific areas. Besides its focus on knowledge assets, it also concerns other resources such as the co-development of products, processes, machinery and other assets or assistance in obtaining business loans or attracting funds. CCN can further be related to information about (existing or potential) competitors, distribution channels and exploration of export opportunities. Strong CCN structures presented significant collective actions (in line with Duymedjian & Rüling, 2010) and high level of trust (in accordance with Hana and Walsh, 2002). On the other hand level and type of proximity seem to play a role in CCN development (Baker, 2003; Garud and Karnoe, 2003).

Participation in collaborations assists entrepreneurs in their efforts to access resources and mainly knowledge in efficient and cost effective ways and speed up the venturing progress (Protogerou and Kargouni, 2012). Strategic alliances, licensing agreements and other forms of collaboration are modes of innovation strategies in sourcing technological capabilities (Vanhaverbeke, Duysters and Noorderhaven, 2002). Across the cases, entrepreneurs developed various types of collaborations according to what they wanted to attain as presented in Tables 7.3 and 7.4:

Table 7.3: Reasons for collaboration at venturing

Reason (at venturing)	Cases
R&D	WCo1, WCo4, WCo8, FCo4, FCo5, FCo6, FCo8, FCo9, FCo10, TCo1, TCo2, TCo3, TCo4, TCo6, TCo7
To develop new production technologies	WCo1, WCo2, WCo4, WCo6, WCo8, FCo2, FCo3, FCo4, FCo6, FCo7, FCo8, FCo9, FCo10, TCo2, TCo5, TCo6, TCo7, TCo8, TCo9
To develop novel machinery for innovative products	WCo1, WCo8, FCo4, FCo5, TCo5
To develop novel products	WCo1, WCo4, WCo5, WCo10, FCo1, FCo5, FCo6, FCo8, FCo9, TCo2, TCo5, TCo6, TCo7, TCo8, TCo10
To minimize development costs	WCo1, WCo3, WCo9, TCo1, TCo2, TCo3, TCo5, TCo8
To develop sales	WCo1, WCo4, WCo9, WCo10, FCo4, FCo5, FCo10, TCo3, TCo5, TCo6, (TCo7-acquisition), TCo8
To gain access to rare or expensive resources	WCo1, WCo3, WCo4, WCo7, TCo1, TCo2

The within and cross-case analysis confirms the fact that new low-tech ventures team up mainly with manufacturers and suppliers who have the resources (e.g. know-how, human capital, financial capital) and are able to provide the requested technology, or innovative coupling of materials and technology. Furthermore, it seems that for new low-tech ventures which base their competitive advantage on knowledge "alliances are particularly alluring […], because they provide the tools businesses need to be competitive" (Page, 1998)

Table 7.4: Type of collaborations during venturing

Type of collaboration	**Cases**
Strategic alliance	WCo1, WCo2, WCo3, WCo5, WCo8, WCo10 FCo10, TCo1, TCo2, TCo3, TCo4, TCo6, TCo7, TCo9, TCo10
R&D agreement	WCo4, FCo5, FCo6, TCo4
Technical cooperation agreement	WCo1, WCo2, WCo3, WCo6, WCo7, WCo8, FCo1, FCo3, FCo4, FCo5, FCo6,FCo8, FCo10, TCo1, TCo9
Licensing agreement	WCo9 , FCo6, FCo8, FCo10, TCo1
Research contract-out	WCo4, WCo4, FCo1, FCo2, FCo3, FCo4, FCo5, FCo9, TCo5

The cases confirm the fact that new ventures with limited resources "realize the mutual benefits they can derive from strategic alliances in areas such as marketing, distribution, production, research and development" (Page, 1998). A review of the literature reveals a list of benefits of strategic alliances, such as access to new, rare or critical resources, skills and capabilities (Rothaermel and Boeker, 2008) development of competencies needed (Baum & Oliver, 1991) and efficiencies (Ahuja, 2000). **TCo10** has formed a strategic alliance to cope with production issues while design collaboration is of core importance for **WCo1** and **TCo9**. There are almost no marketing and sales alliances at the venturing stage. **WCo10** will later develop some but not from the very beginning. However, in many cases value added resellers are targeted as in the cases of FCo1, FCo4, FCo5 and FCo9. On the contrary, most cases develop strong procurement-supplier alliances (Elmuti and Kathawala, 2001) and alliances for R&D and technology development. In many cases and as evident by the Tables above, alliances are actually **hybrids** among different types; for example R&D

alliance can mix with product and manufacturing collaboration (e.g. WCo1, WCo2, WCo3, FCo10, TCo1, TCo9)..

The cross-sectoral analysis reveals that **collaborations are sector-specific**; the co-operation with machine and raw material suppliers seems to be more significant in the W&F sector, while the co-operation with customers or potential customers and even competitors in textiles and clothing. On the other hand, F&B seems to be more active in collaborations with research institutes, universities or specialized consultants. In all three industries, however, there are cases where collaborations extended to areas well outside the sector and the market of these companies (e.g. WCo10, FCo5, TCo2).

Licensing agreements were not very popular among the cases in spite the dominant role of technology producers in low-tech industries (e.g. Heidenreich, 2009; Hirsch-Kreinsen and Jacobson, 2008). However, even out of the five cases (WCo9, FCo6, FCo8, FCo10, TCo1), only WCo9 and FCo6 were developed with the licensing technology as the core of their business idea. The rest cases have used the licensed technology, under certain market and contractual conditions, as complimentary support of their innovative business ideas. On the contrary in certain cases of technical cooperation agreement that resulted to innovative machinery, the entrepreneurs of the cases allowed the manufacturers to own all proprietary rights and sell the novel machinery all over the world.

An exemplary case is the machinery of **WCo8**; it was co-developed with the entrepreneur of WCo8, won the innovation award on 2008 in the most important relevant international trade show and then it was produced and sold by the manufacturer with the entrepreneur to ask for no proprietary rights.

> "I told them: I don't want you to tell me what you have; I want to tell you what I am dreaming and then you may think if we can make it." Actually, I focused on the parametric manufacturing. My business plan turned around this idea. I would use bleeding technology. They were excited with my idea, they helped me and this is how I got the first of the nine innovative pieces of parametric cut in the world in 2000. This cutting machine was initially developed on my ideas and personal work and it incorporated bleeding technology indeed. It actually won the first prize in the manufacturing trade show, the CEBIT in Hannover in 2000. Then the company sold the machinery, of course, but I was not interested any more…"

Of special interest is the fact that although licensing agreements are claimed to introduce rather passive relationships since they mostly refer to "licensing-in" technology, that is technology developed by another, the entrepreneurs of the first two cases (who relied mainly on these technologies) did not rest on it. They tried to develop the novelty further; i.e. **WCo9** produced novel designs, excelled further the profiles by eliminating deficiencies and went on deeper research of material reaction under the Mediterranean weather conditions. **FCo6** used the novel licensed technology as a springboard to create novel products and uses of the raw material.

The least popular type of collaborations seems to be R&D agreements with other companies and academia. This is not however strange since the low-tech firms and industries are not famous for their R&D intensiveness. On the contrary, it constitutes a further confirmation of the established opinions. A closer look at the three cases (WCo4, FCo5, TCo4) reveals that all three were actually based on interpersonal relations: WCo4 and FCo5 had developed strong relationships with professors of relevant Academia Departments who actually laid the basis for the formal R&D agreement. On the other hand, TCo4's mother company, globally known for high-quality products, had long-lasting, strong relationships with many mutual innovation successes in the past before turning to this new agreement. Therefore, contacts in all cases refer to the initial pool, or the "means at hand" according to bricolage literature.

Contracts for research with individuals prove to be significant especially in the food cases. This is again in line with the bricolage literature. Entrepreneurs turn to friends or acquaintances in order to find solutions to realize their novel ideas. It appears that it is the easiest way to access knowledge resources, since sometimes it is quite difficult and time-consuming to access Academia or Research Institute without a concrete and well-described idea[107].

The various types of collaborations, formal or informal, appear to play a special role for the realization of the novel LT-KI idea and consequently the development of the initial competitive advantage. They seem to be very important for new LT-KI entrepreneurs to gain the knowledge necessary to develop or acquire the capabilities

[107] New low-tech entrepreneurs do not approach Academia alone. They prefer to use friends or be introduced by a friend (Based on the author's experience and not only on the specific case studies)

needed for their idea realization, initial KI-based innovation, the subsequent production and market entrance (e.g. Baker et al., 2003; Stam et al., 2007; Park et al., 2005). They can save money and time and speed up the venturing progress.

Relevant Entrepreneurial Characteristics: It was quite interesting that all actors of the cases shared certain common **characteristics** (Figure 6.1) which were related to the intensity of their bricolage capability (Table A5, Appendix A). This is in line with the general entrepreneurship and KIE literature as well as the bricolage literature. Schumpeter had stated that it *is the entrepreneur who initiates a new sequence of economic operations*" (1934/1996) while Boccardelli et al. (2006) follow him by stating "it is the entrepreneurs who establish the firm's initial business strategy on the basis of the particular combination of resources assembled". Actually, this can be considered a further confirmation that bricolage capability is indeed an entrepreneurial capability.

Duymedjian and Rüling (2010) relate bricolage capability to individual's **knowledge and experience,** while there is a significant volume of entrepreneurship literature on the role of ***pre-entry experience*** (see for example Freeman, 1982; Storey, 1982; Reynolds *et al*., 2001; Stam, 2007; Klepper, 2009) and the entrepreneurs' **background** (see for example Evans and Leighton, 1989; Hout and Rosen, 2000; Reynolds *et al*., 2001).) Eisenhardt and Schoonhoven (1990, p. 524) observed that in their sample of semiconductor start-ups, "Entrepreneurs appeared to begin ventures in markets they knew, rather than in markets that industry analysts saw as attractive".

Consistent with this literature, all of the entrepreneurs we studied owned a quite significant former experience; most of them created ventures that were in certain ways outsets of their prior work or their prior range of interests, studies or background. The founder of TCo10 had a long significant experience in the fashion world with well-established relationships to both the production and the market. Many of the entrepreneurs of the research had been raised in a relevant entrepreneurial milieu, had relevant studies and had grown up working for the family business (WCo1, WCo4, WCo5, WCo8, FCo1, FCo2, FCo4, FCo5, FCo6, FCo7, FCo8, FCo9, and TCo2). The rest cases are mostly cases of corporate venturing.

WCo3, WCo7, FCo3, FCo10 are the exceptions. However, the entrepreneurs of these cases had a prior rich work history and experience of former business, different than the new venturing. An exceptional case is the case of FCo10; the strong educational,

business and cosmopolitan background of the entrepreneur could totally cover any deficiencies due to no former involvement with the food sector.

Within the cases, experience refers mostly to a spherical knowledge of the sector, affiliated sectors of any category (high, medium or low tech) and relevant knowledge bases as well as a broader worldview. Shane (2000) tested a group of propositions based on the assumption that differences in people's prior knowledge influence the opportunities they discover (in Baker at al 2003). Respectively, in our LT-KI cases differences in prior business experience influence the choices as well as the ways and mechanisms engaged. This is more evident in the bipolar case of FCo1 versus FCo10. And more specifically:

> **FCo1 versus FCo10:** Both companies used olives as raw material and belong to the same sub-sector. However, FCo1's entrepreneurs raised in a similar entrepreneurial milieu put emphasis on the innovational treatment of basic agri-food, developed further the former knowledge they owned on traditional Greek products (e.g. feta) and chose the strategy of private label with product series positioned both as common and as "premium" brands pioneering in opening the respective niche market and entering such products as "premium" private label.
>
> On the other hand, raised in a strongly cosmopolitan milieu and with strong connections to channels in England and USA, the entrepreneur of FCo10 invested in building a novel marketing model, creating a "way of living" by launching the "meze" concept abroad as the authentic Greek life-style, the cultural-culinary heritage. The corporate venture thus the shift from trade to production opened the way to technological innovation and differentiation in order to support the marketing innovation even more. Thus, innovations in packaging, environmentally-sensitive novel technology (first carbon neutral olive oil worldwide) and a series of other small-scale innovations added value to the new ventures' products. The entrepreneur also chose to re-invent the company's design and marketing to fit better to the new structure of the company.

Thus, **the impact of former experiences and prior knowledge is far more than clear in the above cases.**

All entrepreneurs considered the business challenge as a dynamic puzzle where pieces could come from supplies, markets, customers, neighbor firms, internet, research papers, conferences, or even TV news. The environment was actively engaged in the entrepreneurial process in order to create opportunities and innovative knowledge-based conceptst. Experience stems from a direct and integrated involvement to all range of business activities, stretching from relevant studies and industry-specific knowledge matters, market recognition and user knowledge to administrative duties and management. It presupposes a going though of all the steps of business (Jo and Lee, 1996; Cooper, 1971) but also enables their **direct involvement** to the whole spectrum of an activity. In almost all of our case studies, founders were deeply involved in the sector's environment and its various interactions[108].

> "The fact that Mr R (the entrepreneur) is a mechanical engineer with an experience of more than ten years in the T&C sector was of great importance. He was actively engaged with the corporate venture. He could always evaluate a technology that he would notice in some place or manufacturers would introduce to us. And this played a significant role in actually deciding what we really wanted to do"
>
> *(CEO of **TCo1**)*

The narrations revealed that at least LT-KI entrepreneurs of the sample are *putting something of themselves into it* (Lévi-Strauss 1966, p.21)). The motivational driving force springs from them, while they use external sources and resources to catch up with meaningful challenges brought up by them. This is the **personal touch** which was present even in established firms, be it the entrepreneur (in all but one cases) or some manager under the eye of the entrepreneur (e.g. the cases of WCo2, WCo9, FCo8, TCo6). However, even in these cases the entrepreneurs are present; the actual innovation and its excellent communication of the WCo2 case was the entrepreneur's idea. FCo8 was a "personal bet" of its founders. Thus in most cases -even in established firms - it goes on being a one-man show, whether it is good or bad, common at a worldwide scale or not. It further explains the definition of the

[108] Interestingly, the only case that the entrepreneur left his new venture' fate in the hands of his director was WCo5, an exemplary case of failure as it will be later more clearly explained (please refer to the cases' descriptions as well)

bricolage capability as an autotelic capability (please refer to the *Why Autotelic capabilities?* Section in Appendix)

Successful LT-KI Entrepreneurs are also characterized by **an open attitude** towards scientific, sector and other communities although traditional sectors are well known for their introversion.[109] They engage an open view of incorporating science and new technologies towards creativity and innovation. They present a collective behavior which however has to be supported by mutual trust. They avoid abstract co-operations through formal but impersonal partners (e.g. multinationals or research programs) as it is already evident by the collaborations section above. They need to know in some way the partners either through social or professional networks.
It is quite interesting that this *open attitude* behavior is not restricted to networking and the search for contacts. It appears in cases of product or technology co-development as well. WCo2, FCo5 and FCo6 shared the results of their research and development in multiple ways while WCo8 let the co-developed technology to actually profit the partner. In many other cases the entrepreneurs do not restrict the further capitalization of the innovative findings (e.g. WCo1, FCo1, TCo5) even if they have the right to do so (FCo9).

> "Such firms have a special department for developing the know-how required by the customer. Sizes and profit margins are that big that it really interests them. Besides our formal contract on appropriability it is not really important for us." (**FCo9**)

Another dimension of bricolage which is quite dominant is **the use of unconventional ways** in both seeking and using resources. In contrast to the engagement of strategic planning and linear processes, bricolage engages alternative ways of thinking and acting. Usually, there is a refusal to limitations and an encouragement of choice freedom. Bricolage introduces *a chaos with clear targets* and an open interaction between internal and external environment, while trying to shape both of them for the sake of the start-up venture. In our cases unconventional ways would refer to information and data gathering, resource selection and knowledge acquisition. They further referred to networking methods, ways of production and

[109] This can be understood only if the reader has a sound knowledge of the relevant sectors within the Greek context. Please refer to the sectoral overviews.

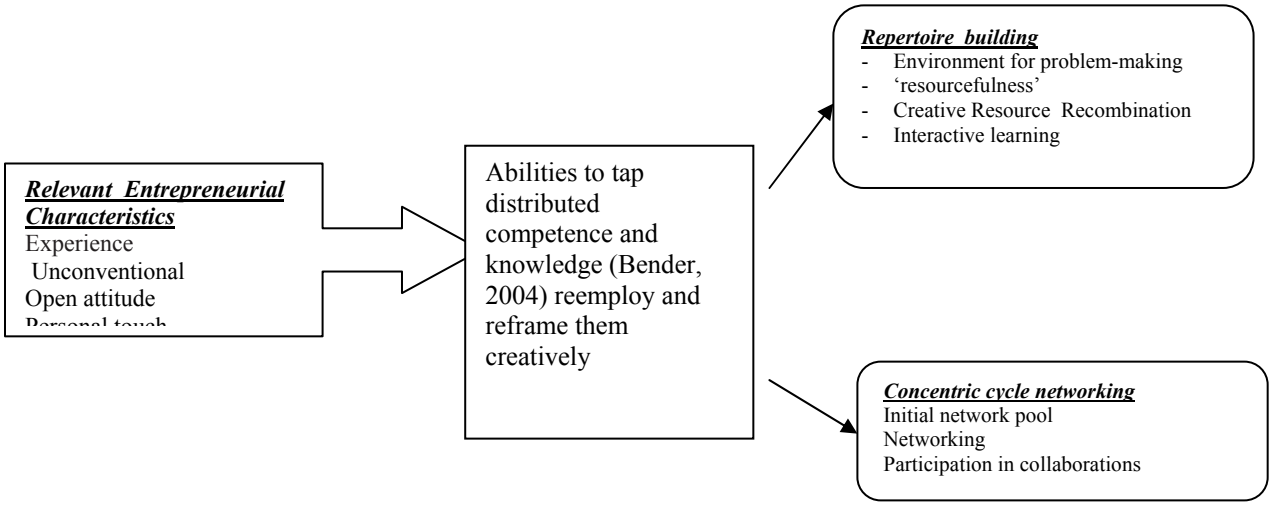
market entrance strategies. Contrary to all strategic rules and innovation management principles the entrepreneur of **WCo2** spread details of his innovative process to all who might concern. The global leading companies of the subsector visited the new plant but that made the entrepreneur globally known opening the way to new contacts and further business contracts.

The entrepreneur of **WCo10** is known worldwide for his unconventional way of thinking and acting. His motto is:

> "No market research. I know what I sell. This is my job: to excel my products and to prepare the market. I am the one to train the market. We are going to train the customer – he himself does not really know he wants!"

Accordingly, knowledge-intensive entrepreneurship in low-tech sectors seems to presuppose the existence of a *bricolage capability* that is strongly shaped and affected by knowledge and scientific areas, physical and financial resources, bases and networks transcending sectoral and national limits. The capability enables entrepreneurs both explore and exploit new opportunities that might otherwise be too expensive to investigate by more traditional means (Baker and Nelson, 2005; Miner et al, 2001; Witt et al., 2008).

Figure 7.1: Bricolage capability



Across our case studies, founders made use of an extraordinarily broad variety of means and resources at hand during and after founding. New business opportunities

seem to be related to the firm's initial knowledge base and its access to external knowledge. The tight coupling of the LT-KI entrepreneurs with suppliers, developers and manufacturers of production technologies, other firms, service providers with specialized knowledge and organizations from high tech sectors is crucial for their ability to build on KIE. The ability to manage and effectively coordinate network relations across company borders appears to be a core precondition for successful LT KIE.

Furthermore, it should be mentioned that bricolage capability can be clearly assigned to entrepreneurial capabilities, since the strong interpersonal dimension is evident and it is directly related to the successful creation of resource bases. The dimensions of the bricolage capability enact the mechanisms of alignment and realignment of resources which in the case of KIE refer mainly to knowledge syntheses together with other resources. However, it also constitutes a dynamic entrepreneurial capability since

- its dimensions can be applied in all cases, are difficult-to-imitate combinations of individual, organizational, functional and technological skills,
- it encloses the potential to continuously reform these skills and competencies at the founding stage as well as the early phase of the new venture, matching the demands of the new and often ambiguous environment.
- It contributes to the creation of initial competitive advantage

Another observation derived by the within-case analysis regards the importance of trust. It is quite evident that bricolage capability presupposes trust among contacts of the network around which the founders build their innovative concepts and trust among partners or company members in the established firm. Concentric cycle networking actually safeguards trust often by using paths of social capital. Friendship, former relations and former experience of one another as decent and credible makes up a contact more stable.

Furthermore, it seems that bricolage capability can be partly but **successfully embedded in mechanisms, procedures and processes** at the organizational level. The constant need for resource-seeking networking, re-interpreting and re-combining knowledge and resources, and searching for the best fit (in terms of knowledge management, i.e. reconfiguration) or sensing and targeting markets (seizing) reveals the importance of the bricolage capability not only in the early stages of firm

development but afterwards, as well. It is also a sign of the start-ups transition to growth (Hite and Hesterly, 2001) and indicates relations with the DCs concept. This is in line with existing literature; Baker and Nelson (2005) argued that bricolage provides a way of recombining and reconfiguring resources but the mechanism has to be embedded into the firm's existing routines if it is to provide long-term rents. Jones et al (2010) claim that bricolage is a dynamic capability that sustains the renewal and reconfiguration of the resource base. Boccardelli and Magnusson (2006) referring to the high-tech sector of mobile internet define bricolage as a potential form of early-stage dynamic capabilities explaining it as the capacity to re-interpret and re-combine already existing resources in order to improve their fit with market demands. This issue will be better and in detail discussed later in this Chapter.

7.2. c) The concept of Improvisational Capability

In 2000, at the Academy of Management Meetings in Toronto, Claudio Ciborra suggested that 'people improvise when they are overwhelmed by the world, and thus, are forced to read the world in a different way'. **Low-tech firms** are actually forced to read markets and systems in different ways, since today neither cost-leadership nor quality alone can assure safe entrances to newcomers. What is rather oxymoron in a case of an LT-KI startup is that while the first decisions and movements are vital for its sudden death or survival, they are also composing the most ambiguous period in its life. LT-KI enterprises need dispersed knowledge while almost always there is no ready, R&D based, unique and maybe patented innovation to guarantee market entrance as in high tech sectors. In any case, young firms are notorious for having to "fight fires" (Churchill & Lewis, 1983), confront unexpected situations and spare no time to plan actions (Delmar & Shane, 2003).

On the other hand, LT-KI entrepreneurship is understood (being a special type of KIE) as a *mechanism to implement an innovation which is not only new to the firm but also new to the sector or product field.* Therefore, LT-KI ventures have to develop significant knowledge-based innovations while the knowledge needed is not necessarily in possession of one organization but can be spread out between various actors and different levels of accessibility (e.g. Bender, 2004). This requires entrepreneurs to act in a constantly evolving environment. They have to literally pivot around a variety of issues: be both "knowledge-based" in the sense of innovating, but also entrepreneurial in organizing the new activity, entrepreneurial in the marketing

mix and business model elaboration and so on (Burger-Helmchen, 2008). LT-entrepreneurs have to work at the intersection between science, technology, innovation and markets. Actually, for LT sectors it would be a pitfall to define processes that describe all the above in a definite way since the periods of concept-forming and founding are the most ambiguous periods in a venture's life. Accordingly, planning has often been criticized as inappropriate in such cases (e.g. Bhide 2000; Delmar and Shane, 2003).

7.2.c.1) The nature of the capability

As expected, none of the cases of the research seemed to follow the "design-plan-execute" linear model. On the contrary, it was quite evident that design and execution converged substantively. The initial entrepreneurial idea as shaped in the mind of the entrepreneur(s) or the organization (in the case of corporate entrepreneurship) would have to be many times reshaped, whether it was a matter of knowledge, production technology, a business model or a marketing mix matter. Even in cases of corporate venturing a substantive concurrence of formulating and implementing together in real time was observed. However, it should be mentioned that in these cases actions were partly planned in comparison to the nascent cases, but still the emergent part of the foundation was quite significant. In all cases, deviations from plans and visions were observed in order to take advantage of opportunities that would arise suddenly, or use pieces of knowledge that were offered unexpectedly, or exploit new environmental data. Besides these creative directions, deviations could be due to the need of solutions to problems and obstacles or limitations confronted.

More precisely, the case study analysis made quite clear that the new ventures almost always would begin with a goal or vision of some form, implying an initial rational outlook (Baum et al., 1998; Shane and Venkataraman, 2000). Inevitably, however, environmental conditions, resource constraints and cognitive limitations (e.g. WCo1, WCo3, WCo5, WCo7, WCo8, FCo2, FCo3, FCo5, FCo6, FCo9, FCo10, TCo1) almost always prevented entrepreneurs from executing their plans as initially intended (Baker et al., 2003; Baron, 1998). On the other hand, changes and refinements could be due to inspirations of the moment, or new arising option and opportunities (WCo2, WCo4, WCo6, WCo9, WCo10, FCo1, FCo3, FCo4, FCo5, FCO6, FCo7, FCo8, FCo9, and FCo10). Yet, in many cases and especially in the cases of textiles and clothing, which are in their majority corporate cases, a mixture of a need to overcome

problems and a tendency for repetitive refinement of the initial idea is quite evident. There were observed even cases with astonishingly significant changes of the initial idea course, taken after some conversation or an emerging but unexpected finding. Actors responded to these opportunities by simultaneously designing and executing the new data that exploited the opportunities at hand:

> **WCo1** changed completely the core advantage of the initial idea due to financial restrictions and after a conversation with a field expert in some German bar.
>
> **FCo9** started with a quite conventional idea to produce cheese crackers with cheese to be the basis of the cracker. Testing for quality, behavior and other properties of some of the pilot products led to the gluten-free snack product idea which transformed completely the new business vision.
>
> **TCo1** started as an opportunity to exploit cutting edge technology and verticalize production. Advancements of relevant processes in Europe and a meeting at an international trade show led to the introduction of a process of patent pilot application reserving an impressive debut of the new plant.

This implied the existence of a relevant LT KIE capability that enables extemporaneous decision making for the fruitful combination and exploitation of existing knowledge and resources while - at the same time - seeking missing pieces and ways of finding them, or better ways to follow.

However this is the actual definition of **improvisation** (Baker et *al.*, 2006; Barret, 1998; Crossan and Sorenti, 1997; Moorman and Miner, 1998 Vera and Crossan, 2005) which implies *the spontaneous and creative process of attempting to achieve an objective in a uniquely new way* (Weick, 2001) or otherwise t*he ability to create and execute new plans on the fly* (Hmieleski, and Corbett, 2008). Ciborra (1999, p. 78) concurs by stating that it is "a situated performance where thinking and action emerge simultaneously and on the spur of the moment". Matched with the relevant theory (e.g. Crossan et al. 2004; Weick 1993, 1998; Rerup, 2001) in most cases,

- **conditions of time pressure** or time scarcity and a sense of urgency,

  > "We presented our innovative products in ANUGA[110] and orders started. We still had no industrial production. We actually did not know how to reach mass production. Time was our enemy." (**FCo9**)

[110] International trade show

"As far as we started our plant, we learnt that the two biggest groups in Greece were ready to imitate our technology. Leaks are so easy in Greece! But we wanted to be the first." (**FCo3**)
"We were thinking of our new innovative firm when our family plant was totally burnt. Then, there was no time for careful planning. Still, we did not want to replicate our old conventional company" (**WCo4**);

- together with **ambiguity and uncertainty**

"The innovative technology excited me. It would allow miracles! But they wouldn't give it to me. I had to reinvent it. Meanwhile whatever I was buying for them in order to create a market was too much expensive. I was not sure about what I was doing. My budget was not big enough to turn to too much experimenting. The idea was good and I was going to find the way to implement it" (**WCo1**)
"The exhibited products were prepared in the lab. The plant was under construction… The German customer ordered feta-staffed olives in amphoral jars – it was our suggestion although there was not yet clear how we could put the cheese inside the olives with no overflow. But we did it! After 3 months he ordered antipasti" (**FCo1**).

would impose the need for design and execution to converge and be largely indistinguishable. Literally, founders "seem[ed] to plunge into the start-up process, designing the firm as they create[d] it" (Baker et *al.*, 2003) with literally "resources at hand" and "no split between design and production" (Weick, 1993b). Observed patterns resembled to descriptions such as 'the conception of action as it unfolds ... drawing on available material, cognitive, affective, and social resources' (Cunha et al., 1999) or Perry's (1991) "formulat[ing] and implement[ing] strategies together in real time". They further revealed mechanisms that turned the founding process or later activities away from "well-structured "anticipatory, rational action" in which "clear goals precede and are independent of action" (March, 1998, p. 156).

Entrepreneurs appeared to respond to new circumstances in flexible ways, make exceptions to rules (Aram and Walochik 1996), and sometimes even make subconscious use of their intuition to generate solutions rapidly (Crossan and Sorrenti, 1997) which could sometimes be characterized as even teleology[111] (the case of WCo2 is an exemplary one). In this context, patterns matched Crossan and Sorrenti's (1997) definition of improvisation as "intuition guiding action in a spontaneous way". Besides this quite significant matching, the within-and cross-case study analysis indicated several similarities between observed patterns and improvisation. Improvisation has been described as an effective behavioral strategy for dealing with

[111] This will be discussed in more detail later in this chapter

change, particularly in dynamic conditions. Respectively, - being just intuitive, in accordance with improvisation theory (e.g. Berliner, 1994; Weick, 1996, 1998). New venture creation and improvisation are both deliberate and intentional processes (Bird, 1992; Krueger et al., 2000) but due to environmental conditions, resource constraints and cognitive limitations almost always entrepreneurs cannot execute their plans as initially intended (Baker et al., 2003; Baron, 1998; Hmieleski and Ensley, 2004). Actually, improvisation for Miner et al. (1996) refers to " … actions, both spontaneous and new-product novel, that result in the creation of something while actions are unfolding" which covers to a great extent the observed actions and patterns of LT-KI venturing. Several authors have suggested that the entrepreneurial process could be also viewed as an improvisational activity (Baker et al., 2003; Baker and Nelson, 2005; Hmieleski and Corbett, 2006; Miner et al., 2001; Weick, 2002).

LT-KI Entrepreneurs are able to effectively **deviate from their plans** in order to adapt to and surpass their environmental conditions, which are often changing quickly and unpredictably (e.g. Hmieleski and Ensley, 2004). Furthermore the adaption of improvisation would cover the **process view** of LT-KI venturing, since "improvisation is not about doing one right thing (output view), but about continuously doing things right (process view)" (Vera and Crossan 2004, p. 738).
Brown and Eisenhardt (1998) assert that, in any firm and industry for which change is the critical strategic challenge, 'improvisation is what enables managers to continuously and creatively adjust to change and to consistently move products and services out the door' (p. 33). Baker et al. (2003) have proved that improvisational foundings are a commonplace occurrence in knowledge-intensive (high-tech) startups. As the authors suggest, improvisation can be utilized to see how current resources can be used to either meet pre-existing goals or to explore what outcomes are possible.

However, actions *are* deliberate*,* meaning that they result from intentional efforts on the behalf of the actors (Miner et al., 1996), as well as *extemporaneous* – they cannot be planned for (Weick, 1990) as in the above case. They even ensue from an attempt to enhance the deliberateness of the emergent part of the formed strategy and action (Mintzberg & McHugh, 1985; Perry, 1991; Crossan & Sorrenti, 1997).
Working on improvisation, Eisenhardt has defined it as " … organizing in a way such that the decision-making actors both adaptively innovate and strategically efficiently

execute [. ..] creating […] in real time" (Eisenhardt, 1997), "... combin[ing] limited structure with extensive interaction and freedom [to make changes] on current products"; "... an organizing strategy of making it up as you go along'; "... it means creating a product while simultaneously adapting to changing markets and technologies" (Brown & Eisenhardt, 1997) and "... rapidly building intuition and Innovation (1995) flexible options so as to cope with an unclear and changing environment" (Eisenhardt & Tabrizi, 1999).

This definition describes broadly some patterns detected in case analysis while most - if not all - of the above references emphasize aspects of improvisation such as intuition, action, limited resources, novelty, knowledge, spontaneity, and flexibility; all of them have been well recognized in most startup cases of the research. Following Baker et al. (2003) who called firms' ability to create capabilities based on improvisation "improvisational competencies", we propose that:

Proposition 2: The concept of improvisation can constitute the basis of a distinct type of dynamic entrepreneurial capability in knowledge-intensive low-tech ventures and namely the *improvisational capability.*

Improvisational capability can represent the ability of LT-KI entrepreneurs to proceed with the gradual formulation of the idea, a type of planning the "flesh and bones" of it by using existing data, information, knowledge and other resources ('resources at hand") with emergent acquisitions, deliberately (by deliberate efforts to seek and find) or not (through new opportunities or knowledge accidentally met). It is the meeting point of planning and opportunity and comprises a blend of the strategic processes of formulation and implementation (Akgun *et al*., 2005; Crossan *et al*., 1996; Hmieleski and Corbett, 2006 and 2008; Kamoche and Cunha, 1998; Moorman and Miner, 1995; Moorman and Miner, 1998b). The capability can allow responses to conditions of uncertainty and ambiguity; even in low-tech contexts, emerging new knowledge or changing regimes and circumstances impose the need to constantly rework and respond to multiple unscripted developments.

It should also be mentioned that the capability although present in all cases, exists in varying degrees in the cases. For example while WCo1 was a case of strong improvisational capability, WCo6 presented a more planned action with rather weak improvisational dimensions. This is quite natural and rather expected. The degree of

dynamism may depend on the kind of venturing; for example the second case regards corporate venturing, the robustness of the innovation, "resources at hand" and so on. Yet, improvisational capabilities exist even in cases of corporate venturing where the new activity was quite pre-planned (e.g. in the cases of WCo2, FCo6, FCo8 and most of the T&C cases). Unexpected problems, crises or even new ideas that would come up the very last minute (e.g. the innovative process of hardboards by WCo2) and new opportunities were confronted as "points of departure" (Docherty and Marking, 1997) due to the improvisational capability. Thus, **improvisation does not refer to the absolute negation of design–execution** (Baker et al., 2003). A major aspect of the capability is the provision of retrospective interpretation and creation of new patterns regarding products, processes, targeted markets, models etc. (Miner et al., 2000; Preston, 1991). Therefore, entrepreneurs shape an ongoing activity.

Accordingly, the improvisational capability following improvisation does not imply anarchy; that is to say "*no rules"* or structures. Brown and Eisenhardt (1998) found in their in-depth studies that improvisation is subject to "...a small number of key semi - structures that are never violated such as priorities, deadlines, responsibilities for major outcomes and targeted real-time measures". The following section describes dimensions of the improvisational capability as formed by the case study analysis and cross-checked and matched with the relevant improvisation theory.

7.2. C.2) Dimensions of the improvisational capability

"Improvisation involves reworking pre-composed material and designs in relation to unanticipated ideas conceived, shaped and transformed under the special conditions of performance, thereby adding unique features to every creation" (quoting Berliner (1994) in Cuhna et al., 1999). Actually, both improvisational and bricolage capabilities target at a constant improvement and refinement of the business idea as initially shaped in the mind of the entrepreneur. But "in the real world the concrete means used and ends sought are ever changing as knowledge changes and what seemed worthwhile yesterday no longer seems so today" (Lachmann, 1986). Therefore the ability to gain and develop the information processing dimension exploiting real-time information is quite significant.

Information Flowing: the term regards the information flows that occur between the entrepreneurs / entrepreneurial team and the environment (Cunha et *al.,* 1999; Chelminski, 2007; Knight and McDanish, 1979) as well as the stakeholders involved in the distinct actions of realizing the business idea (Berente and Vandenbosch, 2009). This can be the expert who undertook the R&D project, or the collaborating companies, Academia, manufacturers and raw material suppliers. Thus, the stakeholder size can range from one to really significant numbers such as the case of WCo2, where 20 firms of 7 countries were selected to build the bleeding technology the entrepreneur asked for.

Table A6 (Appendix A) presents the parameters of this dimension. Information flowing includes the ability to gain the latest information regarding a wide area of interest and manage it as well as the degree to which information is shared (Moorman and Miner, 1998b; Akgun and Lynn, 2002; Crossan *et al.,* 2005; Cunha and Cunha, 2006b, Leybourne, 2006). The role of information is quite significant in LT-KIE (e.g. Hirsch-Kreinsen and Schinge, 2011) but in general as well; for example Cohen and Levinthal (1990) posited that the ability of an organization to recognize and use external information is crucial for innovation.

When there is little or no time lag between occurrence and reporting of the information, then the improvisation literature names it as *real-time information* (Eisenhardt 1989, Eisenhardt and Tabrizi 1995; Moorman and Miner, 1998) which enables *real-time communication*; that is the interaction within and between the teams based on timely information (Brown and Eisenhardt 1998; Vera and Crossan, 2005). A low level in **real-time information and communication** is infrequent and that teams are not well aware of what is happening. High levels of real-time information and communication "are not to be understood as random or chaotic" (Vera and Crossan, 2005); they mean that communication is fluid and flows are wide-ranging and focused on operating information.

Crossan *et al.* (2005) suggest that real-time information and communication in firms can affect their resource allocation decisions and innovation. Research by Moorman and Miner (1998b) identified real-time information and communication as positive moderators of the linkage between new product actions, design and market effectiveness. Especially regarding new ventures, a study by Hmieleski and Ensley (2004) demonstrates that startups led by entrepreneurs with a proclivity toward

improvisational behavior tend to outperform their less improvisational counterparts - especially within highly dynamic industrial environments.

According to narrations the initial business concept had to be many times reconsidered and reshaped due to several reasons such as arising technical problems[112] (e.g. WCo1), inspiration of the moment (WCo2), unexpected laboratory results (FCo9), events or reactions (TCo2, FCo5) and emerging information (FCo8, TCo9) (Table A6, Appendix A). Real-time information and communication can be achieved by formal ways such as a business contact in a trade show that is translated to a modern plant in Greece, employment of experts or and R&D contract (e.g. WCo8, WCo9, TC7, FCo6) or informal ones; for example a personal contact and acquaintance with academia professors which can lead to innovative products or processes (FCo2, FCo5) or a friend (TCo10, WCo5). It can also be mainly internal (e.g. FCo7, TCo1, TCo4, TCo8) or external. It can further be quite generalized and vague (e.g. WCo7, TCo3) or very precise and unique (FCo5, TCo5). Regardless the degree and type, available information especially on knowledge required *a fluid communication and interaction among founders and the environment.* This involves real-time information and reaction to market trends and gap identification which further will feed try-and-error loops. In many cases the use or real-time information was achieved by even engaging customers in testing new products (WCo5) and methods (TCo3). Sometimes pilot market launching checks reactions, as in the case of WCo5 and FCo9, and alters initial purposes. In all cases its performance depended on the level of the communication fluidness among stakeholders, as well as speed and ways of interacting, responding to changes, indications or new problems (WCI, WC3, FC6) and thus the real-time interaction (Orlikowski, 1997, Miner et *al.*, 2001).

Therefore, real-time information and communication regards and can be measured by the degree of knowledge (Mayer, 2002) and information sharing (Akgun and Lynn, 2002) regarding both context-specific and more general issues such as science and technology advances, markets, competitors, suppliers and even experts (Barret, 1998; Crossan 1997; Day, 1994; Huber, 1991; von Hippel, 1988) as well as the number and

[112] Improvisation is useful when "people use the technology to experiment with" (Orlikowsky, 2000).

type of information and communication channels in real-time (McKnight and Bontis, 2002). Vera and Crossan (2005) engage further the communication skills of all stakeholders which seem to be quite significant; WC05 and FCo3 are cases where entrepreneurs seem to lack relevant skills resulting to both poor improvisation and bricolage capabilities.

However, in order to rip the benefits of real-time information, **flexibility** proved to play a significant role. This dimension implied the spontaneous respond to arising circumstances and obstacles, allowing exceptions to rules.

> "That innovative technology came out after our disagreement with the German manufacturing company. We insisted on what we wanted but tried to find alternative ways; we turned to a Greek manufacturer. It was actually a bet. Later the German company asked to use our technology. We had no problem to reveal our secrets, since we are no machine makers!" (**WCo2**)

> "We wanted to verticalize but our budget did not allow for it. We turned to other companies for cooperation. But that is rather impossible in our sector. There are many companies that work as subcontractors but they do not guarantee uniformity. Doors seemed closed for our initial concept. Still, we did not want to become "a conventional company". Being former representatives of Italian kitchen furniture, we knew their way. I mean *distretti industriali*. Then it was the problem of distance. Modular design solved it creating the problem of the production line. All of these problems while we were accepting orders and working in unconventional ways." (**WCo3)**.
>
> "For example, when we came up with the innovative olive package (which is a world-level innovation) we erected the fourth line" **FCo10** started a new production line after an invention to solve a problem.
>
> "The truth is that it came up accidentally. It wasn't among our initial targets. But we saw immediately its huge potential… There was a significant trend (towards gluten-free products) abroad, so it was actually our strategic choice to focus on that property." **(FCo9)**

The above cases justify Raudsepp (1990) who suggests that flexible individuals are able to explore a wide variety of approaches to a problem without losing their overall goal and purpose. Flexibility appears as a creative-thinking skill that enables individuals and groups to explore new cognitive pathways (in line with Amabile, 1998), defined as 'the ability to change or react' (Thomke 1997: 105). Flexibility is further the capacity to rapidly create and seize upon initiatives and opportunities (Evans, 1991; Grewal and Tansuhaj, 2001) regarding resources, structures and decisions.

FCo7 realized that "traditional products –no matter the quality- cannot make you differentiate". The entrepreneur tried re-engineering to enter the world of innovative processes. He advanced from imitation to innovation with mainly try-and-error processes and a flexible use of the knowledge gained from re-engineering, visits, trade shows, internet and books in order to react to the traditional character of his products. "I visited the Fancy Food Show in San Francisco and New York and came in contacts with producers who invited me in their farms in Wisconsin. I visited them and I "saw" opportunities – I mean what I could do".

Flexibility within the improvisational capability enhances the entrepreneurs' *dexterity in manipulating resources* (Duymedjian and Rüling 2005). Most founders revealed that flexibility and working out of routines, budgets and estimations was very important for the realization of their business concept. Many of them revealed that they had not estimated the time and effort needed for the realization of their concept.

> "Trial and error is not like R&D. You do not devote a certain budget in working hours. You and your team deal with the unexpected." (CEO of **FCo5**)
>
> "We owned extended knowledge on clothing and knitting technology. Then we learnt how to handle with military standards. We wanted to differentiate. I mean when you have some advanced know- how and relevant experience you seek to develop competitive advantages. Then you have to find how. We tried to trace some milestones and people to cooperate to gain knowledge… material… techniques… Whatever we needed for our new vision…" (**TCo2**)

How to handle resource flexibility thus stands out as a key issue for the entrepreneur. When referring to **resource flexibility**, knowledge resources act as orchestrators to the rest resource environments, being used in a constructivist approach. That is, collected knowledge generates knowledge and novel concepts and interpretations derived from an interaction between the entrepreneurs' experience and their ideas. The produced novel data guide, then, the manipulation and synthesis of the rest resources in a non-limiting way. This can also be confirmed by Penrose's (1959) suggestion that resources can be used in multiple ways, implying the multi-dimensional interaction among existing and newly required resources. It is also in line with Mosakowski (2002) who stresses that human choices and behaviors matter regarding the significance of resources, while Bocardelli and Magnusson, (2006) referring to high-tech KIE, state that resource flexibility is an important aspect of firm survival and competitiveness in early stages of a company's life. The authors relate resource flexibility to competitive advantage and new venture adaptation to changing

environments in order to survive. Within -at least LT-KIE- cases, this means that besides bricolage that can provide distinctive and special resources for the entrepreneurs to build their initial competitive advantage, the improvisational capability can enable the transformation, re-combination and differentiated use of them implying an interactive view of the matching among resources, requirements and markets. Improvisational capability then seems to provide the flexibility to respond to a variety of both unexpected demands and opportunities within the dynamic and uncertain environment during venturing (e.g. Hitt et *al.,* 2005), by promptly recognizing changes and committing resources to the new courses of the business idea development (e.g. Shimizu and Hitt, 2004).

Improvisational capability allows through flexibility the quick adoption and manipulation of the environmental changes (Grewal and Tansuhaj, 2001). However, besides the resource flexibility we should further state the need for **flexibility within structures**. Although almost evident as expected in cases of new-to-the-world cases, flexibility within structures seems to be a precondition for the spontaneous and self acting permutation of expertise, resources and strategic decision making in cases of corporate venturing. For example, older firms may suffer from excesses of bureaucracy and liabilities of age (Sorensen and Stuart, 2000; Weber, 1978). Therefore, in many cases it had to be clearly defined and specified (together with the other provocative competencies which will be later in this section discussed).

> "Although we had heavily invested in automatization, the shift to design proved to be a highly demanding and resource intensive strategic movement that demanded constant changes in structures and knowledge. Thank God we are a flexible team!" (**TCo8**).
> "You know structures must adapt to your vision. They have the power to ossify it" (**WCo3**).
> "The team should be "fresh" (i.e. new) and small" (**WCo2**)
> "In an established company, if one wants a new venture, one has to take the whole project out of the everyday routines and processes – otherwise you cannot be flexible either with knowledge or other resources" (**WCo9**)

Thus, "Getting out of existing routines, avoid processes and be flexible" was the strategy set by wood-processing mother-company **WCo9** when deciding to establish a new venture producing innovative wood-based products with patented technology. WCo2 worked with a very limited number of former employees and none by mother - company, while the two entrepreneurs were the only connection among the mother

and the new company. WCo10's policy to use no routines when important changes take place is strongly backed by the exceptionally unconventional personality of the entrepreneur.

Flexibility appears then to be an important dimension of the improvisational capability especially in early-stage entrepreneurship and increases in cases of high market or technology turbulence or competitive intensity (e.g. Moorman and Miner, 1998). Changes in products, production technologies, targeted market groups and fit with the demand of the market environment, as well as the speed of reaction to changes and problems are traced in the case analysis and matched as potential measures (e.g. Jambekar and Pelc, 2007 Jones *et al.,* 2006; Krohmer *et al*., 2002). Problems or obstacles are explored by multiple approaches creating a variety of courses of actions. Stressful events can be coped with effectively.

Flexibility within improvisation means that actions are not established patterns, but are results of implicit or explicit **trial and error** behavior. The research revealed further that the improvisational capabilities enabled *exploring, continuous experimenting, tinkering with possibilities without knowing where one's queries will lead or how action will unfold* (Barrett, 1998).

> "Once we had decided the core raw materials, we would try on many possible combinations in laboratory. We were not sure about the final results and even when we presented some of them at the international trade show, we did not know how we would produce them. We were in Hamburg[113] and still the laboratory was experimenting." (**FCo1**).
> "We wanted to try all possible ways. Nobody could assure us that they would work. Even University professors were not sure. Finally we had to abandon some of our initial ideas. They were good, we devoted money and time, but they simply did not work out" (**FCo2**).
> "I tried many things. I did not know if I could make something out of them. I could not tell about the market. When I put a zip in my mattresses, everybody was laughing. Now everybody wants transparency. It is the same with the seaweed (reconfiguration). The raw material does not cost – for the time being-but one has to think of industrial production and this is not easy. Still, I go on experimenting!" (**WCo10**).

This kind of **experimental culture,** thus the ability to explore, experiment and learn appears in all efforts. Especially *try-and-error* is very popular in all thirty cases and in low-tech industries in general (Hirsch-Kreinsen, 2005) (Table A6, Appendix A).

> "In-house try-and-error is usually more efficient that trying

[113] At the international trade-show

to reach more advanced second-hand experiences" (CEO, **FCo6**).

Entrepreneurs in most cases were constantly reforming the initial business idea in pursuit of more novelty and differentiation without hesitating to change plans according to the inspiration of the moment or the new information accidentally met. Trial-and-error approaches applied when developing novel products using repeated prototyping and improvised actions, repeated efforts to adopt and optimize the use of innovative material or to form novel production technologies, adapt requirements to markets or make new models work (in accordance with relevant literature, e.g. Brown and Eisenhardt, 2000; Jason, Eisenhardt, and Bingham, 2009). The need and importance of experimentation is generally in line with the relevant literature; Verona (1999) has proved that experimentation and learning-by-doing facilitates innovation in high-technology firms. Rothaermel and Deeds (2006) argue that start-ups have to experiment and thus invest in learning-by-doing to resolve technological challenges. Miner, Bassoff, and Moorman (2001) distinguish trial-and-error learning as the taking of actions, planned or unplanned, to inform future action from experimentation which is the deliberate and systematic use of varied conditions to learn cause-effect relationships.

Trial-and-error processes appear as continual processes to exploit information, crosscheck science results and "technology pushes" or integrate pertinent available knowledge and thus processes of testing, permutation and substitutions of the initial or existing objects. Yet, the processes appear fast and short resulting in alternative solutions. According to Sanchez's research (1997), resource flexibility is achieved when the scope of the resources is expanded with small switching costs and a quite short –term transfer process. Usually, experimentation in many cases would start with trying cheap, differentiated and fast probes. However, in certain cases it was developed to well-organized processes; entrepreneurs established well organized laboratories to perform R&D.

> "We started to make something without what we call R&D and we ended up with 10 months of R&D till we could have satisfying results (**FCo9**)
> **FCo7** started experimentation on a basis of re-engineering using the existing installations, followed by gradually intensive try-and-error efforts in order to be differentiated in an exceptionally mature market.
> **FCo4** started from simple experimentation on biological mixtures to end up with R&D on semi-pharmaceutical products.
> **FCo5** and **FCo6** developed high-tech R&D labs.
> Most **W&F cases** used extensive try-and-error on innovative material use or new production technologies combined with design.

Experimental culture may be also created due to the entrepreneurs' attitude and culture according to CEO sayings. Narrations reveal mistakes and failures.

FCo2 used hydroponics for cucumber and tomato production investing one million Euros in a method described in science books since 1929 but hardly used in Europe and not used in Greece. The entrepreneurs turned to professors of Academia but even then knowledge was only theoretic. Problems existed even in planting; a woman who had worked in a flower greenhouse in Holland could help them; "She taught us how to plant the seeds. That was very important of course, but that was all she could tell us. Conditions and balances could naturally not be determined by her – she was just a worker. We had to experiment with them however…". FCo2 lost two productions due to these experimentations and Mr M. (their expert consultant) had to turn to Germany and Holland for more help. After the disaster of the first year, and with no real support at practical level, they abandoned the tomato production and managed to cope with the cucumber cultivation and confront consequent technical problems reaching one million cucumbers per year.

In some cases the interviews revealed that this culture was then embedded in the firms as in the cases of WCo2, FCo5, FCo6, FCo8, TCo1, TCo6, and TCo7. This is however in line with relevant literature (e.g. Jacobides and Winter, 2007; Schein, 1992; Vera and Crossan, 2004). According to March (1988) to launch a new course involves a lot of uncertainty and learning through trial and error. Weick (1990) talked about the "aesthetic of imperfection" and Crossan (1997) reminds that such culture promotes faster cycle times and more innovation, which corresponds to the "latter part of the 1990s: …faster, better, smarter" and which comes true for the first decade of the 21st century (Leybourne, 2007).

Therefore, the existence or even the creation of a sense of urgency and pressure, trial and error processes together with the tolerance of mistakes and failures, and the formation of feedback practices seem to be the most important characteristics of experimental culture (Barret, 1998; Crossan 1997; Brown and Eisenhardt, 1997; Pina and Cuhna, 1999).

An interesting observation regards the matching of Dybå's (2000) distinction between explorative and exploitative improvisational actions with our cases. According to the author, the explorative improvisation is more a search for new knowledge, either through imitation or innovation, whereas the exploitative improvisation is the

adoption and use of existing knowledge and experience. The thirty cases can be categorized to these two groups as well a hybrid one. The acquired knowledge and the way it is implemented appear to be major contributors to the creation of the initial competitive advantage, which aims at offering the potential to the newcomer to survive. Most times it does not regard a single patent or invention but a dynamic collage of knowledge, resources and ways of applying them. According to Crossan and Sorrenti (1997), "in highly competitive environments, the rate of learning can be a strong competitive advantage". Experimentation which appears more in the form of try-and-error in LT-KI cases seems to be significant over the early stages of the ventures' life as it builds knowledge, routines, and slack resources.

Provocative organizational competencies (Table A7, Appendix A): Across the cases LT-KI start-up founders appeared to develop high level improvisational capabilities in order to maximize resource utilization, previous experiences and current setting. Due to their newness, this seemed to be easier compared to the cases of corporate venturing. Entrepreneurs would not take established structures, rules and routines for granted, and would invoke complexity for the purpose of coming up with novel ideas. Even in cases of entrepreneurial teams, these would include less than four people; only WCo3, FCo1, FCo2 among the thirty cases presented an entrepreneurial team of four people. All stakeholders would also share the same attitude (WCo3) or mutually accept a leader among them (FCo1, FCo2).

What actually shifted attention on these particular aspects was the fact that things were not that easy or "individual-based and provoked" in cases of corporate venturing. This fact revealed that it didn't regard simply "entrepreneurial traits" but rather some improvisational capabilities' dimensions. More precisely, the study of the transcripts of corporate venturing cases revealed a wealth of patterns resembling a number of factors, collectively called **provocative competencies** (Barret, 1998) as described in the literature of improvisation and namely: ***the absence of adequate routines,*** **the** ***low procedural memory*** **and** ***the minimal structures*** (in accordance with Brown & Eisenhardt, 1997; Cuhna et *al.*, 1999; Crossan, 1998; Crossan, 2005; Moorman and Miner, 1998b; Orlikowski, 1996; Weick, 1998). Thus, established firms were purposefully committed not to use routines or established strategy at the phase of starting up a new venture. Their aim -in our cases- was actually to "simulate" the new venture to a "start-up", in order to reap the benefits of breaking strong path-

dependencies which are considered a major drawback of low-tech KIE (e.g. Hirsch-Kreinsen and Schwinge, 2011), be flexible and build on really innovative ideas and not mere extensions or improvements of existing visions. Weak cases indicated some difficulty in deviating from existing routines and acting according to established memory and path-dependencies (TCo4).

The term "provocative competences" belongs to Barret (1998) who described it as "any deliberate effort to interrupt habit patterns" and as "competences to invoke chaos and disorder", involving a perspective of risk-taking and "gambling on the result" (as clearly stated by the entrepreneur in FCo2). Dehlin (2008) describes provocative competence as the ability to create openings in space and time especially designed for creative activities. Thus, while in technical rationality there seem to be only pre-described ways ahead (Schön 1991), in low-tech KIE one can deliberately claim something out of context, "play the wrong note" (Brown and Eisenhardt, 1997) on purpose and then see where this leads (Barrett 1998; Weick 2001). Within LT-KIE such actions are deliberate - if not even partially planned (especially in business organizations) - but the emergent part of these changes has been found to be considerable (Mintzberg and McHugh, 1985) and answerable by means of improvisation (Perry, 1991; Crossan et al., 1996).

Therefore, the deliberate (in case of corporate venturing) absence of adequate routines and procedural memory supports the tendency to respond to unexpected situations, overcoming problems, obstacles and path-dependence deficiencies. Nascent entrepreneurs seemed even to avoid family practices when family business belonged to the same sector such as the cases of WCo1, WCo8, FCo1 and FCo9, rejecting the safety offered in cases of adapting well-established patterns (Table A7, Appendix A).

> Perhaps the most extreme case was the case of **WCo8**; the nascent entrepreneur advised his father to burn his own plant which however was one of the best firms in Macedonia at that time.

Established companies try to avoid existing routines; LT-KI entrepreneurs set apart the new knowledge-intensive venture as a totally novel "start-up". This is managed either by a mutual agreement among the members involved as in the case of WCo9, TCo1 and TCo9 or even by the physical distance as in the cases of WCo2, FCo6, FCo8, TCo2. Cases which tried to establish provocative competences but with less success can be considered:

- **WCo6,** which managed to reach the initial target and became knowledge-intensive but did not manage to depart to radical innovation;
- **TCo4, TCo6 and TCo8**, which were large companies with well-established routines, capabilities and policies. They were successful organizations internationally known and acknowledged and turned to KIE venturing mainly due to the global changes in the sector. These companies found it more difficult to totally ignore their formerly successful routines or avoid the procedural memories. They further confirmed relative studies; for example, Akgun *et al.* (2006) reveal that strong memory structure inhibits deviations from its previous knowledge store, thereby hindering improvisational activities.

It should be made clear that low memory regards mainly the procedural memory; i.e. processes and routines (Kyriakopoulos, 2004) or problem solving routines. Things are quite different when memory regards knowledge assets and tacit knowledge. Then "memory becomes a useful resource, because it is the result of the creative recombination of previously successful routines of knowledge" (Vera and Crossan, 2005). Thus, even during venture creation, agents build shared knowledge through tangible and intangible types; methods such as sophisticated technology and knowledge-sharing events (McKnight and Bontis, 2002) support the venture process.

Therefore, these two dimensions are related to de-learning or ways of departure of established procedural memories, mainly in cases of corporate venturing. This is done by engaging completely new staff, decentralization by the creation of new culture or the development of new processes and new shifts (in accordance with Chelminski, 2007; Ciborra, 1996; Cunha *et al.,* 2002; Orlikowski 1996).

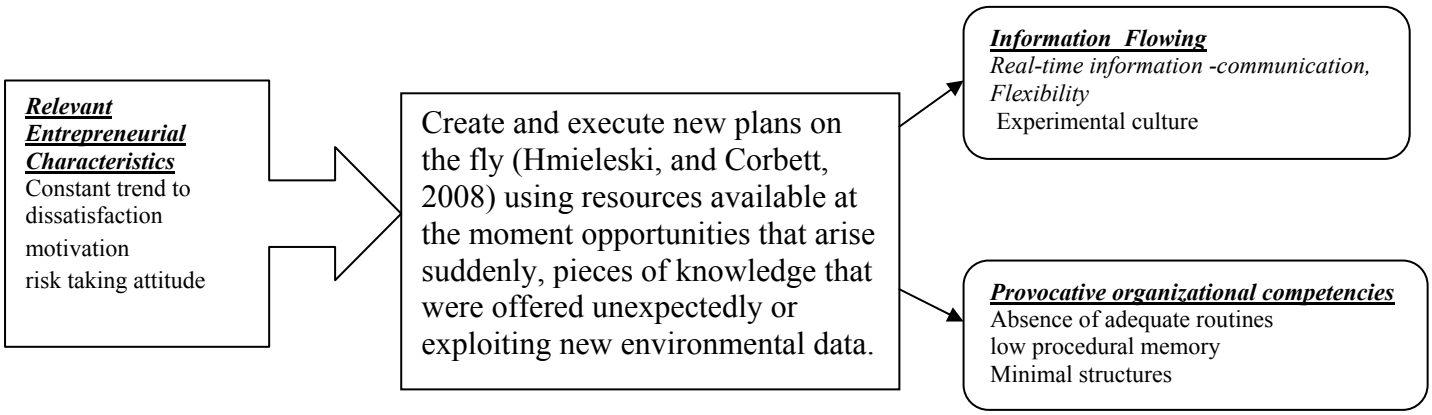
These provocative competencies seemed however to be strongly related to the existence of small entrepreneurial teams (never more than four partners) with high levels of trust and specific communication codes among them for the nascent cases, and deliberate formation of small executive teams to act within decentralized organizational structures for corporate cases (Table A7, Appendix A). This is in line with relevant literature and reflects partly the well discussed term of ***minimal structures*** of Kamoche and Cuhna (2001, 2003) also referred before in several works of Barret (1998), Weick (1998) and other scholars. Minimal structures can provide the above required low formalization and the decentralized structures. Ciborra (1996)

supports the view of "... combin[ing] limited structure with extensive interaction and freedom [to make changes] on current products" (p. 3); Crossan & Sorrenti (1997) argue that minimal structures can be a strong source of competitive advantage.

WCo9 is an exemplary case of deliberate formation of provocative competencies:

> "We were only four… with good chemistry[114]. We would not stereotype, we ought to get out of the mould of mother-company, and we should cut through its red tape wherever possible. No one else should interfere. This was quite clear. We were well out of the group's routines and processes. We had to find the suitable raw material, we should form the mode of co-operation with USA; this had to be direct; no hierarchies; then we would lose communication and flexibility – for example in cases of trouble or when changes were *en route*… Then the new venture was totally disconnected from the mother company's processes and routines. This fact helped us to establish the new plant within a very short time frame. Decision making was very fast, you know. When there is a large group and you want to do something new and innovative you have to take it out of the established way of thinking; this is the only way to oil the wheels of decision – making to make the whole system as easy as possible at every level. This was the founder's idea – to take the whole thing out of the system – I think it was very important for the new venture; he had done it again in the past…"
>
> *(CEO of **WCo9**)*

Figure 7.2: Improvisational capability



As with the bricolage capability, the entrepreneurs presented **some common traits** shown in Table A8 (Appendix A) related to the improvisational capability such as self-confidence and risk-taking in accordance to literature (e.g. Barret, 1998; Hmieleski and Corbett, 2008; Vera and Crossan, 2005) and a constant trend to dissatisfaction (Pina and Cuhna, 1999).

[114] One of the four was the owner of the group indicating the personal involvement as described in bricolage capability

The last one does not apply a negative sense or a rejection but nourishes a constant need for novelties. By making explicit the distance between current reality and vision (Fritz, 1989; Senge, 1990) entrepreneurs in most cases were constantly reforming the initial business idea in pursuit of more novelty and differentiation without hesitating to change plans according to the inspiration of the moment or the new information accidentally met. Founders experience **dissatisfaction** with their current achievements and this leads to a constant "reinvention" as they improvise (Orlikowski and Hofman, 1997), modify (Majchrzak et al., 2000), or tinker (Ciborra, 1992). This constant trend to dissatisfaction (Table A8, Appendix A) reflects a forward-looking perspective where the actors actively seek to anticipate opportunities and out-maneuver even within the founding process to obtain first-mover advantages and shape the direction of the environment.

However, this dissatisfaction has its roots in the entrepreneurs' **motivation incentives**. These can be either achievement motivation or strategic motivation. Achievement motivation has been singled out as the most prevalent theory of entrepreneurship (Johnson, 1990). The concept of Need for Achievement was originated by Henry Murray in 1938 and according to Babb and Babb (1992) that studied entrepreneurs in New England and Florida, it differentiated founders and non-founders. However achievement motivation constitutes a fundamental characteristic within the concept of the transcendental capability as discussed in next section. Motivation has been further connected to knowledge transfer and sharing (e.g. Cohendet and Llerena, 2001; Hmieleski and Corbett, 2006; Osterloh and Frey, 2000) for both to reap benefits and for internal satisfaction.

In most new-to-the world cases (a percentage of 73%), founders had been raised in a similar entrepreneurial milieu; due to advanced studies and the need to create something on their own, they created opportunities either during interactions with suppliers (WCo1, WCo3, FCo6), customers (WCo8, FCo1) or due to institutional and demographic chances (WCo7, TCo1). Most of them indicated a tendency to surpass the success of family business (Table A8, Appendix A). As Nonaka (1994) stated, incentive schemes influence an individual's commitment to create new knowledge. On the other hand, the strategic motivation is present in most cases of corporate venturing. Especially in the T&C sector, which is dominated by cases of corporate venturing, change was almost imposed as strategic motivation for established

companies in order to survive.[115] Yet, there were many cases where motivation was a mixture of personal achievement and a strategic choice.

WCo2 was the result of a strategic decision; however the entrepreneur narrated that it was also a personal bet.

> "It became the most modern plant in the world. Actually this was a bet, *my bet.* You know, when I visited Interzum in Koln in 1983, as a very small company I was disdained by some German…" (WCo2's entrepreneur)
> In the same vein, the new venture was "a family pride matter" for **FCo6**, "a series of personal bets" for **FCo5**, "a way of living" for **WCo10**.

Yet, entrepreneurs are well **aware of the risks taken and accept them**. Risks can regard products (e.g. WCo4, WCo9, FCo3, FCo9, TCo2), processes (e.g. WCo1, FCo2, TCo5) or a mixture of both together with market reactions (Table A8, Appendix A). Risk-taking reflects an acceptance of uncertainty and risk inherent in original activity and is typically characterized by resource commitment to uncertain outcomes and activities. Yet, it seems quite necessary in supporting creativity and experimentation. Then, actors undertake action within conditions of diversity and ambiguity while they use regulation and control quite moderately, with a tolerance of mistakes and a sense of urgency. Risk is embedded in long-range decision making and regards the survival of the venture and not only performance (Mintzberg *et al.,* 1976; Baird and Thomas, 1985).

Both improvisation and bricolage have been treated as concepts, mechanisms, media, models or just activities. Improvisation, described as "a recipe and not a prescription", has been already confronted as a type of capability (e.g. Crossan, 1998; Cunha et al., 1999; Brown & Eisenhardt, 1997) related to resources and entrepreneurship (e.g. Miner et *al*., 2001; Hmieleski and Corbett, 2006; Jones et *al*., 2010). The concept was soon connected to innovation (Vera and Crossan, 2005), knowledge management (Kamoche et *al.*, 2008) and knowledge intensiveness (Baker et *al.,* 2003).

Miner, Moorman and Bassoff (1996 and 2001) have shown that improvisation in both processes and products can be accepted and incorporated into formal organizational activities, in order to increase the survival and enhance growth of new ventures. Gong et al. (2006) support the view that new firms figure out what to do by improvising: "It may be this reliance on improvisation that gives many entrepreneurial firms the sense

[115] For more see the sectoral overview and Protogerou et al., (2013) and the sectoral reviews

of flirting with the edge of chaos but also a degree of fluidity and freedom from excessive inertia".

Thus, besides a former general belief that improvisation and routines are almost antonyms in management due to the repetition basis of the second ones, improvisational capabilities have been gradually claimed to imply a reconfiguration of routines and knowledge through an interaction of freedom and structure (e.g. Baker, 2003; Vera & Crossan, 2007). The case studies indicate that the improvisational capabilities can have important consequences for patterns of dynamic capabilities development. For example, information processing and experimental culture can lay the foundations for sensing processes, continuous learning, knowledge management and NPD[116]. Teece et al. (2007) used the metaphor of 'orchestration' of capacities to describe the enterprise's capacity to successfully innovate and capture sufficient value through the constant cultivation of dynamic capabilities. As we argue simple orchestration is good but not enough in the case of a start-up, a spin off or an organization reorientation. In these cases the power of jazz characteristics with the loose rules and the tendency to creatively deviate and make up are needed.

This is in line with a quite small but significant strand of literature; some authors consider improvisation as a dynamic capability (Cunha et al., 2007; Zahra, 2011) especially in early-phase entrepreneurship (Boccardelli and Magnusson, 2006, Zahra, 2006) which is usually associated with high uncertainty and high competitive environments (e.g. Hmieleski and Corbett, 2006; Leone, 2010). On the other hand, Pavlou and Sawy (2007) distinguish between dynamic and improvisational capabilities as two distinct means for adapting to turbulent environments.

7.2. d) The concept of the Transcendental Capability

> You see things; and you say, "Why?" But I dream things that never were; and I say, "Why not?"
>
> George Bernard Shaw. "Back to Methuselah", 1921, part 1, act 1

Ciborra (1999) connected improvisation to "moments of vision, where a sharper insight into the world takes place, as well as a better understanding of ourselves-in-the world. Such moments of vision lead our Being to express itself in a 'project of action' that precipitates (suddenly, according to clock time) into a 'decision'" (p.89). In order

[116] The relative hypothesis will be discussed in detail in a subsequent section

to start up a new firm based on innovation and knowledge, one needs these "moments of vision" and "the sharper insight" into the entrepreneurial world, after one has successfully understood one's self and one's position (or desired position) inside it.
The research cases indicated that bricolage and improvisation although fundamental, are not adequate capabilities to support KIE in low-tech sectors. The actual basis of a new venture success seems to lie in the *very knowledge-based business concept and its creation.* Thus, the main question of LT-KIE focuses on: *why and how LT-KI entrepreneurs see and create new opportunities on a knowledge-creation or creative-knowledge-recombination basis*.

In entrepreneurship literature there is a common acceptance that entrepreneurs think differently and make decisions in fundamentally different ways from those that approach things in a more factual manner (Alvarez and Busenitz, 2001; Busenitz & Barney, 1997). At any start up or spin off, the business concept that is born has to be unique and able to shape alone the way to survival of the new firm. Furthermore, knowledge-intensive means that the resulting innovation by KIE is not only knowledge-based, but it is going beyond the existing sectoral or product field-specific knowledge bases by creating new knowledge, new ways of problem solving or new processes, products as well as new markets not applied or unknown in the industry before. **We should further bear in mind that an innovation within the everyday company's course can succeed or fail with all known consequences. But the innovation introducing a new venture in the entrepreneurial ecosystem, in which the newcomer will challenge a share, is decisive for its survival or the straightforward entrepreneurial "death".**
In the attempt to "decode" the way KI-LT entrepreneurs/teams created novel knowledge-intensive business concepts and outline "principles that underlie and guide choices of the entrepreneurial acts" (Teece, 2012) we formed the notion of *Transcendental Capability* inspired by Kant's Critique of Pure Reason[117].
Senge (1990) and Senge et *al.* (2005) theorizing on the learning organization relate transcendental to the ability of "building the present on our future". The term has been also used in systems intelligent leadership (Hämäläinen and Saarinen, 2007) and the

[117] "I entitle transcendental all knowledge which is occupied not so much with objects as with the mode of our knowledge of objects in so far as this mode of knowledge is to be possible a priori." (B25, Kant, 1781)

theory of leadership (Cardona, 2000; Kauremaa, 2007; Sanders et *al*., 2003), approached however in different ways.

7.2.d.1) Nature of the capability

"The best way to predict the future is to create it". The famous quote of Peter Drucker is more popular than ever; in today's competitive environment new ventures can survive and grow only if they manage to challenge existing business ecosystems or create new ones. Indeed, it is the "capacity to simulate the future in imagination [that saves] us from the worst excesses of the blind replicators" (Dawkins, 1976).

This holds especially true for low-tech firms with well-established technologies and highly standardized processes, which share to a greater or lesser extent markets on mature products. Furthermore, unlike high-tech sectors with their prevailing technological contingency, the technologies of the LT sectors are well-established with processes and products highly standardized and at an advanced stage (Hirsch-Kreinsen and Schwinge, 2011). Therefore, LT-KI actors need to construct novel knowledge-based concepts that permit consumers to amass a great number of concepts allowing them to interpret their needs in different ways. **Actors of all cases of the present research challenged the very nature of their low-tech industries and their strong path-dependencies. FCo6's** CEO, known for his new firm's strong innovative image, specifies this in a very clear way:

> "While no-one would argue that rice is really rice, knowledge-intensive innovative concepts can argue about nutritional exception, innovative ways of preparation, novel mixtures, waste and by-products genius exploitation, eco-innovation or whatever. Of course all these presuppose knowledge, scientific involvement well outside the boarder of our sector, and experimentation. Still, ideas are a priori, since nothing exists before you imagine and invent them!"
>
> ***FCo6**'s CEO*

Transcendence connotes a capacity to think paradoxically. Lewis (2000) points out that to think paradoxically transcendences traditional first-order thinking or "slight alterations to the logic and behaviors … used in the past" to second-order thinking that involves "critically examining entrenched assumptions to construct a more accommodating perception of opposites" (Lewis, 2000, p. 760).

> "A zip in the mattress? Algae to fill the mattress: people were laughing…" (**WCo9**)

> "Then the biggest problem was the financing, since although our business plan was the best among 94 other, the bank did not want to give us a loan. Furthermore, the whole process of asking for the subsidy was time consuming, expensive and soul destroying. We were told that people working in the relevant subsidy service of the Region were betting about how soon we would bankrupt!... Now the TV channels and the newspapers come and ask about our ideas and methods, but then it was a really hard time for us!"
> "Who decides about the standards of fresh milk… or for the fruit juices? Who decides about the quality? The state had defined a standard of 100.000 TMBC[118]. We asked ourselves what if we tried something better… how we could produce milk - in competitive ways of course - with 50.000 TMBC. We also produce milk with 10.000 TMBC. We actually did not take anything for granded!" **(FCo8)**

"You are a fool - until your idea becomes a success" (Mark Twain). Faltin (2001) argues that this is a pattern that can be found in the biography of almost all innovative entrepreneurs and suggests entrepreneurs to have *eye-opening capabilities*. The transcendental capability, ability to think paradoxically or to deviate from established opinions, resembles closely the ability to see beyond symptomatic solutions (Senge, 1990). In that case, one has to develop this ability in order to come up with an innovative opportunity, beyond the simplistic combination of pieces of knowledge, which may come from any point of the value chain.

Transcendence has been behind many theories on entrepreneurship and innovation. Perhaps more consistent - in general terms - with this perspective was Schumpeter who suggested that entrepreneurial success depends on 'intuition, the capacity of seeing things in a way which *afterwards* proves to be true, even though it cannot be established at the moment and of grasping the essential fact, discarding the unessential, *even though one can give no account of the principles by which this is done'* (Schumpeter, 1934). Kirzner maintained that: "entrepreneurship reveals to the market what the market did not realize was available, or indeed, needed at all" and argued that: 'human action involves a *posture of alertness* toward the discovery of as yet *unperceived* opportunities and their exploitation' (1979). Witt (2002) described the entrepreneurial capacity as "the will to demonstrate that mere possibilities can be turned into reality." Hayek (1978) noted that business ideas occur as 'spontaneous

[118] Total Mesophilic Bacteria Count

orderings' and transcend tight limits of individual knowledge, **relating in this way transcendence with knowledge.**

> "Knowledge pre-exists inside us, it is stored in us and waits to come out as a reaction… You should observe things and see why they exist. So do I. I start …and here we go! At this path, this same myself guides me to do this or that!"
>
> (Entrepreneur of **WCo10**)

Regarding the knowledge perspective, Ihrig et al. (2006) describe the entrepreneurial process in terms of **knowledge development** following Boisot's (1998) Social Learning Cycle**.** Nonaka and Takeuchi (1995) have further commented on the role of knowledge creation on innovation: "when organizations innovate, they do not simply process information from outside in, in order to solve existing problems and adapt to a changing environment. They actually **create new knowledge** and information, from the inside out, in order to redefine both problems and solutions and in the process, to re-create their environment".

Today, knowledge and the capability to create and utilize knowledge are indeed considered to be the most important source of a firm's sustainable competitive advantage (Delmar and Wennberg, 2011; McKelvey and Lassen, 2013; Nonaka, 1990, 1991, 1994; Nonaka & Takeuchi, 1995; Protogerou and Karagouni, 2012), especially within the field of knowledge-intensive entrepreneurship.

Building on the distinction between tacit and codified knowledge (e.g. Nonaka and Konno, 1998), codified knowledge can be regarded as *a set of resources at hand,* thus in the possesion of the actors or objects of search by them. On the other hand, tacit knowledge regards specific competencies to form the framewok within which the resources will be combined and exploited (e.g. Abramowitz and David, 1996; Akbar, 2003; Cohen and Levinthal, 1989; Nonaka and Konno, 1998; Zook, 2004). Accordingly, tacit knowledge has been linked to capabilities and processes of action, such as information selection and elaboration, cognitive frames, creativity and dynamic interactions among individuals and the environment (Cappellin, 2013; Nonaka & Toyama, 2003).

The case analysis indicates that the creation of a KI-LT business idea lies mainly on a ***perspective of knowledge generation and a capability to form concepts based on transcendental ideas***; thus it cannot be approached by the traditional economic and organizational views, based on the significance of R&D, patents, ready technologies and rational processes of optimization. "Instead of merely solving problems,

organizations **create and define problems, develop and apply knowledge to solve the problems, and then develop new knowledge through the action of problem solving"** (Nonaka et al., 2000b). External "stimuli" can be induced by threats and opportunities, competitive pressures, technology changes or just inspirations accidentally produced.

This view further indicates that in cases of new KI-LT venturing, actors actually ***choose the environment*** in which they decide to build their competitive advantages. This contradicts both the positioning school of Porter[119] and the established view on the low-tech passiveness. It also exceeds the resource view which regards the firm as a collection of resources and connects outperformance to superior resources while it does not show any interest in the entrepreneurial side of organizations which seems to be a main drawback of the DC view as well (e.g. Teece, 2007, 2012)

The birth of new conceptual artifacts and structures in the intersection of knowledge and transcendentalism is not a novel perspective. Jantsch (1980) has named knowledge creation a transcending process. Nonaka and Toyama (2003) argue that entities (individuals, groups, organizations) transcend the boundary of the old into a new self, by new knowledge. Thus, building on the views of these limited but yet quite interesting stream of literature, the notion of **transcendental capability has been developed mainly around the core themes of knowledge generation and transcendence** to explain the attributes and behaviours observed regarding the formation of a novel business idea within the context of the low-tech but knowledge intensive cases of the research. It is proposed as the core strategic dynamic entrepreneurial capability which actually drives the other two, i.e. the bricolage and the improvisational capabilities in order to translate a novel idea to an economic entity by requiring resources and integrating complementary production capabilities.

Therefore, we assume **transcendental capabilities (TCs)** as the key drivers of shaping unorthodox ideas and orchestrating the other two DECs to realize these ideas. TCs enable investigation in a variety of fields- be them knowledge, practical or other types- and through a variety of ways. Entrepreneurs form by anticipation genuine concepts which do not relate immediately to the final object (be it a product or a service) but to the use of conscious rational processes (based on Kant, 1781):

[119] The positioning school focuses on the environment in which the organizations operate (Porter, 1980).

Gluten-free products was not the expected result of **FCo5**'s business concept; R&D development embracing biochemistry created conscious processes to medical food innovation.

The cases indicated that what the actors regard as business ideas are actually some **raw ideas** that have to form the real business concepts. KI-LT entrepreneurs are trying to capture the "extraordinary" and "unique" (Faltin, 2001) but at the same time "familiar" and "acceptable" (Table A9, Appendix A). This cognitive capability which determines the origins, the extent, and the objective validity of knowledge on the idea development is derived by Transcendental Capability. TC enables knowledge to build on information extracted from data (Boisot, 1998) and at the same time to form new requests on more knowledge, new information and novel data. Then, entrepreneurs start their resource acquisition efforts through the bricolage and improvisational capabilities[120].

TCs facilitate a path carving within the "beginner's" chaos, limiting any "deals" with the laws of market, technology and business, in so far only as they refer to *a priori* set targets. They form a distinct difference between KIE and plain entrepreneurship, enacting all mechanisms needed to allow unexplored knowledge paths and produce innovative business concepts, which is quite evident in all cases. The fruits of TCs seem to be able to permit a newcomer be accepted in an already established and seemingly saturated market environment, entice customers, deliver value and persuade them to pay for value. This is in line with literature; Aldrich and Fiol (1994) have argued that new organizations can have a powerful influence on broader contexts shaping industry environments. Furthermore, "… an organization actively interacts with its environment, reshaping this environment and even itself through the process of knowledge creation" (Nonaka et *al*., 2001, p.610). This suggests that it is not the opportunity but rather the idea that is out there waiting to be discovered.

In order to define and operationalize TCs using the case data analysis we sought theories that could explain the **relationship between knowledge and transcendence at the venturing phase** and explore why the new knowledge could have an economic impact on LT-KI new ventures. This led to a quite extensive study of the relevant literature as presented in Chapter 2. However, besides the rich literature found on

[120] Discussed above in this Chapter

knowledge and its strategic importance as a source of competitive advantage for firms in general (Grant, 1996; Kogut & Zander, 1992; Macher & Boerner, 2006; Tsai & Li, 2007; Matusik & Hill, 1998), existent theoretical and empirical evidence could not match several of the patterns found in the LT-KI cases.

Perhaps **the closest general approach was that of Nonaka** who was among the few scholars to try to explain the dynamic process of knowledge creation and utilization (Nonaka, 1994; Nonaka & Takeuchi, 1995; Nonaka et *al*, 2000) opening new knowledge-based perspectives in other strands such as the innovation management and organizational learning literature. Knowledge, defined as ‘‘justified true belief’’, increases an organization’s capacity for effective action (Nonaka, 1994; Nonaka & Takeushi, 1995). According to Nonaka and Nishiguchi (2001) knowledge is often in the eye of the beholder, and one gives meaning to a concept through the way one uses it. Nonaka et *al*. (2000) actually developed the s*piral model of knowledge*: new knowledge always begins with the individual, whose knowledge is transformed into organizational, and then it expands through the organization being valuable to it as a whole (Nonaka, 1991; Nonaka & Takeuchi, 1995; Nonaka et al., 2000a). In Nonaka and Toyama (2003),the authors try to advance this knowledge-based theory further by incorporating the dialectic thinking such as Hegel, and Bhaskar (1993), Eastern philosophy, and the Structuration theory (Giddens, 1984) arguing that knowledge is created through ***the synthesis of the contradictions between the organization’s internal resources and the environment***. The context for dialectic knowledge creation is *ba*, a concept originally proposed by the Japanese philosopher Kitaro Nishida. Ba is subject to the environmental influence and refers to “shared space for emerging relationships” which provides a platform for advancing knowledge. Owing to these properties, a firm can be viewed as an organic configuration of various ba, where people interact with each other and the environment (e.g. suppliers, universities and so on) based on the knowledge they have and the meaning they create. Yet, Nonaka’s approach applies in knowledge creation within an established organization and not at the time of the entrepreneurial idea creation. The author further does not connect knowledge creation to capabilities.

Yet, several scholars tried to relate knowledge generation to organizational **processes and capabilities**; Autio *et al* (2000) related knowledge-based resources to performance in dynamic environments, where knowledge is held by individuals but is also embedded in organizing principles. Kogut & Zander (1996) introduce

combinative capabilities which enable the continuous recombination of knowledge bases and the application of this knowledge to new market opportunities. Craig (1996) identified "vision" and "forward-looking . . . thinking" as vital components of *the general capabilities* firms need in order to succeed in hypercompetitive environments.

On the other hand, **transcendence** is a common word in entrepreneurship literature denoting mainly the ability of entrepreneurs to transcend their current way of thinking (Bosch, 2013; Ji and Yan, 2011; Klein, 1999; Lindhult, Carlsson, and Grinbergs, 2011; Schwartz, 1992). Transcendence has been also behind many theories on entrepreneurship and innovation with no exact reference to the term (e.g. Faltin, 2001; Schumpeter, 1934) as discussed shortly above in this section. Oliver Williamson exploring business strategy by governance and competence perspectives asks himself whether human agents are myopic (Cyert and March, 1963), or they have the capacity for foresight looking ahead and repositioning (Williamson, 1999). George Schultz's (1995) views on economics support the foresight view as well: "my training in economics has had a major influence on the way I think about public policy tasks, even when they have no particular relationship to economics. Our discipline makes one think ahead, ask about indirect consequences, and take note of variables that may not be directly under consideration'. The businessman Rudolf Spreckels knew this in his bones: 'Whenever I see something badly done, or not done at all, I see an opportunity to make a fortune' (in Williamson, 1999).

Perhaps the most relevant approach was the Kirznerian approach where transcendence comes in any of innumerable forms such as ideas "in pricing, production, organization, contracting, product line, marketing, customer service, and so on" (Klein, 2011). In the same vein, Senge (1990) and Senge et *al.* (2005) theorizing on the learning organization relate transcendental to the ability of "building the present on our future" instead of building it on the past.

In the same field of learning organizations, Scharmer (2001) presented[121] his quite interesting approach on "self-transcending" knowledge which is to our knowledge the **most known intersection of knowledge creation and transcendence**. "Self-transcending" knowledge regards tacit knowledge which enables leaders to sense emerging opportunities before these become manifest in the marketplace. Combining

[121] In parallel in Journal of Knowledge Management (a special Issue), in Nonaka and Teece's edition on Managing Industrial Knowledge and in the Japanese Soshiki Kagaku (in Japanese) in 2001

his theory with Nonaka and Takeuchi's (1995) spiral theory on knowledge creation, the author tries to find the forces that drive the knowledge spiral. Examples of this form of knowing are what Nonaka and Konno (1998) call "originating ba"; von Krogh (1998) calls "care"; what Senge (1990) calls "personal mastery"; Kappler (1993) "presencing"; and what Scharmer (1999) calls "not-yet-embodied" and later 92001)"self-transcending" knowledge.

> "It is the kind of knowledge Heidegger (1993) meant when he talked about Being as "coming from absence into presence" and truth as coming from "concealment into un-concealment," and what the Japanese philosopher Nishida was referring to when he spoke of "pure experience" (1990) and "action intuition" (1987). All of these scholars point at a formative state of knowledge that precedes the separation of subject and object, or knower and known."
>
> (Scharmer, 2001, p.139)

The insights of this theory matched in a perfect way the attitude of the case-study entrepreneurs; today, LT-KI founders are indeed faced with the challenge of figuring out what in their environment may "contain the potential new" (Keiser and Fordinal, 2010). Self-transcending knowledge can support actors "to see what does not yet exist" (Uotila and Melkas, 2008, p. 225).

> "Bill Gates is not so much a wizard of technology, but a wizard of precognition, of discerning the shape of the next game."
>
> Arthur (1996, p.5)

However, while this approach developed the forces that drive the creation and evolution of knowledge, it did not address the development of a bundle of structured capabilities to do so. The specific theory hasn't been used in KIE so far, or in the area of the entrepreneurial idea creation. Therefore although useful in shaping the nature of transcendental capability, it could not apply in TCs conceptualization.

In modern philosophy, Kant[122], in his theory of knowledge, introduced *transcendental* as a concept concerned with the *conditions of possibility of knowledge* itself, presenting ***a seminal approach of knowledge creation and transcendence:*** for Kant transcendental meant knowledge about our **cognitive faculty with regard to how objects are possible *a priori*.** Transcendental knowledge, a kind of *knowledge* which

[122] For a short CV of Immanuel Kant and a short description of the Critique of Pure Reason please refer to Appedix E

is both *synthetic* and *a priori*, defined the boundary between *empirical* knowledge and *speculation* about the transcendent realm. Kant further opposed the term *transcendental* to the term *transcendent i.e.* "that, which goes beyond" (transcends) any possible knowledge of a human being.

> "I call all knowledge *transcendental* if it is occupied, not with objects, **but with the way that we can possibly know objects even before we experience them**."
>
> (Critique of Pure Reason, A12)

Immanuel Kant and his theories have served as a basis of inspiration and a springboard of theory building in entrepreneurship, long before this thesis. Tyler Cowen (2003) reviews extensively similarities and draws parallels among Austrian economics and Kant's theories. The author presents significant resemblance between Kirzner's theory of the entrepreneur and Kant. Von Mises is associated almost exclusively with Kant's notion of the synthetic a priori in his *Critique of Pure Reason.* Shackle's "General Thought Schemes and the Economist" (reprinted in Shackle, 1990) has the general flavor of Kantian epistemology, with its emphasis on the need for mental schema, but does not cite Kant directly[123]. The author makes clear that the modern Austrian and Kantian stories do not allow for direct translation. However, the Kantian notion of genius bears some resemblances to the Austrian notion of entrepreneur.

> "In both cases individuals engage in creative activity of a kind that stands outside of traditional rule-governed behavior. Kant tries to show there is a form of knowledge distinct from the rules of science, just as Kirzner tries to illuminate a form of behavior distinct from optimizing search. Kant refers to those entrepreneurial abilities as "genius," which is the ability to create products that defy description by rules or formal conceptual schemes".
>
> *(Cowen, 2003, p. 11)*

Clarke and Holt (2010) employ Kant's concept of maturity to develop insight into entrepreneurial goals as socially embedded. Elaine Chou (2013) applied Kant's theory of knowledge to tech patent law claiming that Kantian distinction between creativity and property provides an essential component to solving the tech patent wars. Spender (1996) refers also to Kant in his effort to make knowledge the basis of a dynamic

[123] Shackle (1979:1) does, however, cite Descartes as an epistemological foundation for his work, as a background justification for his emphasis on Unknowledge

theory of the firm. Kogut and Zander (1996) drew upon Kant's views to explain the superiority of firms over markets due to the fact that groups of individuals develop firm-specific shared identities that support communication and coordination on the basis of firm-specific procedural norms. This argument was later described as "brilliant" by Verbeke (2003, p.498). Attempting to explore the signs of responsible behavior for Internet entrepreneurs Stevens (2010) engages a Kantian approach in order to build his framework of the different types of online behavior. John Mathews discusses in his "Resource-based view on Schumpeterian economic dynamics":

> "There is an uncanny resemblance between this Schumpeterian conception of economic dynamics and Kant's great theory of moral action; perhaps Kant was present in Schumpeter's mind as he was writing. Kant created a conception of a universe of causality in which scientific laws rule supreme, but in which new sources of causal chains can be created by acts of the will, i.e. a willed action by a human creates a chain of events whose links can be explained by science, but whose origin can only be accounted for in terms of moral values and free will. Schumpeter's analogue is the entrepreneur who creates a new "line of business" which redistributes resources in the circular flow, and which once it is up and running, is amenable to traditional economic analysis".
>
> *(Mathews, 2002, p. 85)*

Critique of Pure Reason (1781, 1787) is a complex Endeavour which involves probing the limits of human capacity for knowledge, reflection and action while in parallel revealing the underlying assumptions, conditions, values and beliefs which are implicit. In other words it is the uncovering of the basis of knowledge. Kant argues that there are two kinds of knowledge. While most knowledge is derived from experience, part of our knowledge is a priori, and not derived from experience.

In Kantian philosophy, transcendental knowledge is knowledge of how it is possible for us to experience a priori objects as objects. The core question of the study regards the relationship between knowledge and "things- in-themselves"; this resembles the research question on the relationship between knowledge and the LT-KI entrepreneurial idea creation. Following Vokos (2004), we accept his argument that: "Schematizing Kant's philosophy, it is quite evident that it can be reduced to a number of simple and thus difficult principles" since this perspective allowed for certain matches among attitudes and patterns observed in our case studies and the Critique of Pure Reason. More specifically:

The first Kantian principle regards the existence of the "thing-in-itself"; however this absolute reality (the "thing-in-itself") although familiar to someone is totally

unfamiliar regarding "what it is" and "how it is". In Kantian philosophy the "thing in itself" exists independently of the human beings, unfiltered by the forms of sense. By association, entrepreneurs of the research narrated of their high degree of certainty that novel ideas exist even in the saturated mature low-tech markets, their familiarity to their "absolute reality" thus the area they wanted to differentiate in, but in most times they did not actually know "what it was" and "how it was".

> "We had in mind to do something innovative which would regard massive catering. We had no idea what it would be" **(FCo3)**
> "We knew it had to be in the bakery industry. We wanted to find something that it would be innovative, but at the same time not too far from the known staff, something that would have the potential to develop, differentiate and to be produced at industrial level. You know, craft production and industrial production are two totally different issues." **(FCo9)**

The next significant principle regards the Kantian question "what we can know, and how we can know it[124]". Knowledge is mainly empiric and constitutes a resource of scattered senses. Actually we derive the greater part of our knowledge from observing the real world. This kind of knowledge is the knowledge of sense-perception. In a parallelism, LT-KI entrepreneurs ask the same questions; their knowledge resources are indeed selected in different areas such as education, former experience and so on which represent the "real world". They try to find "what they know" and "how they can know it".

The third principle regards the Kantian position that the act of cognition is not passive, but active. This is also observed in our cases. The act of knowledge creation entails a conscious selection of information, a careful classification, interpretation and combination.

For Kant experience starts inside the mind and it is not only created by the world outside. The knowledge we gain of the boundary line informs us about what Kant called the "transcendental" conditions for empirical knowledge. It requires "transcendental reflection" which in simple words means thinking about the ***necessary conditions*** for the possibility of experience (Palmquist, 1987). With the term *transcendental*, Kant refers to whatever proceeds, as a fact of experience, and constitutes a precondition of empiric knowledge. Experience (*Erfahrung*) is the conjunction of two elements: the sensual perception and the Intellect. "Thoughts

[124] This is one of the central questions of philosophy—the theory of knowledge or cognition ("epistemology").

without content are empty, intuitions without concepts are blind". According to Kant, something transcendental is something that must be true otherwise our experience itself would be impossible. Here one can realize how close Kant and Schumpeter are: "entrepreneurial success depends on 'intuition, the capacity of seeing things in a way which *afterwards* proves to be true, even though it cannot be established at the moment" (Schumpeter, 1934).

Kant states,

> "Although all our knowledge begins with experience, it does not follow that it arises from experience……Hitherto it has been assumed that all our knowledge must conform to objects. But all attempts to extend our knowledge of objects by establishing something in regard to them *a priori*, by means of concepts, have, on this assumption, ended in failure".
>
> (Bxvi)-Norman Kemp Smith, trans. (London: Blacmillan, 1929).

Following Kant's reflections, we transfer the general concept of knowledge and experience to the knowledge-intensive entrepreneurial arena within a low-tech context. In conventional low-tech entrepreneurship literature, it has been formerly assumed that all knowledge would conform to existing structures, i.e. new production technologies offered by manufacturers to cut down costs or improve quality or incremental innovation in the pursuit of optimization. Low-tech firms appeared as passive adopters of the innovation and technology created by high-tech industries engaging in "profit enhancing" or "survival facilitating" activities (Hirsch-Kreinsen, Jacobson and Robertson, 2005). Within the new LT-KIE context, new knowledge does not arise always from established conditions and low-tech firms are not simple adopters of supplier technology (Hirsch-Kreinsen and Schwinge, 2011; Caloghirou, Protogerou and Tsakanikas, 2013).

On the hypothesis, therefore, that there may be LT-KI concepts, having an "*a priori* reference to objects as acts of pure thought" (Kant, 1787), these are conceived as a priori; i.e. concepts which are created **just by thinking, without consulting how the world appears (**Thurow, 2007).

According to Kant, these *a priori*, or transcendental conditions, are "seated in one's cognitive faculties and based on the *form* of all possible experience". Attempting a parallelism, cognitive capabilities and extended experience enable the entrepreneurs structure their new "worlds". Kant here can be applied directly" ***Knowledge does not***

depend so much on the object of knowledge as on the capacity of the knower"[125] Revolutions seem to derive from changing the point of view; Copernicus rejected the view that the movement is in the stars and accepted it as being a part of the spectator. By reversing the point of view he explained the movement of celestial bodies revolutionizing astronomy. The essence of the "Copernecian turn", as Kant himself had termed it can also be found in the economy of David Ricardo one of the most influential classical economists. As Foucault (1996 [1966]) narrates, Ricardo's human production constitutes the denial of the scarcity in nature. Alvarez and Busenitz (2001) discussed the reverse of "a benign environment or emerging threats" for the majority to new opportunities. It has also been embraced by Senge (1990) who in his Fifth Discipline actually agrees that

> "New insights fail to get put into practice because they conflict with deeply held internal images of **how the world works** - images that **limit us to familiar ways of thinking and acting**[126]".
>
> *Peter Senge, The Fifth Discipline, p.174*

In his Critique of Pure Reason, Kant makes a subtle move from the question of *how we can cognize objects* to *How objects can become issues of our cognition.* In parallel, the present research moves from the question of *how LT entrepreneurs can cognize opportunities* to *how opportunities can become issues of LT-KI entrepreneurs' cognition.* In most of the cases, LT-KI entrepreneurs try to change established perceptions due to the low-tech strong path-dependencies (e.g. Hirsch-Kreinsen and Schwinge, 2011) or change the point of viewing them.

> "Veneer has to present a rough surface since it is a natural product." – this is how the world works. – **WCo1** rejected this view.
>
> "Rice is just rice. You can only try to package it in a more innovative way…" – this is how the world works – **FCo6** challenged it
>
> "The model is purely theoretic. Even theorists say that it cannot be applied. How can a small company make it work?" – This is the reality in clothing industry – **TCo5** rejected it.

[125] Chadwick, Ruth F.; Cazeaux, Clive (1992). *Immanuel Kant, Critical Assessments: Kant's Critique of Pure Reason*. Routledge. p. 43. ISBN 0-415-07411-8.

[126] Emphasis added

"Fashion is the ultimate change in apparel. I mean it is there, ready. What else to do?"- **TCo7** challenged it.

"There is not much to do with kitchen furniture. Especially, when you are not big enough to play with electronics or famous enough to play with design"- **WCo8** questioned it.

Cross-case analysis indicates that the ability to create and/or sense opportunities is clearly not uniformly distributed amongst the entrepreneurs, which is rather expected. They do not all possess knowledge, experience or other resources or have access to information at the same level, neither have they developed their knowledge-intensive business ideas in the same way. Furthermore, innovation does not always regard an invention, a patent or an R&D breakthrough. However, "The real voyage of discovery consists not in seeking new landscapes but in having new eyes (Proust). This is in line with existent literature on LT-KIE where traditional firms do not actually triumph with their breakthrough findings but with their ability to offer more options or create novel uses and new niches. Thus, all cases present the **knowledge-transcendence** core relation.

Regardless the level of innovativeness, most of the innovative LT-KI business concepts were results of *a priori* knowledge generation processes. This new knowledge seems to enlarge the sphere of an individual's / organization's judgments beyond the limits of their present experience. And it is in this very kind of knowledge which transcends the mature low-tech world, and where established practices can neither guide nor correct, that the Transcendental Capability enables investigations in a variety of fields- be them scientific or technical knowledge, technology, practice, design, models or of other types; these inquiries can be considered, by their importance, far more excellent and by their tendency far more elevated than anything common entrepreneurial practice can find in the sphere of common entrepreneurial phenomena. This is precisely the meaning of KIE in TLT sectors; unique knowledge, be it internal or external, is the most valuable asset of a firm for achieving competitive advantage (Liebeskind, 1996; Robertson and Smith, 2008).

In parallel with Kant's conception of the human mind as the active creator of the experience instead of being a passive of the sensory perception[127], LT-KIE is

[127] This is accepted as the most *authentic contribution* of Kant.

characterized by the active role of the actors instead of their passive role as plain technology users. Entrepreneurs have to act as "knowledge operators" working at the intersection between science, technology, innovation and markets utilizing existing knowledge to extend horizons and then seeking novel knowledge, combining the newly acquired knowledge assets and generating new knowledge. It really appears as a matter of mind. As Winston Churchill noted in a speech at Harvard in 1943, "The empires of the future are the empires of the mind." Even Teece (2011) accepts the fact that at least in medium-tech industries knowledge or mind processes drive the success of certain undertakings: "… in the petroleum industry, oil in a fundamental sense is "found" in the mind, not in the ground. Put differently, oil reserves are found using the knowledge empires of the major petroleum companies" (Teece, 2011, Dynamic Capabilities, a guide for managers).

Therefore, it seems that the knowledge-intensive business concept creation regards a process which is based on knowledge and a transcendental capacity of the entrepreneurs**. However, it does entail some processes and preconditions in order to be successful.** The cases indicated that within the chaotic knowledge system which seems to be far more complicated within the low-tech industries, actors need to develop a constant sensation of where they are and where they want to go. This task involves the thorough determination of their cognitive situation, the search for ways that lead to objective knowledge, the ability to receive and spontaneously react to the new input and synthesize it in order to create the novel concept.

A new iteration of the case studies revealed some further interesting parallelisms of patterned behaviours and practices of the entrepreneurs and the entrepreneurial teams with Kantian thoughts. More precisely, Kant contents also for individuals to experience meaningful development that they need consciousness of passing into a higher sphere of being, possess a deepened conviction and make sense of spaciousness (research from Sanders, Hoplins, & Geroy, 2003).

Furthermore, Kant describes the process of knowledge generation using the acts of receptivity and spontaneity, as well as judgment as significant individual capabilities. Such patterns, however, appeared in most of the cases as complex combinations of skills, abilities and informal processes based on former knowledge and experience as it will be discussed in the following paragraphs. Certain dimensions of them could be carefully planned before attempting the venture (as in the cases of WCO1, WCo2, WCo9, FCo6, TCo1, TCo2, TCo8) and can provide useful criteria for agents

regarding needed capabilities before LT-KI venturing in order to create innovative knowledge-intensive concepts. Thus, based on the above analysis of the nature of TCs and certain indications of specific and measurable dimensions, we propose that

Proposition 3: Transcendental capabilities constitute a novel distinct type of dynamic entrepreneurial capabilities in LT-KIE in order to describe the genesis of challenging concepts by mismatches of common and transcendent ideas.

7.2.d.2) Dimensions of Transcendental Capability

Transcendental conditions[128]*:* In traditional sectors markets seem saturated and radical, breakthrough innovation is not easy. Globalization and trade liberalization within a rather fluid and unfavorable ever-changing context make "new horizons and contents" (Faltin, 1999) in traditional business landscapes sound a utopia, while most entrepreneurs tend to protect themselves from emerging threads and changes. On the other hand, starting a new venture – especially in the new-to-the-world cases - the agents attempt to get out of the conventional business, usually bearing a picture of the traditional sectoral paths which revolve mainly around domestic markets and certain knowledge patterns. "To be open and free is to be exposed and vulnerable. Open space has no trodden paths and signposts. It has no fixed pattern of established meanings; it is like a blank sheet on which meaning may be imposed" (Tuan, 1977). Common low-tech efforts turn around low price strategies, faster deliveries for bulky products (e.g. furniture – a last bastion that fell after IKEA's smart idea), upgrade of technologies and uses of ICT or locality privileges (e.g. fresh milk and feta cheese). Most times, at the founding process space is limited to the agents' experience and knowledge. Thus, **for start-ups, environment is actually unknown, hostile and sometimes difficult to interpret or try to change.**

> "In general, low-tech entrepreneurs won't get off the beaten track easily due to ignorance and fear. They keep on with feta and oil. "Business as usual" is still the prevailing watchword!"
>
> ***FCo1****'s entrepreneur*

[128] The term is used by Kant only two times (in A106 and A107) in order to denote the transcendental self-awareness. According to Kant the transcendental condition is necessary in order to be able to produce thoughts of the objects of our intuitions. It is reminded that most Kantian terms are used as an inspiration to depart and explain the KIE phenomenon. Therefore, for the present thesis Transcendental Conditions are necessary to be able to produce insight for the concept and the content of our innovative idea.

Cross-case analysis revealed the existence of a constant sensation of where the agents were and where they wanted to go; the stronger the cases, the more challenging the novelty entrepreneurs were seeking for (please see Table A10, Appendix A). It seemed that actors could envisage conditions of business possibilities outside of their domestic markets in order to develop strong competitive advantages. In most cases LT-KIE was confronted at global level, while innovation was considered the very "specific function" (Drucker, 1985) of KIE, involving strong efforts to apply knowledge from different functional areas, not known or anticipated from the very beginning of the idea creation (Table A2, Appendix A). This was named ***sense of spaciousness***[129] **actually describing the conscious excess of the limited 'known' because of the existence of the unlimited 'unknown'.** The cultivation of such sense stimulates forward-looking thinking, creates opportunities and shapes visions. It is a precondition of possibility for entrepreneurs to become aware of the existence of empty "spaces" and fill these discovered, empty but unknown spaces through knowledge-based innovation; this is a significant differentiation from others who regard space as "a determination of existing phenomena".

"Spacious" in the American Heritage Dictionary is defined as "providing or having much space or room." In fact, space can be a very complicated and confusing concept precisely because, at first glance, it appear so obvious and commonsense (Bill, Bjerke and Johansson, 2010). Space has been called a 'room for activities' (Massey, 1995) and an 'arena' (Berglund and Johansson, 2008). For De Certeau, space is what is created by practice (Cresswell, 2004). To Kant, space was situated in the subjectivity of the human mind (Casey, 1997). Space is the situation of enterprise (Johnstone and Lionais, 2004). According to Bjerke (in Bill et al., 2010) spaces "Are valued predominantly through the lens of production and consumption based on supply and demand, use of factors of production and operations on markets".

On the other hand, ***speciousness*** regards the intellectual enlargement (Exodus, 3,8 in Tuan, 1977) and implies freedom, or otherwise, enough room to act (Tuan, 1977).

> "Spaciousness is closely associated with the sense of being free. Freedom implies space; it means having the power and enough room in which to act. Being free has several levels of meaning. Fundamental is the ability to transcend the present condition, and this transcendence is the elementary

[129] Inspired by Kant (1781) : "…one might very well imagine that there should be space without object to fill it. Space is therefore regarded as a condition of the possibility of phenomena, not as a determination produced by them". (Kant, transl. by Mueller, 1922, p50)

> power to move. In the act of moving, space and its attributes are directly experienced. An immobile person will have difficulty mastering even primitive ideas of abstract space, for such ideas develop out of movement—out of the direct experiencing of space through movement…… **When the Paleolithic hunter drops his hand ax and picks up a bow and arrow, he takes a step forward in overcoming space and yet space expands before him** *(bold added):* things once beyond his physical reach and mental horizon now form a part of his world".
>
> *Yi-Fu Tuan, 1977, 8th ed., 2001, p.52-53*

Spaciousness and crowding are antithetical feelings. **Thus, although traditional markets are usually considered as "crowded", the sense of spaciousness allows for these markets to generate opportunities instead of imposing limitations.** Kant says "space is essentially one; however, the general concept of spaces arises entirely from limitations". In this vein, we suggest that while mature markets are difficult to change (in contrast to high-tech ones), niche markets and new sub-markets arise mainly from limitations set by new rules and novel concepts created by entrepreneurs, such as

- ***Stricter quality standards or new translation of quality*** for the cases WCo1, WCo2, WCo6, WCo9, FCo3, FCo6, FCo8, TCo1, TCo3, TCo4.
- ***New market segmentations*** such as, innovative products focusing on ecology: WCo4, WCo7, WCo10, TCo6; novel uses of innovative novel material: WCo5, WCo9, TCo2, TCo7; novel food trends (at various directions): FCo1, FCo4, FCo5, FCo7, FCo8, FCo9; FCo10;
- ***New rules in production or other functions of the firm, raising established limitations*** such as WCo3, WCo8, FCo2, TCo3, TCo5, TCo8, TCo9

The width and the quality of resources required, sources to seek, mismatches and combinations to make are then defined by spaciousness which then becomes the driving force for bricolage.

> Among the major weaknesses of **WCo5 and FCo2** was the limited cognition of space. Both interviewees exposed their impotence to widen ranges and scopes while trying to create new opportunities; lack of scientific knowledge, reluctance and fear to get out of national borders or pay for further research were some of the weak points mentioned.

On the contrary, the majority of the interviewed entrepreneurs would see *entrepreneurial space (without entrepreneurial activities) to fill it*. Globalization for example has been treated as a menace by many low-tech entrepreneurs[130]; however, it was regarded as the opportunity to set out to be global from the very inception for many of the questioned ones (e.g. WCo1, WCo2, WCo6, WCo10, FCo1, FCo5, FCo6, FCo9; FCo10; all TC cases). The cases indicate that the sense of spaciousness is the dimension that poses a beginning, a potential and a capacity for creativity. After all, according to Faltin (2001), the piece of utopia is necessary for entrepreneurs to translate innovative ideas into real options.

Furthermore, **the sense of spaciousness is also valuable for knowledge to be created** (Nonaka, 1998). This kind of spaciousness resembles Nonaka's *ba* (which means roughly place); ba is a phenomenological space where knowledge, as 'a stream of meaning' emerges (Nonaka and Toyama, 2003). Ba provides the places together with the energy and quality for the knowledge conversions, since knowledge is created in situated action (Suchman, 1987). Accordingly, a sense of spaciousness can provide the necessary foundations for the development of ***"know how to know"*** (Kant) providing the space where information will be given specific meaning, it will be interpreted and will turn to novel knowledge through existing knowledge. This sense of spaciousness can afterwards lead to a joint venture with a supplier, an alliance with a competitor, or an interactive relationship with customers, universities, local communities, or the government (Nonaka and Toyama, 2003); thus it can drive the bricolage and improvisational capabilities. Sense of spaciousness regarding knowledge can be even regarded as the criterion for the agents to find out whether they "know" or they "do not know" and this according to Confucius is actually knowledge.[131]

The sense of spaciousness can be thought as purely entrepreneurial; it seems to regard the openness of the entrepreneurs to novelty depending on their attitudes, experiences, knowledge as well as the level of search they do for novel ideas such as the areas (sectors, sciences, perspectives) they search, the agents they envelop, the markets they

[130] Please refer to the sectoral reviews

[131] When you know, to know that you know, and when you do not know, to know that you do not know, that is knowledge. (Confucius, Analects)

explore, mechanisms and channels they use, networks they build and visions they develop in order to build subjective expectations of an unknowable future.

Still, the ability to realize intra-industry space in saturated markets seems to be strongly dependant on the ability to view global markets ***in a panoramic way*** being in the position to estimate value chains, intra- and inter-sectoral industry potential. Therefore, it seems that *a kind of awareness* is necessary which, however, is not limited in the individual as the Kantian "self-awareness" but covers the broader area of business ecosystems. For Kant, the transcendental self-awareness

> "makes it possible for us to have representations of objects, [otherwise] we couldn't have any knowledge at all. . . . . It merits the label 'transcendental' because. . . .it is the a priori basis for all concepts". [107]

For the LT-KI entrepreneurs the kind of awareness should make it possible to gain "representations" thus information and data on their areas of interest in order to create the necessary knowledge (otherwise they would have no knowledge at all). According **to Scharmer (2009) "ecosystem awareness" denotes the ability to perceive a problem from all of the perspectives in a given social-ecological system, internalizing the concerns and issues of the other players**. Moreover, according to Nonaka and Toyama (2003), ba is connected to *higher viewpoints* and a need to look at things from outside. Thus, sense of spaciousness seems to be related to an ability of viewing a given phenomenon from various points simultaneously.

Most of the entrepreneurs of the cases admitted long periods of intentional time-and-money consuming search and questioning, to develop this ability of obtaining a broad awareness at least of their sector at national and global level.

> "As a client I tried to visit all relevant plants of the planet! I needed to know everything. It took me **about a decade** to create and realize my vision" (**WCo2**).
>
> "After the first idea we travelled a lot, we visited trade shows all over the world, we cross-checked the innovativeness of our idea not only in the trade shows and internet but we visited in person big super market chains and local markets. You see if we found something similar it could not be a radical innovation. Falling on the gluten-free property of the first pilot products (improvisation) we turned our efforts towards this direction. This meant further searching in this new area……..
>
> Entrepreneurs should search abroad. Such experience is far more beneficial since it contributes to the development of novel entrepreneurial culture and opens up new and enticing horizons. A good deal more would it help if the agent is a technocrat and has developed some strong links abroad; studies or

other business maybe? I strongly believe that this should be supported by some national strategy" **(FCo9)**

"I have known him since 1985; then he owned a very small craft business. But he was in love with jeans. He wanted to excel. He would go many times in Italy (the mother of jeans fashion) and search for knowledge. He would visit denim producers and look for differentiation. He wanted to be similar to Levis. Jeans was all his life. He learned it step by step. …… At first we were working with Greek companies. Then we turned to Italians since they could engage us in the world of fashion. He became good friend with the CEO and he opened the way to Italian producers. We were very strong customers then… If you are that strong they help you with knowledge and ideas and help you make new contacts" (CEO of **TCo7**)

Accordingly, the entrepreneurs seem to try to define the sectoral potential and at the same time develop a capability to recognize triggers, information and knowledge for LT-KI raw ideas transcending their sectoral ecosystem. We named this capability as *panoramic ecosystem awareness (PEA)* combining the Kantian "transcendental self-awareness" with Scharmer's "ecosystem awareness" in order to underline the importance of the "bird's view". A close concept is Ray and Cardozo's (1996) "entrepreneurial awareness"; the authors defined it as ''a propensity to notice and be sensitive to information about objects, incidents, and patterns of behavior in the environment, with special sensitivity to maker and user problems, unmet needs and interests, and novel combinations of resources'' However, this "propensity" is a general one, applying to "any recognition of opportunity" missing the quite significant bipolar factor of sectoral-panoramic view as well as the link between awareness and knowledge (as expressed by the Kantian view). Furthermore, PEA creates the conditions for the identification of opportunities and can drive choice of information, but - according to our findings - it is not the main ability to create specific opportunities. Thus, our approach comes to agree more with Gaglio (2004); the author relates this ability with the need of recognizing the context or framework that indicates the rules of the game (causal chain), the appropriate resources (means), and the index of value (ends). Commenting on this paper, Aviram (2010) argues that in real life, this framework is in constant flux due to numerous regulatory, economic, social, and technological changes. Besides Aviram (2010), who makes a clear distinction between awareness and alertness, the above authors connect the meaning of awareness to the Kirznerian *alertness*; the term was first used by Kirzner (1973) to explain the entrepreneurial recognition of opportunities. However, Kirznerian entrepreneurship promotes changes within *an existing situation* by discovering

profitable discrepancies, gaps and mismatches (Cheah, 1990) while LT-KIE brings into existence novel knowledge-based opportunities by cognitive processes, creating actually *new* (and not existing) situations through discovering, combining and acting. Thus, PEA can direct attention, guide choice of information and ways of processing it as well as evaluate the specific situation requirements. Developing PEA, entrepreneurs see connections among different input and translate information in novel ways so that their outcomes can be shared and inspire new ways of thinking. It should be made clear that there is really *no top to conquer*. In most examined cases a conscious acceptance of spaciousness, an almost systematic creation of a broader view of the entrepreneurial landscape and a will and a plan to achieve widespread experience and knowledge were observed. Inspirations seem to come from complex data retrieved by multiple sources and alternative directions and surpass the mere defensive attitudes of survival through common strategies (e.g. FCo5, TCo7). Actually PEA launches the interaction with the environment; actors want to acknowledge the environment and reshape it through knowledge creation (Nonaka et al., 2001).

FCo10 is a corporate LT-KI case of strong and continuous development of panoramic ecosystem awareness. Six years before corporate venturing, a "cosmopolitan" an "a man of the world" with a strong educational background and some entrepreneurial experience started cultivating PEA at global level on traditional Greek agri-food after the relevant advice of an old lady in London:

> "a guru of its field,… (i.e food sector). She was commenting on the wealth of the Greek land and the inherent high quality and good taste of Greek agri-food products contrasting to their absence from international markets. She gave me that idea… although I had nothing to do with the industry… I have a background of law and maritime studies and my MBA is on financial law. You see, I was indented to follow a political career…"

The entrepreneur came to acknowledge the whole value chain and all necessary mechanisms to develop the initial idea. Then he started seeking reasons and ways in global markets to transform traditional Greek products such as olives and oil into gourmet delights and managed to do so.

FCo10 earned soon a strong positioning in foreign markets due to innovative promotion methods, concepts and awards. This advanced gradually PEA through sensing and seizing processes. The entrepreneur travels a lot, and can foresee new niches since he is the one to direct the new born market.

> Six years later the entrepreneur attempts LT-KI corporate venturing. He has captured the need to turn to innovating enveloping technology as well since competition becomes intense. Now, PEA is advanced and deliberately extended to new areas. Having a panoramic view of the industry, the value chain, the markets, packaging and a strong marketing network, he turned to knowledge-based innovation seeking knowledge in the areas of environmental issues, technological innovation, in combination with design and novel marketing. Spaciousness refers now both to markets (as before) and entrepreneurial activities as well as to the range of the company's enveloping due to the benefits of technology, ecology and globalization.
>
> Today, FCo10's extra virgin olive oil's superior quality, the first worldwide to be certified Carbon Neutra is well appreciated by the international trade and its gourmet products enjoy a high reputation though the innovative promotion and marketing. This is the reason why FCo10's exports to all markets are constantly increasing at a fast pace.

The entrepreneur of FCo10 developed PEA, thus the ability to have a panoramic view of the related business ecosystems, global markets and inter-sectoral industry potential. He acknowledged the environment, interacted with it and changed it creating a new niche market. The new venture turned to a low-tech but knowledge-intensive firm, based on principles of innovation. **Conventional entrepreneurial attitude would have created another olive and olive-oil packing factory.**

PEA regards mainly the level of acknowledgment of the inter-sectoral business ecosystem view (starting with the specific industry and expanding to areas defined by the actors) and the level of perception of changes. Prior knowledge and previous experiences and successes, existing strong networks or a strong starting knowledge pool can assist PEA's development. This is in line with Shane (2000) who postulated that entrepreneurs will discover opportunities because prior knowledge triggers recognition of the value of the new information. Actors usually travel a lot to collect experiences, information and data. "Today's entrepreneurs, by definition, have to look at the entire globe as their arena," says Derek Goodwin, head of the Global Entrepreneur Program at UK Trade and Investment.

WCo1, a really micro-company, had made West Europe a wide "neighborhood": Germany and Austria for machinery and technology, Spain and Italy for raw materials and design.

WCo2 travels all over the world to collect pieces of knowledge and technology.

WCo10, FC01, FCo10, TCo6, TCo9, TCo10 admit that they have traveled a lot, met people, exchanged knowledge.

The entrepreneur of **FCo6**, holding a diploma in philosophy but raised in a traditional cheese-making family, visits Cretan farms and cheese producers, meats USA cheese makers and exchanges knowledge and experience with French gourmet producers.

According to our cases the development of PEA needs either **time** (in the case of WCo2 it took almost 10 years) which is evident in most of our corporate venture cases, or can be developed **due to pressures** as in many of the cases; for example WCo1, WCo4, WCo9, FCo3 and TCo2 . However, this is not strange, since "pressure makes us notice of space" (Tuan, 1977).

In many of the cases PEA seems to be further related to the existence of entrepreneurial milieu, which is in line with the general acceptance that the children of entrepreneurs have a much greater chance of becoming entrepreneurs themselves (Aviram, 2010; Anderson et al, 2005; Dyer and Handler, 1994; Heck et al, 2006). On the other hand, the ability of entrepreneurs to learn from previous business ownership experiences can also influence PEA.

Thus, potential LT-KI entrepreneurs need to purposefully develop panoramic ecosystem awareness before concept-building. A limited picture of the sector which revolves around local markets and certain knowledge limits seems to affect negatively LT-KI venturing.

As already discussed, in traditional industries there are core rigidities in both innovating activities and market penetration. Unlike the high-tech sectors, low-tech innovation does not necessary relate with economic success. For example, within the food and drinks manufacturing sector, innovations such as functional or even medicinal food need to conform with strict laws and regulations making their development even more expensive and introducing an element of future uncertainty

about their approval and marketing success which can cause some firms to refrain from investing in such developments (Leis, Gijsbers and van der Zee, 2011)[132].
LT-KI Entrepreneurs have to anticipate that their ideas will be accepted by markets; otherwise the new ventures will result in early death. Sense of spaciousness and PEA create the transcendental conditions that entrepreneurs need to have developed **before** the opportunity creation. They create a need for the actors to turn to themselves and through this internal fall back to search for knowledge (Kant). This is in line with Richard Rumelt who noted in a conversation that "…if a firm looks inside itself, and at its market environment, sooner or later it will find a business opportunity"

Transcendental synthesis (TS): Kant considers that knowledge is not possible without a concept, however obscure or imperfect it may be, and a concept is always, with regard to its form, something general, something that can serve as a rule. In accordance, we suggest that knowledge creation starts becoming meaningful when an initial concept, no matter how general, obscure and imperfect may be, is formed in the mind of the potential LT-KI entrepreneur. Thus actors are not alert to meet opportunities but due to PEA and spaciousness, they have already identified areas of interest or otherwise their ***"objectives"*** (the Kantian term).
The case study analysis indicated at least two senses of "objectives": **The first characterizes acquiesces that are grounded on experiences and/or other established assents** (e.g. existence of technologies, raw material, established trends etc) that are, in turn, evidentially connected *to the objective* in question. In these cases the business concept formation was based manly on "combinative" knowledge or the original combination of different "specialized knowledge". Therefore, actors would search for information, technology, data, stimuli, tacit and codified knowledge in quite known areas in order to develop PEA, Then bricolage and improvisational capabilities would support transcendental synthesis providing the framework of an iterative process of experimentation of failure and success. It relates to the quote of Cappellin and Wink, (2009) *"the combination of the three basic colours: red, green and blue, creates all other colours, thus the pre-existing pieces of knowledge, whether combined in an original way, give origin to new knowledge*" and regards most of the cases of corporate venturing, as well as several new-to-the-world cases. (e.g. FCo7,

[132] For more please refer to the relevant chapter

WCo8, FCo1). It actually regards the majority of the cases but this was rather expected since we refer to low-tech industries.

The second sense of "objective" is much broader: it applies to any "inter-subjectively "communicable" assent" (Kant)—that is, any assent that is rationally acceptable by the entrepreneurial team **but usually not initially accepted by the interacting environment**.

> In the case of **FCo2** the idea although acceptable by the entrepreneurs was initially rejected by the funding authorities and by the scientific community as "non –applicable at practical level due to many unknown parameters"
>
> "Even my partner called me crazy to waste money in zips" (**WCo10)**
> "We were searching for something globally innovative but within the bakery industry…..Cheese made products– too vague and on the other hand, how could one detect the difference? Yet, we were sure about our ideas' excellence" (**FCo9)**
> "What Mr A has is that once he believes in some new idea, he will invest and be involved and will stay firm even when obstacles appear" **(WCo9).**

These cases presented more radical but more vague and raw ideas; although exciting, they cannot establish areas of interest from the very beginning, and they cannot easily define markets or even final products and processes. In these cases actors define **areas of interest** during the iteration process of transcendental synthesis while many times they even change directions marginally (e.g. WCo1) or even follow completely novel ways (e.g. FCo4, FCo5). PEA then is more difficult while TS becomes more complicated and in need of enhanced bricolage and improvisational capabilities.

In both categories it is transcendental synthesis that will integrate the multiple indications, intuitions, concepts and ideas in order to form the novel but initially vague idea; this will initiate the creation of the new LT-KI business opportunity. **TS is perhaps the most creative if not the most important dimension of transcendental capability and the one most related to Kant's way of thinking.**

Therefore, once again, it was Kant's Critique of Pure Reason that guided the translation of patterns, acts and attitudes observed within the cases to the specific capability dimension. In all cases, it was clear that inspirations would come from complex data, retrieved by multiple sources and alternative directions surpassing the mere defensive attitudes of common low-tech strategies. Entrepreneurs of the sample admitted to have started out of domestic and sectoral limits, which are quite unusual

for traditional industries, at least within the Greek context. They further recognized connections among different input and translated data and information in novel ways so that their outcomes could inspire new ways of thinking.

Grouping the above actions, we could form three main processes during the idea formation: the process of ***receiving data and stimuli***, ***a spontaneous reaction***, and a ***repetitive action of judgment***. However, these are quite the faculties described by Kant in his effort to answer his core question on what we can know and how we can know it.

> "General logic, as we have often said, takes no account of the contents of our knowledge, but expects that representations will come from elsewhere in order to be turned into concepts by an analytical process.
> Transcendental logic, on the contrary, has before it the manifold contents of sensibility *a priori,* supplied by transcendental [p. 77] æsthetic as the material for the concepts of the pure understanding, without which those concepts would be without any contents, therefore entirely empty. It is true that space and time contain what is manifold in the pure intuition *a priori,* but they belong also to the conditions of the **receptivity**[133] of our mind under which alone it can receive representations of objects, and which therefore must affect the concepts of them also. The **spontaneity** of our thought requires that what is manifold in the pure intuition should first be in **a certain way examined**, **received, and connected, in order to produce a knowledge of it.**
> **This act I call *synthesis*.**
>
> In its most general sense, I understand by synthesis the act of arranging different representations together and of comprehending what is manifold in them under one form of knowledge. Such a synthesis is pure, if the manifold is not given empirically, what is manifold (whether given empirically or *a priori*). That knowledge may at first be crude and confused and in need of analysis, but it is synthesis which really collects the elements of knowledge, and unites them to a certain extent. It is therefore the first thing which we [p. 78] have to consider, if we want to form an opinion on the first origin of our knowledge.
> We shall see hereafter that synthesis in general is the mere result of what I call the faculty of imagination"

Kant, Critique of pure reason, transl. Meiklejohn,1905, p.75

[133] Bold added

Taking into account his own assurance that Critique of pure reason is "ultimately a book on method" (B xxii), we made the parallelisms that drove the development of TS as a conceptualized capability dimension.

According to Kant, some active power we own, can both structure the particular features of an intuition to match an existing concept and modify or create the concept necessary to match the intuition. Kant calls this power the imagination.

> "Imagination is the faculty of representing an object even without its presence in intuition" [p106][134]
> "But the figurative synthesis [*of the manifold*], when it has relation only to the originally synthetical unity of apperception, that is to the transcendental unity cogitated in the categories, must, to be distinguished from the purely intellectual conjunction, be entitled the transcendental synthesis of imagination". [p106].

Kant calls the synthesis of the manifold in imagination transcendental, if, without reference to the difference of intuitions, it affects only the *a priori* conjunction of the manifold. Thus, imagination becomes the ultimate source of synthesis or, as Einstein put it "Imagination is more important than knowledge. For knowledge is limited to all we now know and understand, while imagination embraces the entire world, and all there ever will be to know and understand."

In parallel complex conjunctions of different data - information - knowledge manifolds with "prior to experience" results are characteristic for knowledge-intensive innovations in medium tech (Cappellin and Wink, 2009) and low-tech cases (Hirsch-Kreinsen and Schwinge, 2011; Hirsch-Kreisen, 2008; Jensen, 2007) in order to produce novelty. Otherwise, outcomes will be imitations, reproductions or mere improvements and upgrading. "Science-driven knowledge in high tech sectors on the other hand advances through the marginal extension of the existing analytical or abstract knowledge base and through logic or mathematical thinking and it is leading to discoveries characterized by a more general applicability to different problems in various productions" (Cappellin and Wink, 2009) .

Especially in cases of new venturing experience comes in a fragmented way. Information comes without obvious links. Behind creative experience there are *a priori* elements to be found that form the unity of the received experience. Successful

[134] These pages refer to *The Critique of Pure Reason* by Immanuel Kant, trans. J. M. D. Meiklejohn,1905, The Electronic Classics Series, Jim Manis, Editor, PSU-Hazleton, Hazleton, PA 18202

LT-KI entrepreneurs are keen to recognize these *a priori* elements and work on that basis. All knowledge does not come from experience although they use the support of its media in order to form the opportunity and produce the innovative output.

The dimension of TS actually rules and harnesses the act of unifying and combining the manifold information, data and stimuli into one idea which will be further developed into a knowledge-intensive innovative business concept. No matter how preconscious and well structured or tacit it may be, each synthetic act of processing information is not merely an operation of converting raw elements of information into higher level, newly ordered complexes of knowledge. Within Transcendental Capability it's an act of intelligent unification which triggers bricolage and improvisation in order to realize the initial "entrepreneurs' subjective acts of the imagination" (Chiles et al., 2009).

Synthesis plays an essential role in knowledge by allowing the agents' *a priori* knowledge (knowledge independent of experience) to enter into concepts and providing them with contents that they would otherwise lack. It seems that without synthesis, novelty is quite difficult to be thought of or known within the context of low-tech KIE. Once again the knowledge-intensive result does not depend so much on the object of knowledge as on the capacity of the knower. It is also a product of a far more complex process than just a combination of knowledge bases (as described in Kogut and Zander, 1992; Hirsch-Kreisen, 2008). A business concept has its basis then *on the a priori knowledge power* of the entrepreneur/s or the organization which is nourished by the transcendental synthesis. The term transcendental denotes the fact that its outcome, i.e. the formed concept, entails a kind of knowledge which is both *synthetic* and *a priori* (as discussed above), defining the boundaries between *empirical* knowledge and *speculation*[135] (hypothesis) about the innovative/creative realm.

The above suggestions do not contradict current entrepreneurship theory; As indicated by Loasby (2003), the actual generation of new ideas is necessarily tacit and what has not been thought cannot yet be codified. New ideas always develop at the frontier of different established knowledge fields, which are extended into new directions (Loasby, 2003). For Ihrig et al (2006) the conception of a new venture idea

[135] Based on Kant (1781) as mentioned above

resembles “a more exogenous thinking – the agent based on prior knowledge comes up with an idea that might result in an opportunity, which, theoretically, other potential entrepreneurs could also have conceived”. They suggest that it is not the opportunity but rather the idea that is out there waiting to be discovered. Shackle and Lachmann being both deeply committed to radical subjectivism, embraced this view (in Chiles et al., 2009). Shackle developed an alternative approach rooted in imagining novel possibilities with the potential to surprise and Lachmann borrowed and incorporated the basic idea of imaginative choice in the notion of plan. By doing so, Lachmann fundamentally reinterpreted human action as oriented to plans based on an entrepreneur’s subjective expectations of the future (Vaughn, 1994 in Chiles et al., 2009).

Todd et al. (2013) postulate that genuine entrepreneurial choices are due to entrepreneurs’ subjective expectations of an imagined future and can themselves “create and continually recreate opportunities through such imaginative acts”. Cappellin and Wink (2009) argue on the significance of imagination and pattern making which allow the establishment of connections between pieces of information and knowledge: “It is the result of a process of selection, association and simplification (“pattern making”) that allows to combine different and complementary information, technology and knowledge borrowed from various sectors, disciplines and regions in the solution of a specific problem, which stimulates action and which usually requires the joint contribution of various actors interested to it”. Nonaka and Toyama (2003) see synthesis as the integration of opposing aspects through a dynamic process of dialogue and practice; knowledge creation goes through seemingly antithetical concepts such as order and chaos, micro and macro, part and whole, mind and body, tacit and explicit, and creativity and efficiency. Vesper (1993) claimed that “Idea creation can be approached deliberately and systematically”.

In terms of LT- KIE, the above aspect seems to be true. LT-KIE ideas entail creativity and their creation process can be approached. Furthermore, it becomes evident that it is not the opportunities that are exploited (by the ones that saw them first or even managed to see them) but the **very venture ideas that are created.** Knowledge mechanisms that result to innovative products / processes (or concepts in a more general approach) are aroused by incentives which either lead directly to the concept genesis or activate the mechanisms of assessment, comparison, combination, separation and further elaboration of the amorphous collected knowledge mass in

order to produce a novel concept which is a new experience (a priori). Processes of codification and conceptualization refine them and make them fit in specific contexts. Consequently, it is not a mere matter of luck or "God-given charisma" (although according to our opinion, they both share a part of a firm's success).

Transcendental Synthesis appears to affect the quality and quantity of these innovations, shaping both existing capabilities for competitive advantage and entrepreneurial opportunities (Ireland et al., 2003). Cases indicated that TS can be **productive** or **reproductive** (Table A11, Appendix A), that is either exhibiting and producing an original concept prior to experience (*exhibitio originaria*) (e.g. FCo5, FCo9) referring to radical innovations, or producing it on a derivative way by bringing back an empirical intuitive business idea (*exhibitio derivata*) and then we refer to adaptive or relevant types of innovation (e.g. TCo6, FCo7, WCo10). Thus, as mentioned above, the first type of TS regards the broader sense of "objective"; the "inter-subjectively "communicable" assent" (Kant)—that is, any assent that is rationally acceptable by the entrepreneurial team but not initially accepted by the interacting environment. The second type corresponds to the first simpler type of "objective" which resembles Faltin's (2001) proposed technique for the creation of innovative entrepreneurial ideas: discovery - by means of seeing a new potential in - "something existing" by making new combinations and (re)integrating functions.
It should be mentioned once again that the terms productive and reproductive once again belong to Kant used not in direct translation however.

> "The imagination (*facultas imaginandi*), as a power to intuit even when the object is not present is either *productive* or *reproductive*. As productive, it is a power of original exhibition of the object (*exhibitio originaria*), and hence of an exhibition that precedes experience. As reproductive, it is a power of derivative exhibition (*exhibitio derivativa*), an exhibition that brings back to the mind an empirical intuition we have had before".
>
> (Quoted in *Critique of Judgment*, 91n)

Transcendental synthesis entails bottom-up and up-down information processing capabilities, depending on the cognitive properties and perceptions of the agents, their knowledge on ways to locate, retrieve and store data, their mechanisms to process them as valuable information and combine them with relevant resources in order to prepare the manifold. While transcendental conditions provide a structured coordination of getting to know the external environment (micro and macro

environment, industries and markets) and work on the internal environment of the entrepreneurial team or the company (cognitive properties, capabilities, resources etc), TS enables the creative receipt and exploitation of all input.

Conceptually, it is suggested to be a higher-order capability underlying its dimensions, in which each dimension defines a specific domain of its content (Law et al., 1998). Case study analysis indicated the following dimensions: ***Receptivity, i.e.*** an ability of receiving data, ***spontaneity*** i.e. the ability of shaping a concept through these data and thus a capacity for creative mental activity and ***judgment***, i.e. the competency of questioning and deciding on choices, alternative and idea elements' formation (Table A11, Appendix A).

For Kant, **receptivity** is the faculty of receiving representations:

> "Since, then, the receptivity of the subject, its capacity to be affected by object, must necessarily precede all intuitions of these objects, it can readily be understood how the form of all appearances can be given prior to all actual perceptions, and so exist in the mind *a priori*" (47/ A26/B42).

Thus, in our research receptivity involves the "capacity to be affected by data" namely the "capacity for receiving data". It regards the ways and processes used of sensing, retrieving and storing data and information, their mechanisms to process them and combine them with relevant resources in order to prepare the manifold. By itself receptivity yields **only** "the manifold of data". In accordance with literature, receptivity was found to regard openness to ideas (Sinkula et al., 1997; Wang et al., 2008) and external stimuli, as well as sensitivity to internal signs and stimuli in cases of corporate venturing. In this second case, signs can come from the external sectoral environment (as in most of the textile and clothing cases) or even from the firm itself as in the case of

> **WCo6**: messages sent by their own production e.g. the weakness of the plywood production system, a need for more control of raw material and efficiency improvement were creatively combined to external messages of the need of new strategy and the weaknesses of the Greek market together with the development of new technologies which offered the potential to create new needs for novel characteristics, uses and more complementarities.

However,

> "This faculty (receptivity) of receiving representations (Vorstellungen) can make knowledge possible only when combined with spontaneity". (62)

For Kant, **spontaneity** is the power of knowing an object by the received representations (due to receptivity). It is the theoretical aspect of freedom, and a close analogue to its practical aspect of autonomy. As in Kant's general discussion of freedom, spontaneity combines the two properties of ***freedom from external determination and freedom to self-legislate.*** Spontaneity bears a similar role in improvisation theory (e.g. Vera and Crossan, 2004).

> *It [spontaneity] creates an explosion that for the moment frees us from handed-down frames of reference, memory choked with old facts and information and undigested theories and techniques of other people's findings. Spontaneity is the moment of personal freedom when we are faced with reality, and see it, explore it and act accordingly. In this reality the bits and pieces of ourselves function as an organic whole. It is the time of discovery, of experiencing, of creative expression.*
>
> **Viola Spolin** (November 7, 1906 — November 22, 1994),
> an important innovator of the American theater in the 20th century

The function of spontaneity is to combine the manifold (result of receptivity) or to synthesize it in the production of experience. Thus, spontaneity is the power of turning this manifold in conjunction with opportunities and initial vague visions and raw ideas into specific business concepts.

This entails mostly informal (but can also be formal mainly in cases of corporate venturing) mechanisms and processes of acceptance or rejection of the manifold its reproduction within the context of the future venture (adaptations, extensions, new requirements e.g.) and its recognition in a form of a better structured business idea.

Receptivity and spontaneity become sharper in relation to prior knowledge and experience (Nieminen, 2005).

> Thus, in the above case (**WCo6)** knowledge and long experience on *okume* wood, plywood processes, conventional technology and market supported the spontaneous creation of novel strategy formation regarding ***value adding though innovation (the first raw idea for company reformation).*** Receptivity yielded the manifold of internal and external data and together with spontaneity produced the initially vague idea of a total restructuring. This would be based on the creation of new strategy based on innovation, quality-

based niche market creation and NPD in order to strengthen its presence abroad.

Quotes of Cappellin and Wink, (2009) and M. Proust are proven real in the **FCo10** case. We have seen above the development of the transcendental conditions which formed the basis for the transcendental synthesis. The entrepreneur based on all prior knowledge and experience comes up with an idea that aims to result in opportunity creation. Receptivity and spontaneity is exercised by locating collateral characteristics and needs of target groups ; e.g. environmental care is through spontaneity translated into carbon free and water saving and combined with healthier ways of living, easy-to-prepare concepts, natural tastes and *Unique Selling* Propositions with the potential to surprise (spontaneity). The idea will then be realized through production and organizational processes. The entrepreneur has established the "need-listen (the consumer) – create value" model in all his NPD and R&D efforts assigning a significant focus on receptivity.

At this point it should be mentioned that all mechanisms above of both dimensions of the Transcendental Capability (i.e. transcendental conditions and transcendental synthesis) are not linear processes but rather dynamic continuous loops and iterations since novel input is both sought and accidentally acquired, concepts become more clear and ideas more refined. The transcendental capability enables the recognition and analysis of all resources of knowledge and its abilities that lead to knowledge–based entrepreneurial results by a constant interplay between the adjustment of the objectives to the abilities and the adjustment of the abilities to objectives applying actually Kant's "Copernican Turn". The spontaneity reaction brings new ideas and approaches, new applications of existing technologies, novel long-term vision and of course the relevant risk taking usually incorporating a sense of pressure and a time orientation (Vera and Crossan, 2005) together with the ambiguity and uncertainty of new low-tech venturing. The two processes are cumulative; knowledge creation leads to the development of new foresight as well as new competencies which increase receptivity. In parallel, they unfold the manifold, giving detailed flesh on the abstract bones of the raw idea and shaping the way to concepts and markets. In these iterations bricolage and improvisational capabilities are actively engaged.

TS provides both original combinations of different knowledge represented by any relative or irrelative way within iterative processes of try and error and try and succeed, and the uncovering of entirely new concepts (a priori). Hmieleski and Corbett (2003) suggest that: "an individual who has a priori knowledge of available resources can plan how to best combine those resources before taking any action". TS is dominated by interactivity among concepts and tangibles, imagination and reality where the pieces of knowledge are the trading assets among the new venture, resource suppliers and markets. This aspect relates to Winter's (1987) view of knowledge as an asset. It refers to "representations or images….considered as a valid representation of a certain reality, based on some kind of justification. Knowledge then becomes a belief and a mental process". (Weinstein and Azoulay, 1999)

Therefore the dual function of receptivity and spontaneity cannot be separated from the capacity or process of **judgment.** According to Penrose (1959) "astute entrepreneurial judgment goes beyond vivid imagination, good insights, and self-confidence. It also involves organization of information-gathering and it leads into the whole question of the effects of uncertainty on, and the role of expectations in, the growth of firms' (Penrose, 1959, p.41). Judgment brings together understanding and sensibility, hence concepts and ideas by making difficult decisions in a short time frame with imperfect data.

Actually, there is a significant body of literature regarding entrepreneurial judgment which seems to even increase lately (e.g. Hurst, 2012; Sarasvathy and Dew, 2007, 2013; Foss and Klein, 2004, 2011, 2012; Maley, 2013 among others). Even since 1921 Knight had paralleled entrepreneurships to a particular form of judgment and had stated that judgment should be exercised for new ventures. He had introduced judgment to connect firm-level economic profitability to the concept of uncertainty. An alternative view, part of the Austrian tradition, describes entrepreneurship as the exercise of judgment regarding an uncertain future (Cantillon, 1755, Knight, 1921; Mises, 1949). Actually Richard Cantillon's *Essai sur la nature de commerce en géneral* (1755) conceives entrepreneurship as judgmental decision-making under conditions of uncertainty.

Foss, Foss and Klein (2007) have connected judgment to formation of business ideas, specifying the fact that such ideas can even be very loose overall concepts. Judgment

is then required 'when no obviously correct model or decision rule is available or when relevant data is unreliable or incomplete' (Casson 1993) and regards the "coordination of scarce resources" (Casson, 1982). As Langlois (2005:5) puts it: "Judgment is the (largely tacit) ability to make, under conditions of structural uncertainty, decisions that turn out to be reasonable or successful ex post". Thus, the entrepreneurial judgment approach regards mainly how entrepreneurs arrange capital assets, which combinations of assets they will seek to acquire and which assets they may later divest in an attempt to carry out the commercial experiment that embodies their judgment (Foss, Foss and Klein, 2004, 2005, 2007; Knight 1921; Casson 1982; Foss 1993; Langlois and Cosgel 1993; Foss and Klein 2005).

However, judgment is very important for Kant as well. Besides the wide use of this "faculty" which represents the use of the *understanding* by which an *object* is determined to be *empirically* real, through a *synthesis* of *intuitions* and *concepts*, Kant devoted a whole essay in this faculty under the name of "Critique of Judgment"

> "Judgment can be regarded either as mere[ly] an ability to reflect, in terms of a certain principle, on a given presentation so as to [make] a concept possible, or as an ability to determine an underlying concept by means of a given empirical presentation. In the first case it is the reflective, in the second the determinative, power of judgment. To reflect (or consider) is to hold given presentations up to, and compare them with, either other presentations or one's cognitive power [itself], in reference to a concept that this [comparison] makes possible". (CJ, 211´)

In parallel for the present thesis, judgment is regarded as a spontaneous cognitive capacity that mediates the formation of business ideas. It is spontaneous mainly at start- up processes. Whenever it is externally stimulated by raw unstructured sensory data as inputs, it then organizes or "synthesizes" those data in an unprecedented way relative to those inputs. This is done by applying *specific rules* that directly reflect the internal structures of the entrepreneur/ organization, thereby generating its correspondingly-structured outputs. Besides resources, judgments can refer to quality, quantity, mode, efficiency, importance and acceptance or rejection of limitations etc. Judgments' main feature is that they permit the "re-cognition and restructuring of experience", (and in this way Kant accounts for the creative activity of the imagination). Judgments unite the actions and capacities involved in business idea formation and the creative capability involved in the production of novel order.

In cases of KIE in general as well as in LT-KIE more specifically, there is usually no direct market to judge the outcome, so it is the agents' judgmental decisions that will prepare the manifold for the formation of the idea and mediate and promote the access to the business idea. This is usually done by accepting or rejecting, combining, deploying and enriching or abstracting resources, goods and capabilities while simultaneously estimating future events and outcomes. The emerging entrepreneurial LT-KI ventures are actually a result of exercising such judgments based on cognitive abilities to effectuate and to achieve initial competitive advantages.

In most cases entrepreneurs claimed that during this idea-forming period they plunged into a plethora of alternative options as potential candidates for development, within conditions of time pressure together with ambiguity and uncertainty. Narrations made evident the existence of **judgmental decisions** on issues such as scarce resources (WCo1, WCo3), combinations and deployment of capital goods (FCo3, FCo6, FCo10, TCo1, TCo8)) expectations (WCo1, TCo10), choices (TCo4), resolving conflicts (TCo5) and increasing variety (FCo7, WCo2) among others. Furthermore, judgmental processes seem to become stricter as the idea is refined since new choices are shaped by the actors' deeper involvement in the competitive arena and new needs are created as entrepreneurs envision new ways of acquiring and using resources. This dimension safeguards this antinomy of paradox thinking and the danger of teleology, due to its dependence on individual thinking, (as it will be later discussed in more detail). Csikszentmihalyi (1996) suggests that this stage is the most challenging, because it requires entrepreneurs to be **brutally honest with themselves;** they must assess whether they have merely a good idea, or a truly viable business opportunity.

Continuing the case of FCo10, judgment regards many aspects of the new idea formation. The motive was to keep on being world leaders in the specific niche market. The entrepreneur then collected information, data and stimuli around this raw idea which started to take a shape gradually (receptivity, spontaneity). Judgments regarded:

- *the new market requirements*: "Other companies entered the niche market we had created. We should become pioneers once again in order to keep our leading position", "new trends imposed the need for ecofriendly production, sound messages of healthiness, and besides the concept of the

"traditional Greek" we should deliver innovation as well. These requirements showed us the direction we should follow"

- *limitations of the former model and new potential*: "we asked for top quality. Our former business model did not allow for that". "Leadership requires top standards, constant quality, variety, surprise through new different products, innovation. Therefore it was also a question of flexibility in a constant evolution of products and ideas. If an idea is good enough we will find a way to make it real".
- *The interaction between benefits of establishing production and the former business models*. The new products could not go no being sold as private label (almost 50% till then)

The above judgmental decision eliminates also the uncertainty regarding the p lant decision and the relative investment in capital. It was "completely necessary" to ensure the quality consistency, flexibility, differentiation and a better control. On the other hand, it appeared that there was no money limitation or any relevant risks (but this is author's assumption and not clearly stated by the interviewee as in the case of WCo1). Transcendental synthesis in this case does not refer to the products or the processes themselves but to the fact that the result encourages the formation of embedded systems of knowledge, open innovation (the entrepreneur talks of many R&D co-operations that followed) and cospecialization management (as the case's course proves such as co-branding).

WCo6 *chose to devote* significant financial capital ("we chose the most expensive way"), *chose to invest* on high quality standards ("for us quality is the spearhead of our strategy. We produce the most expensive marine plywood[136] in the world") *invested time and money* to find and apply the innovative technology ("innovative technology is rather treacherous, but we knew that and we chose that") The first output of the corporate venture, unique plywood products of high quality, will soon be followed by regular NPD.

[136] Marine plywood is an expensive, water-resistant grade that is more tightly constructed and glued than ordinary plywood.

However, in many cases decision errors, as hyper-optimism and strategic disorientation were mentioned as keen to jeopardize the core business concept formation. Such errors were significant for some newcomers such as WCo5 and WCo7; their firms did not manage to survive within the severe crisis. This can be partly attributed to the fact that original **judgment remains with the owner** (quoting Foss et al., 2007). Or as Rothbard (1962) puts it: "It is the owners who make the decision concerning how much capital to invest and in what particular processes". It should be however mentioned that while in new-to-the-world cases the entrepreneur hold the entire "game" in his hands, in corporate venturing, at least of our cases, entrepreneurs are basic actors but they are not alone in decision-making. Yet, many times judgments keep being individual decisions of the entrepreneurs and not ones of collective nature (e.g. WCo2, WCo6, WCo8, FCo7 and all TCos corporate cases). Quating Casson (1982) 'The entrepreneur believes he is right while everyone else is wrong.' (1982) but although Casson adds that this type of teleology is not a feeling of superiority but a result of judgment, we cannot be sure that teleology is always absent. In corporate cases, adversaries (managers or even engaged consultants and other stakeholders) should be freely allowed to comment on entrepreneurial decisions and should also be opposed through reason since "dialectical strife increases knowledge" (Kant) and the openly expression of strategic thoughts leads to improved insights.

The above observation (i.e. that judgment remains with the owner) can be maybe attributed to the fact that judgment in the beginning implies that in spite the lack of sufficient objective and subjective grounds for the undertaking, the business can still be rationally held under the right circumstances. **It is usually *the entrepreneurs* who are aware of it and it usually t*he entrepreneurs who invest money on it***. The transcendental capability can then enact the mechanism of risking rather anything, even at the peril of error, than that one should surrender such investigations (in the framework of transcendental synthesis), either on the ground of their uncertainty, or from any feeling of contempt (e.g. of the "who's gonna buy it?" type).
Therefore, it should be their own judgment that can support the risk taken by such activities. Without it there would be a time loss trying to evaluate[137] and secure the

[137] "Actually you cannot always justify why you are doing what you are doing…" (CEO of WCo2)

best among multiple competing investment paths by managerial teams, which is quite time-consuming and thus dangerous in cases of new ventures.

Judgment also "lands" novelty into the existing world. To gain widespread acceptance, a radically new low-tech concept must be comprehensible in terms of existing knowledge (Hargadon & Douglas, 2001). In other words, KI entrepreneurs, in order to succeed, must catch and couch the strange in the language of the familiar[138] (Chiles et al., 2010) especially in the case of low-tech industries. That refers both to the internal organization development and the introduction and acceptance of the suggested product, process or model. **The innovative idea should be at the same time surprising and familiar looking.** According to Hargadon and Douglas (2001, p. 488), "An innovation's design should invoke preexisting understandings, which do not constrain us to only those existing understandings and actions, instead allow us to discover new ways to interact with the new ideas as our understandings evolve."

Judgment further takes into account constraints of compatibility with the laws of nature, the principles of human nature and the posture of things in human thoughts. Capital resources and institutions also serve as "common signposts" to which entrepreneurs orient their plans (in Chiles et al., 2009).

It is quite evident in all thirty cases that **judgment is mainly based on the entrepreneurs / the entrepreneurial teams, their perception, knowledge and experience as well as the level of their transcendental conditions**[139]. This explains the significant heterogeneity within the specific sectors; different individuals will make different decisions that will produce different outcomes:

> **FCo1** and **FCo10**[140] are exemplary bipolar cases: they both started in the same area, i.e. olives and oil. However, the first entrepreneur has a high level of PEA in the area of raw-material and processing technologies, while the other in the area of marketing and business concept building. Accordingly,

[138] "Even Thomas Edison, whose name has become a byword for innovation, gained acceptance for his idea of the electric light not by emphasizing its radical departure from the deeply entrenched institution of the gas lighting industry, but by designing its concrete details to fit seamlessly into the existing system" (Hargadon & Douglas, 2001)

[139] Therefore a useful implication for potential LT-KI entrepreneurs is to investigate the level of PEA they own and maybe they need to enhance that level before investigating their sense of spaciousness.

[140] This bipolar example has been also discussed above as an indicative one.

they developed different senses of spaciousness while judgment guided receptivity and spontaneity at different directions. FCo1 resulted with innovative gourmet products in the form of private label creating a flourishing niche market which was soon followed by many other entrepreneurs either in the area of branded products or private label ones. FCo10 created a totally innovative business model with innovative marketing creating the "meze concept" which was soon adopted by the "kerasma" promotional initiative launched by the Hellenic Foreign Trade Board, under the auspices of the Ministry of Economy and Finance. As it has been mentioned in a section above, if not for LT-KIE they would be both cases of olive and oil packaging conventional firms with an uncertain future.

A particular feature of judgment appeared to be the stance of entrepreneurs regarding the ***institutional setting***. Many of them took advantage of a **favorable climate**:

- **WCo2** took advantage of the vigorous signs of growth of the building sector, due to a general climate of prosperity in Greece of 2000 and the Olympic games of 2004, as well as the quite favorable conditions of buying the bankrupted MDF manufacturing plant.
- **WCo8** was found within an era that markets favored such investments; a ready to consume market and a high income economy, relative alluring subsidies and the flourishing industry of CNC machinery. "The time I decided to establish my own business, there was an extraordinary growth rate of the Greek market which assisted my growth. I derived in 10 years the benefits that a 40-year-old company would normally derive in 30 years[141].
- **WCo9** exploited wood shortage and relative price crisis, as well as the growing trend towards ecology.
- **FCo4 and FCo5** took advantage of the general and fast arising trends towards healthy nutrition and medical food
- **TCo3** grasped the opportunity of renewable energy institutions and combined it to ecology, flexibility and service novelty (one-piece dying)

[141] i.e. a rather mature company and not a newcomer (author's further explanation)

- New national and European legislation on mass catering led to the creation of **FCo3.**

Others took advantage of **threats and turbulence in the market**, or some kind of disaster:

An unfriendly environment towards artificial fibers turned **TCo6's** initial plans to cellulose and blended yarns.

- The fire in the conventional factory drove **WCo4**'s entrepreneurs to seek innovation and flexibility in their effort to survive.
- A similar fire and the vulnerable T&C market led **TCo4** to develop a firm of technological intensity.
- **FCo5** turned to become a highly innovative company due to the very low possibility it had to survive among other 450 similar conventional wheat flour producers in Greece among which some owned the lion's share.
- **FCo10** turned to corporate venturing when they felt threatened by intense competition.
- Most **TCo-**cases turned to KIE as the only alternative to survive the disastrous consequences of trade liberalization and the negative course of the industry in all developed countries.

7.2.d.3) The danger of teleology

Sometimes as mentioned above, LT-KI entrepreneurs appear to sustain practice of seeking **teleology**[142] i.e. "the use of the ultimate purpose to define their outcome", (quoting T. Keiningham) in their decisions, to which they commit certain amounts of time and resources, and for which they derive examples by their experience. The entrepreneur anticipates that his superior **judgment** will be confirmed by the way that events turn out. His own beliefs will be proved correct and the beliefs of those who bet against him will be proved false.

While **teleology** can be used in this positive manner, it is quite dangerous when it is not grounded on judgment; the entrepreneurs anticipate that their choices will be confirmed and that their own belief will be proved the right one. Then, one can detect some pitfalls equally important for entrepreneurs who start a company and justify their choice on such a teleologic attitude.

[142] Teleology is a philosophical term used in natural sciences as a means of explaining phenomena. Roughly stated: form follows function

- There is usually *a natural tendency* to assume causal relationships where correlations seem to exist, that drives decision making to the desired and not the rational. Hypothetical examples: "Our product will be unique and everyone will love it. All our friends have said so", "Japanese will love feta". Some of our cases presented such type of teleology:

  "We loved the material and we considered that it will have a future. This was rather intuitional you know, an analysis of our own poor data – what we have seen in the internet and some journals… We thought it would be a new trend. ST (the owner) is a very hard worker but with no studies and no broad views…" (CEO of **WCo5**)

  "The main volume of investment regarded equipment. We always wanted to differentiate and this was due to the constant development of know-how, our extreme product specialization and the "impossible" of the other companies"

  "How did you elicit it?"

  "Our high level of know-how… At times you could find even bankers in the industry. We had grown up in this business at all stages; we have personal experience and know-how which would develop in parallel with technology. I have personally a strong belief in the value of technology which today I can admit that actually blew up in my face. I have invested huge amounts of money and then because of the state everything went wrong[143]"

  (a part of the interview with **TCo4**'s entrepreneur)

- Another pitfall is the very popular fashion of innovation by *the "guru as god" mindset* (expression of T. Keiningham at an interview). This is when an effect of the one time is assumed to exist at all cases:

  "Our client was more than happy and we were happy too, since they would absorb all our production and at a very good price. But then, when we turned to other customers, there was no interest at all." **(FCo4)**

  "A client asked us about some new properties on fabrics. We saw an opportunity and started research in cooperation with chemical industries. When the product was ready the customer was not interested due to the economic recession and there were no other customers either.

  (TCo4)

- Then there is the *"knowing my knitting" syndrome* where former employees and organization members start their own business counting on their involvement in the relative entrepreneurial environment, where "they know all", "they live in it",

[143] This case is very interesting since it regards one of the strongest T&C companies worldwide until 2004-2005. TCo4 tried to change in order to confront the downturn of the sector in Europe but a series of wrong choices led to rather mediocre results. The company did not manage to escape the teleologic attitude and seek alternative solutions out of the power of technology. It did not manage to escape the well-structured routines and processes which gave it the long-term superiority. The case will also be discussed in next chapter.

"they have developed the instinct "and so on. There was no such case in our sample but this pitfall emerged by the conversations with entrepreneurs as a *reductio ad absurdum* result; most of them would underline the fact that no matter the experience and the education, they did not have the "whole package".

"You cannot have the knowledge you need by yourself. You do need the help and support of others and other sectors as well, especially in the beginning". (**FCo9**)

"Then it is knowledge. When you don't have it (and you cannot know everything), you buy it. Knowledge is expensive" **(FCo8)**

Relevant Entrepreneurial Characteristics: the development of transcendental conditions and transcendental synthesis depends also on the ability and willingness of the actors to act. During the cases certain personality characteristics and fundamental attitudes were observed among which, high need for achievement and deepened conviction seem to play a core role for the specific capability (Table A12, Appendix A).

More precisely, entrepreneurs of the sample admitted to have started out of the tight local and sectoral limits, with an unshakable belief in something without need for proof or evidence. Such **deepened conviction** (Davidsson, 1995) is partly a trait of entrepreneurs but it also depends on previous experiences and successes as well as on the existence of strong networks (e.g. WCo2, FCo10, TCo1, TCo4, TCo9) or a strong knowledge pool (e.g. WCo2, WCo6, FCo6, FCo10, TCo1. TCo2. TCo6. TCo9). Deepened Conviction plays an important role in the formation of challenging concepts produced by mismatches of common and transcendent ideas. It is actually a moderator of "how much challenging" the business concept will finally be.

Deepened Conviction was most times found to support **intuition**, another creative skill closely associated with spontaneity (Cummings and Oldham 1997; Vera and Crossan, 2004) and judgment (e.g. Dutta & Crossan, 2005; Gaglio, 2004; Mitchell, Friga, and Mitchell, 2005; Politis, 2005; Sadler-Smith, 2004). According to Poincare (1854-1912) "*intuition is the* instrument of invention". Intuition in management was discussed explicitly as far back as Chester Barnard's *Functions of the Executive* in 1938. It has been related to creativity and innovation (Agor, 1989; Isenberg, 1984; Mitchell et al.,2005; Sadler-Smith and Shefy, 2004) which are significant elements for business start-up and growth (e.g Bilton, 2007).

It has been also called entrepreneurial intuition (Behling and Eckel 1991; Crossan et al., 1999; Vera and Crossan, 2004) and it has been related to idea generation due to gap identification (Isenberg 1994), flexibility and solutions based on exceptions to rules (Crossan and Sorrenti 1997; Leybourne and Sadler-Smith, 2006). Entrepreneurial intuition accords with the Schumpeterian view of entrepreneurs as change agents who ‘‘initiate innovation and transformation in the economy on the basis of their intuition about the emerging future’’ (Dutta & Crossan, 2005, p. 437); Schumpeter (1911: 85) also notes that: “**intuition,** the capacity of seeing things in a way which afterwards proves to be true, even though it cannot be established at the moment and of grasping the essential fact, discarding the unessential, even though one can give no account of the principles by which this is done.”

Actually, in accordance to most scholars, we accept the fact that “intuition is difficult to describe but easy to recognize”. Actors of the cases would either define it or would let us recognize its existence, which sometimes however would show signs of teleology as well (please see the examples above). They would describe times where they would be able to recognize a highly interesting idea or whether o new product would make it; but they would find it difficult to articulate the reasons of success. This was rather painful when they would seek for money (e.g. FCo2) or where they would try to convince managers (e.g. the case of WCo2).

Furthermore, another quite strong trait observed (and rather expected to be found) was **the need for achievement**. It refers to the actors’ desire for significant accomplishment, control, or setting and meeting high standards while it motivates them to excel in activities which are important mainly to them. The term was first used by Henry Murrey (1932) and associated with a range of actions, such as: "intense, prolonged and repeated efforts to accomplish something difficult; to work with singleness of purpose towards a high and distant goal; to have the determination to win". However, the concept was subsequently popularized by the psychologist David MacClelland (1961) with a particular relevance to the emergence of leadership.

Matched patterns of behavior of interviewed actors and characteristics attributed to high achievers have been found to be the following:

a) Undertaking of innovative and engaging tasks. When in such position, entrepreneurs think more of their contributions than of competing arenas. “*I cared*

for transparency and real ecology in mattresses. I wanted my customers to literally sleep in nature. My message is to return to nature" (**WCo10**)

This sounds too simple and self-evident, and yet led to a fast growing mattress company with worldwide recognition with multiple innovative ideas on products, processes and business models which altered the existing mattress business ecosystem from value chains to markets.

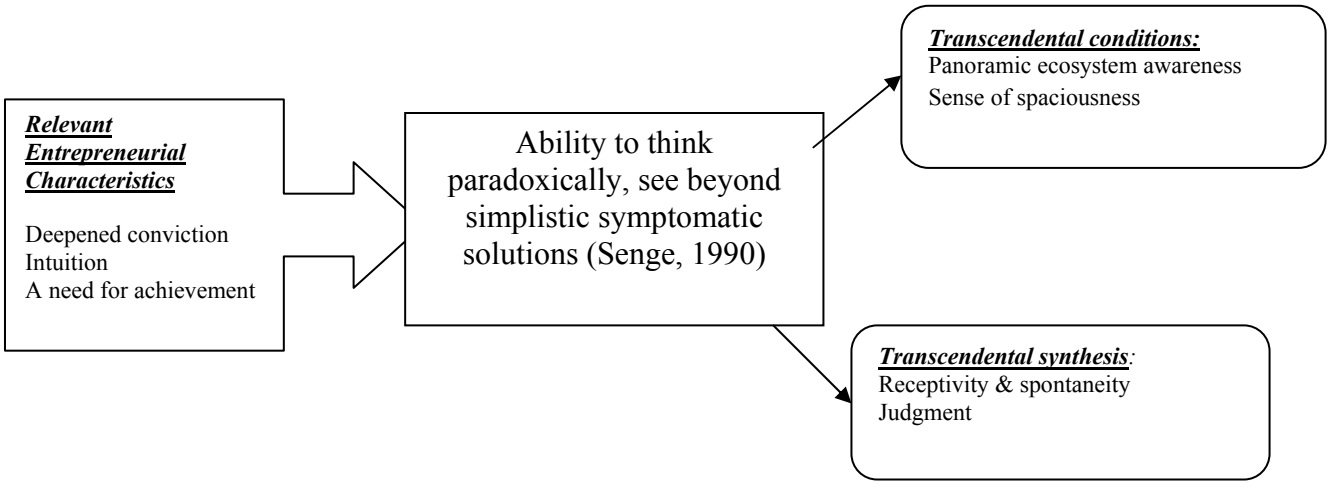
b) Monetary rewards serve only as an index of this accomplishment.

> "My brother and I myself did not actually work for the money then (note: after the first plant in Trikala). It is the joy of creation, the desire to create nice products… we bought a plant of 6000 square kilometers and we made it 150000, we wanted to give people a job, to produce wealth in this country. After a number, nobody really cares about numbers anymore…." (Entrepreneur of **FCo8**)

c) Actors are not gamblers. They will accept risk only to the degree they believe their personal contributions will make a difference in the final outcome. This is quite evident in all cases.

Need for achievement is a rather common attribute in entrepreneurship literature related to innovation and risk-taking propensity (e.g. Stewart et al., 2003; Carraher et al., 2010). It has been used as a measure and a key component (Cover and Johnson, 1976; Hansemark, 2003). Witt (2002, p. 13) described this trait as "the will to demonstrate that mere possibilities can be turned into reality." Schumpeterian entrepreneurs, exhibit "the will to conquer" and "the will to found a private kingdom" (Schumpeter, 1934, p. 93).

Figure 7.3: The Transcendental Capability



Transcendental Capability is a totally novel concept which explains 'how' innovative knowledge-intensive concepts are built. It regards mainly the process of intangible assets' creation, such as novel knowledge and know-how which according to Teece (2011) constitute the new, hard to "build" and difficult to manage "natural resources". We claim that innovative business concepts are results of a priori knowledge generation[144] processes.

Transcendental capability enables the a priori cognitive configuration, the ability to cognize the nature of what is going to offer competitive advantage according to a priori principles and paradox thinking. LT-KI entrepreneurs derive from experience nothing more than what is requisite to present an idea through pure conception or through opportunities which serve as the media to lead to innovation. This is in accordance to entrepreneurial opportunities' definitions of Casson (1982) and Shane and Venkataraman (2000); *they are just situations in which new goods, services, raw materials, markets and organizing methods can be introduced through the formation of new means, ends, or means-ends relationships.* The transcendental movement from non-existence to existence is a fact which takes place within the field of creation and knowledge (knowledge-based innovation) starting from opportunity creation.

The level of the transcendental capability development depends on the level of the Transcendental Conditions and affects significantly the other two DECs. TS is the dimension actually responsible for the capture of the novel but initially vague idea which will build the new business opportunity based on the transcendental conditions. Hence, TS enables idea generation by forming the potential to see the entire picture of a specific reality by interacting with options of this very reality from other angles. However, contradictions and mismatches are confronted as necessities to create knowledge instead of obstacles to overcome through transcendental synthesis. This quite special type of visioning process becomes then an inquiry into the future we truly seek to create (Senge, 1990) and sets the foundations for the DC micro-foundation of sensing. Especially spontaneity can constitute a fine precursor of the

[144] We were happy to read Teece's (2011) relevant statements which support our views. E.g. "… in the petroleum industry, oil in a fundamental sense is "found" in the mind, not in the ground. Put differently, oil reserves are found using the knowledge empires of the major petroleum companies".

seizing capability while judgment creates links in the formation of sensing and seizing processes. This issue will be discussed in more detail in a subsequent section.

KI business ventures will be attempted only when there are certain ideas as proper bases. Most times entrepreneurs when elaborating their venture concepts, they find out that the *schema*[145] or even the initial definition of it, rarely corresponds directly to the idea. It seems as if the idea lies like a germ with its parts undeveloped and hid. This is due to the fact that the majority within the entrepreneurial landscape regardless the sectors they belong, remain attached to a *sui generis* (ιδιόμορφη) idea, which they cannot render clear to themselves, and that they thus fail in determining the true content, the articulation or systematic unity, and the limits.

LT-KI entrepreneurs of the research appear to have the capability to create the content of the idea, forming it by much iteration due to the DECs they have developed. The *schema* which is originated from a KI entrepreneurial idea forms the basis of a sort of architectonical unity. **Knowledge is organized around the entrepreneurial idea.** Then, the origins of all knowledge collected and selected to form the entrepreneurial idea are derived by a complicated set of multiple, multifarious and multifaceted knowledge areas and are subject to interactions. That means that there must be certain time and resources devoted for the collection, selection and technical disposition of the media (information, knowledge, networks, and other resources) needed under the guidance of the actually underdeveloped idea while there is actually no definite plan of arrangement. Then it becomes possible to view the idea in a clear light and to project a plan of the whole according certain architectonic principles. This is how knowledge and science enters the organization's knowledge basis in LT-KI cases.

This was observed both in cases where an invention occurs (FCo5, FCo7, FCo9) with the shifting of the system structure to new knowledge areas (e.g. to biofunctional food), and cases of simpler forms of innovation (e.g. TCo2, TCo7) where again the system structure enters new knowledge areas (bulletproof and fire proof technology in fabrics – denim treatment).

As clarity about the nature of the idea increases, so does the awareness of the gap between the idea and current reality and therefore bricolage and improvisational

[145] In psychology and cognitive science, a **schema** (plural *schemata* or *schemas*) describes an organized pattern of thought or behavior that organizes categories of information and the relationships among them

capabilities are then applied more intensively. Therefore, transcendental capability in coexistence with bricolage and improvisation capabilities creates the entrepreneurial platform for innovation. DECs allow the transcendence through non convenient but rather functional ways. According Kant knowledge is always *en route* to the better.

However, as in the other two DECs, social, cultural, and historical contexts are important for the transcendental capability as well. As Ricardo Cappellin (2013) notes "in creation, one cannot be free from one's own context…. because such contexts give the basis for one to interpret information to create meanings". Then, of course the market will be the final area of judgment. Although Kirzner argues that "entrepreneurship reveals to the market what the market did not realize was available, or indeed, needed at all" (Kirzner, 1979, p.181) and this is further repeated my many of the interviewed entrepreneurs, it is actually the market test that will sort out which entrepreneurial ideas are workable (Klein & Klein, 2001).

As an epilogue to the transcendental capability, FCo5 case:

FCo5 started in 2003 as a conventional wheat flour producing firm. However, the entrepreneurs soon realized the limited chances the firm had to survive among 450 Greek competitors not counting the imported products and the substitute ones, if they went on with "business as usual". Being former owners of a tomato packaging export firm, they had developed a significant level of **PEA and sense of spaciousness** searching for novelty in the food area. Their initial target was differentiation.

Information manifold regarded accidental data and stimuli such as the phone-call: "A celiac disease patient called to ask if we produced gluten-free wheat flour. Imported products did not satisfy him*"* in combination with a relevant article in a newspaper "We had read (before the phone call) that tourist groups from Australia wanted to visit Greece but they hesitate due to the fact that there was no provision on where and what to eat". Collecting multi-directional information (**receptivity** e.g. product ideas by celiac-disease patients, bio-functional food niche markets and science through social /academic networks, etc.), a wider question on dietary requests was set regarding science-based wheat-flour products (receptivity). Information and

multifaceted knowledge (science articles[146], contacts with specialists, lab tests) was *ere long* transformed into the basic novel concept patented novel products (**spontaneity**) by transcendental synthesis engaging bricolage and improvisational capabilities and using judgment in many cases.

Judgment is externally stimulated by raw unstructured sensory data as inputs regarding specific demands on taste and tolerance of the target groups, science limitations and technological potential. It further regards the desired competitive advantage of the first mover, exploiting market opportunities in a preemptive fashion, redefining where and how the competitive game is played in the field of biofunctional foods. Pilot market tests and judges the first outcomes. Relevant experiments mainly in the form of try-and-error lasted two years.

One can detect the capacity of the knower - a "knowledge operator" who works at the intersection between science, technology, innovation and markets. Creative and productive transcendental synthesis leads to high-value novel products and multiple target-group enticement. FCo5 further used multiple plant manufacturers and developed a tight informal network between the research staff of the University, the manufacturing companies and the suppliers. The products are prior to experience; biofunctional foods are opening prospering markets and a potential to grow as far as the innovative imagination of the researchers goes, since these niche markets are at an infant level. "There is an endless list of innovative ideas in my head. It is impossible to catch up with all of them but some of them! –Yes, I will!" (Dr K., biofunctional food expert, one of FCo5's spin-off partners closing the interview).

FCo5 entrepreneurs sensed and continue to sense "emerging trajectories hard to discern" (Teece et al., 1997). Engaging bricolage and improvisation, designing the firm as they created it, FCo5 actors established a highly innovative, fast growing LT-KI company with worldwide patented products, strong co-operations with University Departments, a science-based spin-off and a new market. They opened new niche markets addressing special target groups such as cancer patients and athletes worldwide. The company

[146] "The manhours we spent on reading relevant papers (besides our every day work) cannot be described only by saying "we studied relevant literature!" (CEO of FCo5)

flourishes even during the severe economic crisis in Greece with sales rates growth 20.8%, 47.5%, and 12,8% in 2011, 2012 and 2013 respectively.

In a nutshell, **Transcendental capabilities** in the examined cases seem to define the depth, the impact and the degree of novelty of knowledge-intensive business concepts; that is the core of the initial competitive advantage, the positioning of the new venture within the existing or the newly created business ecosystem and the new venture's dynamism. **Although bricolage capability allows for the hunt of knowledge and improvisational capability for the convergence of design and execution, it is the transcendental capability that rules and curves the directions towards novelty and knowledge seeking, indicating solutions to limitation refusals**. Thus, transcendental capabilities guide and direct the other two dynamic entrepreneurial capabilities. Bricolage and improvisational capabilities perform executive functions while transcendental capabilities are strategic directional capabilities.

7.3. Sub-Section 2

Hypothesis 1 and sector-level analysis

7.3.1. WOOD AND FURNITURE SECTOR

7.3.1.a) Bricolage capability

Bricolage in the wood and furniture sector is found to engage mainly machine and raw material suppliers i.e. CCN includes mechanical engineering, IT and chemistry, material engineering and design. Respectively, the hunt of knowledge on relevant sub-sectors, regards mainly familiar areas than chasing radical innovation. Innovations of the field, although knowledge-intensive, target in their major percentage local/national markets, are mainly incremental but *do bring* considerable benefits which are noticed more by B2B customers (e.g. the furniture sector in the case of wood processing) and less by the final consumer. However, they do not refer to mere improvements of products and processes.

All cases *create problems*[147] which are then solved by creative resources recombination through interactive learning.

Most cases present significant bricolage capability dimensions (Table 7.5). The **established companies** use corporate venturing to get out of the limits and try to surprise the world (WCo10, WCo2), or capture excellence (WCo6, WCo9) by innovative processes. **WCo10** and **WCo2** produce more rapid innovation with unexpected results and expand their seeking activities wider, while they care for their image worldwide. Both companies develop **very strong bricolage** capabilities without resting on existing networking although it is already large and extended. CCN and knowledge hunting is almost an obsession for both entrepreneurs; they both invest money and time to search for the best worldwide. They create provoking challenges and are both totally unconventional and with an open attitude – and yet completely different. More human and nature-centric, WCo10's founder builds on innovative image collecting pieces of all areas (marketing, human resources management, materials, production, R&D) while WCo2's founder focuses on technology excellence and expansion through several types of collaborations (as core choices).

On the other hand, both **WCo6** and **WCo9** rest mainly on existing networking and people they trust and develop new ventures on known paths and courses; i.e. quality by novel processing in one case and new product which *solves problems* and can be absorbed by known markets on the other. CCN and repertoire building expands in already known areas although novel concepts engage unknown elements which contain risk and opportunity benefits as well.

Thus, all dimensions of bricolage appear more dynamic in the first two cases although **they are strong in all four cases**.

Sometimes, strong bricolage capability brings even not-expected results supporting the creation of strong initial competitive advantages. WCo2 reaches worldwide technology innovation and WCo10 creates a unique image and a new trend toward the phenomenon of sleep. Although well-established organizations in both cases, the ***characteristics of the entrepreneurs*** play an important role: both leaders of the corporate venturing are unconventional, totally involved and with an open attitude towards all input. Yet, other ***resources*** and abilities are also important: strong existing

[147] Some of them have been already mentioned in the above section of the first hypothesis analysis.

networking cycles and existing or easier prepared teams to work, richer capital resources (i.e. money, human resources, contacts, and firm's reputation among suppliers and/or customers) and already existing capabilities for bricolage.
Quite the same goes for **WCo8.** Although it is a new-to-the-world firm, it is well backed-up by the relevant family company and this supports the development of strong bricolage capability. The entrepreneur finds a strong initial pool; however, due to his education and former experience, he develops further dynamic CCN and strong repertoire building in direct and active interaction with machine manufacturers and raw material providers. Results for **WCo8** are again surprising: innovative concept, world-patented machine, and market transformation (at local however level).
Regarding only new-to-the-world firms, **WCo1, WCo3, WCo4 and WCo8** present **strong bricolage capabilities** which affect the results the agents expect. Innovation became multifaceted and spread in many areas such as quality, production, NPD, design, energy and ecology for all four cases. For example, WCo3's initial intention to create a novel model led to further innovations and a rapid sales growth. However, most start-ups stay trapped in small concentric cycles avoiding aggressive hunt of knowledge and presenting quite similar attitudes.

Weak bricolage capabilities (in combination with the other two DECs which seem to be also weak) cannot lead **WCo5** and **WCo7** to surprising results. CCN is not expanded on a research basis, while pieces of information and knowledge are limited and insufficient for creative combinations. Both companies' agents are too ***introvert and not really unconventional.*** They both ***lack former experience and knowledge of the sector,*** while their academic studies and background are not really on the concept's subject. Actually, they ***do not collect and exploit pieces of knowledge;*** instead they "hang on" others and let them produce both knowledge and business concept. **WCo5** offers all property rights to its strongest customer, a large group which does not seem to be the best way to market. The new venture expected support on R&D matters which never came. **WCo7** contented itself to the patented technology initially adapted to local conditions without seeking any new skills, capabilities or novelties to add and incorporate during the starting stage, as done by WCo9. While in 2006 (foundation year) pellets were totally unknown in Greece and just starting to show their potential in Europe, the company did not manage to exploit properly the first-mover advantage. Within the next 4 years, 5 new wood pellet plants were

constructed while in 2012 14 new plants were expected to start production. The technology initially adapted by WCo7 became obsolete in a very short time since it did not try to update it improving properties and adapting to Greek needs.

Furthermore, both **WCo5** and **WCo7** show a ***reluctance*** of further adding knowledge which results in limited access of the known world and many problems to be confronted at all levels and activities. Thus, interactive learning is not well exercised by both companies which appear even to *fail to learn*. In many cases, the actors of these two cases could not even recognize failures. This is an *episode* of failed improvisation: the entrepreneurs spent resources on repeated experiments in support of developing solutions that did not work in the end since failures and their reasons were not taken into consideration.

In both cases the resulting concept was the expected one but both ventures did not achieve real first-mover competitive advantages. Although the innovative ideas led to unique products and created new markets at national level, they collapsed very soon, did not manage to bring sales growth, led to bad choices (e.g. the one customer) and caused many technical, production and market problems**.** Actually, these two companies do not manage to survive. WCo5 turns to other entrepreneurial activities and WCo7 closes down in 2012.

Table 7.5: W&F bricolage capabilities

Bricolage capabilities	**WCo1**	**WCo2**	**WCo3**	**WCo4**	**WCo5**	**WCo6**	**WCo7**	**WCo8**	**WCo9**	**WCo10**
Type*	N	E	N	N	N	E	N	N	E	E
Repertoire Building	strong	Very strong	strong	strong	weak	strong	weak	strong	strong	Very strong
CCN	strong	Very strong	strong	strong	weak	strong	weak	strong	strong	Very strong

**** N= startup, E=established***

Interactive learning appears to be a main sub-dimension of the repertoire building. In most cases it constitutes a highly dynamic process: **WCo1** collects, combines and generates knowledge while embedding a relative culture of constant learning. **WCo8** uses knowledge from various scientific areas to realize its novel "boxing concept". **WCo2** invests mainly in technological knowledge to intervene in innovative ways to known processes increasing productivity, incorporate ecological aspects, achieve

energy savings, and recycling while patenting innovative processes. In all cases learning comes besides conscious knowledge generation, through trial and error and experimentation. As learning is then embedded in DCs, the relevant iteration of the case studies analysis will show that a major problem for **WCo3** was exactly the fact that it did not cultivate this micro-foundation enough. Actually the new firm seems to become very early "tired" of trying to incorporate too much knowledge and drive novelty in the sector. This can be attributed to its small size, the fact that DECs were not actually transferred in well-developed DCs or the fact that the new firm could not manage knowledge-intensiveness properly.

All firms engaged more or less all bricolage dimensions and created the environment for problem-making, dealing with difficulty and trying to be flexible. However, the status of the founders imposes various restrictions. Even ***proximity*** has a different meaning for a big established company (e.g. the parent firm of WCo2) and a nascent firm (e.g. WCo1). Suppliers and other stakeholders "gather" easily around an existing and known company while there are core difficulties to trust and be close to a new one. It seems then to be a matter of capital, image and trust. The level of cooperation and former relationships are also important factors when building such relationships.
Furthermore, ***resourcefulness*** appears in quite different ways among established and new organizations. ***"Resources at hand"*** affect the ways of acquiring new resources and the number of different uses of existing and required ways or even the easiness of CCN. Differences have been observed among physical resources and available human capital, social capital and networks. Hunting of knowledge depends also on the knowledge base the agent starts from.
On the other hand, the internal development of resources depends further on visions, capabilities, background and the transcendental capabilities of the actors. As an example, we remind the diametrically opposed cases of WCo2 and WCo6. We should also mention here that according to our observations, resourcefulness seemed to contribute further to the way founders *interact with the environment and the level of the information flowing dimension (improvisational capability).*
"The obvious difference between the resources of founders with a limited private capital background (as WCo1, WCo3 and WCo7) and existing firms setting up KIE as corporate entrepreneurship" (Hirsch-Kreinsen and Schwinge, Deliverable 1.3.6) was quite notable in our cases too. Established firms finance their new ventures (WCo2 is

an exception where political capital played an important role and can be considered as a "private network"). **Limited initial resources such as lack of financial assets and infrastructures, human and social or even political capital led to weaknesses in properly applying both the bricolage and all DECs respectively.** For example limited economic resources led all new-to-the-world firms to heavy loans or subsidies; sometimes they were not paid back in due time causing a constant increase of initial debt. Major weaknesses of the three companies with strong but not equally satisfying improvisational capabilities (WCo1, WCo3 and WCo4) are due to the above deficiencies.

WCo5 and **WCo7** with the weakest bricolage capabilities presented shortages in other resources as well such as physical capital, human and social capital, existing knowledge of the sector and the individual activities and ability to reach information combined with weak mechanisms for resource-seeking, learning and networking. Yet, we cannot suggest that resource shortage impacts negatively bricolage capability; WCo1 although encountering resource and time shortage, developed strong mechanisms and synergies for resource seeking networking.

In any case, it appears that *the pre-existence of resources affects positively bricolage capabilities.*

A different case appears to be **WCo6**; the new venture has achieved expected results *and* a strong competitive advantage although bricolage capability was not as strong as the first subgroup's ones (WCo2 and WCo10). The result can be attributed to former experience and an excellent combination of dynamic and dynamic entrepreneurial capabilities. Strong sensing and seizing revealed the need to stretch to the new venturing. In order to realize it, the company let again DECs emerge (engaging the proper human capital) and the effort returned the expected results[148]. The same goes for WCo9 as well, as clearly stated in report.

All agents are engaged in ***real problem making*** which required a big variety of types of knowledge and turned to a hunt of knowledge, at different levels though. They all gather information and knowledge for later use, arranging and re-arranging the accepted pieces while at the same time they apply degrees of freedom to add new inputs. Yet, once again we observe different levels of synthesizing with a clear but

[148] This will be further discussed in the DEC-DC section

flexible orientation and focus, with bricolage capabilities to rank from very strong (WCo1, WCo2, WCo10) to very weak (WCo5 and WCo7).
Among entrepreneurs' characteristics we assume it is not irrelevant that "weak ventures" are established by agents with **no previous experience and knowledge of the sector.** It is clear that *differences in prior business experience influence the choices as well as the ways and mechanisms engaged.*

New-to-the-world cases of the sample start with ***informal networking*** based on personal contacts and former relationships (initial pool), developing flexible types of co-operations. **Established companies** use more formal ways of networking.

Therefore, summarizing the observations regarding bricolage capabilities in **W&F cases** we could state that:

- Knowledge-intensive W&F entrepreneurs through bricolage capabilities disregard the limitations of commonly accepted definitions mainly of technology and standards, insisting on trying out solutions, collecting knowledge from diverse areas and combining resources for new purposes to fit their business concepts.
- Bricolage capability appears to have a positive effect on making progress in the emerging stage of knowledge intensive venture creation and the creation of initial strong competitive advantage in wood and furniture sector.
- Bricolage capabilities seem to affect innovativeness and the underpinnings of new product development and performance in wood and furniture low-tech industry.
- Differences in prior business experience seem to influence bricolage capabilities and moderate the relationship between them and the likelihood of a strong initial competitive advantage and consequential path creation in wood and furniture low-tech industry.
- The cross-case analysis of the W&F cases regarding bricolage capability further indicates that the capability is affected by the pre-existence of resources, while the level of the entrepreneurial human capital and the initial knowledge assets impacts it together with prior business experience of the entrepreneurs.

7.3.1.b. Improvisational capability in the W&F sector

It has been repeated many times in this thesis that knowledge-intensive low-tech start-ups are seldom founded on the basis of "out of the lab" results. Actually it appears that the whole concept is built around a core idea which has to be constantly revised since new information, knowledge and other resources gather around it through bricolage and reshaped by the impact of the transcendental capabilities. In this vein, in the case of **WCo2** an invention and parallel innovations appear during the erection stage ***in pursuit of more novelty and differentiation.*** The entrepreneur does not hesitate to change plans according to the inspiration of the moment or the new information accidentally met. In the same line, for the sake of innovation and differentiation **WCo4** presents a "female mind" *(use of Greek term hired by Antonis Travlantonis, (1867-1943)*) and implies elements of the improvisational capabilities all over the pre-formation, formation and starting stage of the new venture; the entrepreneurs blend cutting edge technologies with innovative new-to-the market products such as laminated wood from particles and biomass energy novelties.

Changes can also occur due to restrictions and limitations. A typical example among the wood and furniture cases is **WCo1**. The entrepreneurial idea turned around *uniformity in veneer surfacing (which was an innovative concept by then).* Yet, it was changing all the time following the needs and restrictions arising: the business idea shifted from total innovative veneer production to innovative stitching due to financial and technological limitations converting acquired knowledge (e.g. by the German company and the veneer producers) into complementarities and elements of the founders' competitive advantage. **WCo3** uses improvisational capabilities to solve arising problems mainly due to distance resulting in the modular design concept (benchmarking SWATCH) and the subsequent novel changes in machinery.

***Moving on the line between limitations and wish for differentiation*, WCo8 is** established on a totally novel concept. Spontaneous responds to arising problems leads to the "box concept". Opportunities of co-operations and use of novel materials are due to significant improvisational capabilities. Initial target of multi-machinery is further developed in a well-organized and linked production system and requirements appear one after the other (material handling systems, relevant CIM program, adoption of design to industrial design etc.) constantly improving the initial idea. The

entrepreneur was further the first to try the CNC model and man-made raw material in Greece.

Improvisation can also happen just ***due to a strongly embedded improvisational culture*** which is however motivated by the entrepreneurs. An exemplary case of such improvisational capabilities is **WCo10**. The improvisational capability actually supports the strong transcendental capabilities of the company and especially the of the entrepreneur. After the decision to broaden the business scope and scale of the company through corporate venturing, the entrepreneur and his team reworked pre-composed material, plans and designs in relation to unanticipated ideas conceived, shaped and transformed under the special conditions of enriching raw material range. They were constantly adding unique features, building an unconventional image engaging information and knowledge and turning them to strong advantages. They engaged, when suitable to targets, *rebranding, bartening*, *experimentation* and *production and technology* changes, in order to create and promote a "holistic approach of natural life". In order to attract customers and "educate them to the "sleep-in-nature" phenomenon and philosophy, they buy nights at hotels, donate mattresses, co-operate with ecology-cultured hotels (and eventually buy hotels), open unconventional corporate shops abroad and use unusual and unconventional promoting methods. The entrepreneur engages customers, partners or even researchers in his projects or ideas making them stakeholders in order to solve problems or make the most of inspirations. This is a fine way to have real-time information and promote and improve or abandon initial concepts. The entrepreneur claims that improvisation happens for the sake of improvisation and not for specific targets. WCo10 is a constant journey for the entrepreneur. He does not care for the end of it, but he is passionate and impatient about improving, excelling, innovating, involving people into a more natural way of living (and sleeping)

> *"I tell them the truth" he says "and I keep doing the same. I was not afraid when I was in a great need to feed my family and risked to go to jail. Why should I stop now?"*

The entrepreneur trusts his team to improvise and develop their common visions on totally natural living.

Entrepreneurs in all cases were ***constantly reforming the initial business idea even at the erection stages.*** In the two cases of WCo6 and WCo9, reforms refer mainly to

improvements and refinements, as well as deviations which create opportunities. Improvisational capabilities exist in these cases, are effective but are not so strong as in the cases of WCo2 or WCo10. More precisely,

WCo9 revealed certain dimensions of improvisational capabilities, such as diversity, moderate use of regulation and control with a tolerance of mistakes, a sense of urgency, promotion of experimentation and action. Information flowing is achieved mainly through formal business contracts, supported by a strong network that allows synergies and co-operations. **Avoiding routines was a main guideline of the entrepreneur in order to establish a successful new venture.** A core executive team of devoted members was responsible for the realization of it, selecting a flexible team of a few members (in terms of minimal structures) to join the effort and capture as much extensive knowledge around WPC as well as ways to collective activities. Teamwork and collaboration support one another's initiatives. Deviations from plans are associated with arising opportunities such as the possibility to cooperate with Greek supply companies, solutions to problems such as the product's behavior in Greece and alternative methods and uses of the new products. Plant started production within a year expanding markets and opportunities for the Group.

In the case of **WCo6**, improvisational capabilities are characterized by a conscious and stable communication and interaction with the environment. Real-time information excelled the implementation of the new technology, through the study of the results of the lab results and engaged customer's observations. Contacts are mainly formal but changes (mainly improvements) were free to be imposed by all team members. WCo6 is the major case of W&F sample where DECs are significantly affected but not overwhelmed by the strong routines and culture of the company's dynamic capabilities. However, this dependence may have deprived the company of a more innovative profile and maybe better sales rates.

Weak improvisational capabilities appear mostly in cases of remedy actions for **WCo5**. In this case one can detect more an effort to solve unexpected problems or not well planned activities than creative improvising. Major weaknesses in improvisational capability to be named are weak communication and interaction with the environment, a false approach to knowledge management, inadequate human capital and no teamwork. They affect the venture's choices, the competitive advantage they develop, as well as the way this evolves all along the following years.

WCo7 is also a case of weak improvisation capabilities, where facts are not connected to creative actions on the fly. Almost all improvisational dimensions are weak and this in turn created significant disadvantages to further development despite the rapid sales growth the first three years. WCo7's entrepreneurs were the first to tap the related technology and adopt it to local conditions creating the new market segment. However, they did not engage real-time information or any type of flexibility. That is more evident in the ways the entrepreneurs manage information and knowledge as well as their weakness to approach experimentation and market penetration although they both manage to be pioneers in offering to local- national and neighboring markets innovative and knowledge-intensive products and services.

Such weaknesses of improvisational capabilities drive the two companies in very fast product obsolescence, although they both had a pioneering business idea. The two companies rank last in almost all rankings and mostly regarding innovativeness.

38**Table 7.6: W&F improvisational capabilities**

Improvisational capabilities	**WCo1**	**WCo2**	**WCo3**	**WCo4**	**WCo5**	**WCo6**	**WCo7**	**WCo8**	**WCo9**	**WCo10**
Type*	N	E	N	N	N	E	N	N	E	E
Information flowing	Very strong	Very strong	moderate	Very strong	weak	strong	weak	Very strong	strong	Very strong
Provocative organizational competencies	Very strong	Very strong	Moderate	Very strong	weak	strong	weak	Very strong	strong	Very strong

**** N= startup, E=established***

An important dimension of this DEC is the capability to derive and exploit ***real-time information*** which however is not planned or structured. It is the ability to exploit arising opportunities as in the case of the experiments during the erection stage which followed some observation of the entrepreneur and the erectors (WCo2). Or it is the ability to engage customers in testing new products and methods assigning them the role of coordinators and close partners (WCo5, WCo9). Cases refer either to industry customers, such as the cases of WCo1, WCo5, and WCo7 or even to final consumers such as WCo8 and WCo10. Almost all cases include machine manufacturers as main stakeholders since many times such co-operations could lead to innovative machinery –the case of WCo8 is quite an exemplary one; real-time information and cooperation led to a world-level patented new machine that won the innovation prize of the year.

This dimension will later be embedded in the ability to sense the environment all along the value chain and be able to incorporate changes, trends and novelties even if the start-up course had started with different directions (WCo1, WCo4). Market fitness can be partly responsible for imposing such processes of market trends' and gap identification, try and error loops and collaboration setting with various stakeholders all alone the value chain.

Innovative products, processes or even models had to fit with the demands of the market environment thus covering existing markets (WCo3, WCo6, Wco8, WCo10) or introducing new ones (WCo5, WCo9, WCo10). This seems to be almost imperative in the cases of wood and furniture industry. It is quite notable that no case prepared a final business proposal in-house to present it directly in the market without interacting with the environment all along the preparation stage. Sometimes this interaction would take place even before this phase, as in the cases of WCo1 and WCo3.

WCo1 actually shaped and reshaped many times its initial product-and-process concepts relying on the real-time information of manufacturers and local customers. **WCo4** experimented on many completely novel ideas which however did not seem to fit with the existing local/ national markets and led agents to reshape even initial business concept and create a core business based on high wood-processing technology with strong personal elements. **WCo10** started its long journey to new natural raw materials besides the classic ones (i.e. cotton and wood) by **experimenting and many try-and-error loops** regarding both processes of elaborating materials for mattresses and reactions of customers. The dimension of establishing interactions with the environment affects mainly the sensing capability[149].

WCo4 assigns its *high improvisation capabilities* to the strong experimenting dimension and the exceptional provocative competencies the agents own. The company presents high innovation performance although this does not result in relevant sales growth.

Provocative competencies appear in all cases at different however levels of intensity. Most founders revealed that flexibility and working out of routines, budgets and estimations was crucial for the realization of their concept. The new-to–the-world

[149] The two cases of weak improvisational capabilities in general presented also rather weak dynamic capabilities as well (mostly market sensing).

cases do not have routines due to newness and improvisation appears as a normal attitude supporting both inspiration and problem-solution. On the contrary, established firms appear to be purposefully committed *not to use routines* at the phase of starting up a new venture. During the founding actions expansive plans were followed by incremental or even radical deviations as occasions for stretching out into unfamiliar territories, responding in this way to unexpected situations (WCo2), overcoming problems (WCo3, WCo5, WCo8), obstacles (WCo1, WCo3, WCo7) and deficiencies (WCo1, WCo3, WCo4, WCo5).

Across our ten case studies it was quite clear that while flexibility was quite normal and natural in new-to-the world firms, together with the other provocative competencies, they all had to be clearly defined and specified in the cases of corporate venturing. *"Getting out of existing routines, avoid processes and be flexible"* was the strategy set by wood-processing mother-company of **WCo9. WCo2** strategically chose to work with a very limited number of former employees of the bankrupt plant and none by mother-company, while the two entrepreneurs were the only links among the mother and the new company. **WCo10's** policy to use no routines when important changes take place is strongly backed by the exceptionally unconventional personality of the entrepreneur.

Whilst more experience is said to lead to better improvisation and consequently better performance (Arshad, 2011), the converse is evident to two of our corporate cases. These two established companies (i.e. WCo6 and WCo9) *do* create knowledge-based innovative low-tech ventures but they don't manage to depart from established borders the mother company has set. Besides the statement of WCo9's entrepreneur and the creation of a distinct team to work on the project, they did not manage (together with WCo6) to get out of limited changes regarding the novel concept. The impact can be mainly found on the relatively **low innovativeness** of the two ventures.

Creative dissatisfaction is evident in all cases, at different levels though, affecting the evolution of the initial competitive advantage, its quality as well as the paths the new venture will follow. Such dissatisfaction is very strong for WCo1, WCo2, WCo4, WCo8 and WCo10. All these companies established a strong innovative and pioneering (more or less resounding) image in their markets followed by an increasing rate of NPD to date. Creative dissatisfaction was very weak for WCo5 and WCo7. WCo5 tries more to solve problems than produce innovation as a strategy, while

WCo7 did not manage to get further from the initial novel idea and was shortly overwhelmed by other similar ventures. On the other hand, in the cases of WCo6 and WCo9 dissatisfaction is evident but not at a significant level compared to other cases. They follow a more structured and routinised way (compared to the passion of WCo2 and WCo10's agents). In fact, they proceed mainly with experimentation and improvements on initial concept, products and processes.

An important observation is that as repeatedly mentioned above, all dimensions of the improvisational capability are affected more or less by **the personal traits, characteristics, education and experience of the entrepreneurs**. Even in cases that there is a certain number of executives to take over the new venture (corporate venturing), entrepreneurs' contribution is significant. WCo2's and WCo10's entrepreneurs own strong enthusiasm for innovation, while their attitude towards knowledge and novelty, their extroversion and their creative and provocative dissatisfaction lead to the cultivation of better improvisational capabilities contrasting the entrepreneurs of WCo6 and WCo9 who have a rather conservative attitude.[150] These two appear less aggressive and provocative and prefer to compete in well-defined areas (at least within this research), while the other two appear more risky. One should also note that these two entrepreneurs follow the results of sensing and seizing in order to decide new venturing, while the first two seem to rely more on their intuition and inspirations.

In WCo2 and WCo10 cases, it is evident to the observer that although not mentioned, the entrepreneur is the creator, the animating spirit and the main actor for the vision realization. Regarding WCo10, all members seem to be able to follow their leader's vision and act within well-defined roles and rules; indicatively, the HR manager, a person of special skills has succeeded in promoting strong CSR culture outside the company under the entrepreneur's guidance and inspiration but after high-level training as well. Employee involvement in the decision-making process is actually considered important. Motivation incentives are inspired by the entrepreneurs and

[150] *Note! That is only when compared to the first two entrepreneurs only. Both Mr. M. and Mr. Al. are innovative and pioneers in many aspects; e.g. Mr. Al. was the first to produce flat pack furniture in Greece in 1980 introducing the concept of the "element systems" in order to offer integrated furniture syntheses and not under the logic of IKEA. This concept was further reshaped in 1984 ("soft forming" – partly self assembling furniture and 1987 with "components" – totally self assembling furniture for integrated modular furniture.*

well communicated by the executives. It is a case where **individual characteristics of the entrepreneur** turn into values and routines of the whole company.

WCo2 starts with a strong team of engineers of different branches not belonging to the group. The entrepreneur states that "*Development is supported by good relationships"* and has developed a plan of meetings with all value chain partners at different levels. This strategy led to multilevel construction team approaches focused on specific interests. The team uses the "*open books*" method (term provided by the entrepreneur) meaning meetings on various subjects such as problem-solving, knowledge diffusion and information sharing. Company's motto is "high-level extroversion". Yet, one cannot avoid the feeling that strategic decision making **belongs to the entrepreneur who seldom changes his mind.** His executives talk about a man with "the gift":

> "*He has his own rules - that is just a more complicated way of thinking or I don't know. If I knew I could be an entrepreneur myself ... maybe….*"
>
> *(General Director of WCo2)*

The same feeling is hovering around for WCo10's entrepreneur as well, although not directly mentioned by employees.

Altogether, it appears that in W&F cases improvisational capabilities enable mainly design and execution convergence supporting the other two DECs and thus, the constant refinement of the initial business idea. This can be

a) in pursuit of more novelty and differentiation: WCo2, WCo4
b) due to restrictions and limitations : WCo1, WCo3, WCo8
c) due to a strongly embedded improvisational culture WCo10
d) due to the need of improvements and refinements: WCo5, WCo6, WCo9
e) for solving problems and obstacles: WCo1, WCo3, WCo5, WCo7, WCo8

Sometimes it can be a combination of the above reasons but in all cases it happens without really knowing where one's queries will lead or how action will unfold. As presented in Table 7.6, among the ten cases, five of them presented very strong improvisational capabilities (WCo1, WCo2, WCo4, WCo8 and WCo10), two of them strong (WCo6 and WCo9), one of them moderate (WCo3) and two of them very weak ones (WCo5 and WCo7).

The improvisational capability appears to have a positive effect on making progress in the emerging stage of knowledge intensive W&F venture creation and the creation of initial strong competitive advantage. It seems to affect mainly innovativeness and path creation thus future strategy and choices, shaping at the same time the technological part of the W&F business concept. . However, strong improvisational capability appears to be **irrelevant of company's size and former condition.** Therefore, it is further confirmed that resources alone are not sufficient to create strong improvisational capabilities or build strong initial competitive advantages. **In contrast to bricolage, established companies do not present stronger improvisation capabilities than new ones.** The capabilities seem to be better *organized and well-structured* but not stronger (e.g. WCo1s, WCo3, WCo4 and WCo8 present very strong improvisation capabilities).

Therefore, **summarizing the observations** regarding improvisational capabilities of W&F sector,

- Improvisational capabilities enable the constant refinement of the initial business idea in pursuit of more novelty and differentiation, due to restrictions and limitations or due to a strongly embedded improvisational culture but without really knowing where one's queries will lead or how action will unfold
- Improvisational capabilities affect innovativeness and the underpinnings of new product development and performance.
- Improvisational capabilities have a positive effect on making progress in the emerging stage of knowledge intensive low-tech venture creation and the creation of initial strong competitive advantage.
- The level of human capital of the entrepreneurial team will moderate the relationship between improvisational capabilities and the likelihood of a strong initial competitive advantage.
- The amount and quality of existing resources affects improvisational capabilities and moderates the relationship between and the likelihood of a strong initial competitive advantage and consequential path creation in wood and furniture low-tech industries.

Yet,

- Resources are not alone sufficient to create strong improvisational capabilities or build strong initial competitive advantages in knowledge-intensive low-tech ventures.
- Strong improvisational capabilities seem to be irrelevant from type of venture to be created (new-to-the-world or corporate). However, in cases of corporate venturing, established organizations were observed to deliberately activate provocative competencies as well as the other dimensions of improvisational capabilities.

7.3.1.c Transcendental capability in the W&F sector

Summarizing from the first hypothesis' analysis, we have claimed that transcendental capabilities are responsible for the initial business inspirations of the actors. They actually guide and direct the other two dynamic entrepreneurial capabilities. We could say that bricolage and improvisational capabilities perform rather executive functions while the transcendental are strategic directional capabilities. **They are actually the ones to define the depth, the impact and the degree of novelty of the business concepts;** ***that is the initial competitive advantage, the position of the new venture within the existing or the newly created business ecosystem and the new venture's dynamism***. In traditional low-tech industries agents cannot rest only on the technological novelty as in the majority of high-tech innovation start-ups, but they produce a whole new system around their idea. Otherwise even innovative products can be driven to trivial results. Typical examples of unique novel business concepts belonging to traditional sectors in relative literature are IKEA and Zara[151].

The W&F case analysis indicated that strong transcendental capabilities lead to strong business concepts with unique characteristics which create in turn strong initial competitive advantages. And more precisely,

WCo10 with its strong transcendental capabilities produces worldwide pioneering results which do not rest only on product-process and model novelties but reform the relative business ecosystem as it will be explained in the following section[152]. Based

[151] e.g. At the heart of Zara's success is a vertically integrated business model spanning design, just-in-time production, marketing and sales. A unique 'fast fashion' business model and relative growth strategy

[152] Coco-Mat has 70 stores in 11 countries. Since 2012, the company's affiliate in China has been opening shops at the rate of one per month. A Coco-Mat outlet inside the ABC Furniture building in

mainly on knowledge and transcendence, the entrepreneur states that his business idea fits with nature and that **he is the one to define the market demands** ***for those who accept to be educated***.[153]

39**Table 7.7: W&F transcendental capabilities**

Transcendental capabilities	**WCo1**	**WCo2**	**WCo3**	**WCo4**	**WCo5**	**WCo6**	**WCo7**	**WCo8**	**WCo9**	**WCo10**
Type*	N	E	N	N	N	E	N	N	E	E
Transcendental conditions	moder ate	strong	moder ate	moder ate	weak	strong	weak	strong	strong	strong
Transcendental synthesis	Moder ate	strong	Moder ate	Moder ate	weak	strong	weak	strong	strong	strong

**** N= startup, E=established***

Methods and strategies used are rather unconventional. The entrepreneur of **WCo2** took advantage of its innovative process to become worldwide famous by ***revealing his secrets*** to global competitors; a rather unorthodox idea! He organized a campaign around it, inviting all interested in the specific innovation. He himself explained his novelties to the most important multinational melamine producers of the world. CEOs of American, European and Japanese companies visited Grevena to see the novel technology. That was the entrepreneur's way to enter the world of global leaders and to "*become one of those, who make the rules of the game... The plant is open to everybody. It is a way to build new contacts and relations, to exchange knowledge… This networking is driving me today in USA's market".*

The agents have the deep feeling and conviction of creating the future. In these two cases of corporate venturing, the agents alter the relations with the suppliers, they move up the value chain and give new different and value adding meanings to conventional products **changing existing markets**. Mattresses become more than just bed accessories and the act of buying a mattress turns to an act of pleasure and of "return to nature". Melamine produced by WCo2 brings up the challenge of modularity and variety entering ecological aspects in an artificial product.

Lower Manhattan opened in 2010, and the brothers plan to open 10 stores in the United States in the next two years. Global sales for 2011 were $70 million, 15 percent higher than the year before. Of the 30 Coco-Mat stores in Greece, five opened in 2011, in the very teeth of the crisis.

[153] He is actually the one who gave the author the idea of the transcendental capability. *"It is the ability to "see behind" things. Yet, it is a privilege that you must always exercise. Alone it is not enough. You look to the same direction with someone else and you can see opportunities while he sees only difficulties"* Paul Evmorfidis, WCo10's entrepreneur.

The other **two corporate ventures** are moving on a more secure road. They both want to master their eco-systems but in more conventional ways; i.e. by excelling in quality **(WCo6) challenging existing standards and beliefs** and by creative application of patented technology (**WCo9**). In a way, they both see their efforts ***as acts of offering*** to the world of marine and eco-materials respectively[154]. Intentions result in moderately exploited reproductive transcendental synthesis. However, the two companies challenged and changed their ecosystems advancing customers' requirements, methods and techniques (e.g. shipyards worldwide). They further created new entrepreneurial activities all alone the value chain such as recycling polyethylene producers as suppliers, and WPC fence and floor makers and installers (a new business activity at least in Greece, Cyprus and Balkans) as customers. Both companies produced satisfactory revenues, increasing fame and securing leading roles in the relative subsectors worldwide. Thus, it seems that t*he stronger the transcendental capabilities, the better and wider the formation of the new business ecosystem around the new venture regarding W&F cases.*

WCo8, the only new-to-the-world case to present strong transcendental capabilities is established by an entrepreneur who holds the privilege of a PhD and a successful relevant family company. The entrepreneur deliberately shaped a new ecosystem in kitchen construction for small companies *based on automatization, parametric design and flexibility* at the same time, taking the leading role in it. This has been appreciated by both customers (in the high-value market the agent strategically chose) and by competitors; actually, the two major Greek competitors replicated the novel process methods under the WCo8 entrepreneur's guidance. The entrepreneur managed to keep staying a pioneer with further novelties for more than a decade presenting fast growth sales and high level of innovativeness. The severe crisis of the last years (2009-2013) hit the company since it covered only local/national markets. The main weakness of the entrepreneur's transcendental capabilities could be located in transcendental synthesis which was trapped within national borders and limited the company's dynamic potential. (*Some hesitation due to the age of the agent? A false interpretation of the "think globally act locally" way the entrepreneur had consciously adopted*?) The case lagged behind the 4 corporate ones in **this dimension of market expansion.**

[154] Wood shortage, increase of timber price due to China entrance to the world markets and recycling were mentioned as important reasons that drove the entrepreneur to decide about the new venture

Its consequences are evident during the crisis period in Greece with company's sales dropping remarkably at an annual basis since 2009.

All the other new-to-the-world ventures present transcendental capabilities which range from moderate to weak. **WCo1** and **WCo4** present **moderate transcendental capabilities** (regarding mostly transcendental conditions which cause a domino effect to the other dimensions)**.** The new ventures do not manage to cause significant changes to their business ecosystems and take a leading role in them. **They create a strong initial competitive advantage regarding mostly technical innovation but they cannot work it out to capture leadership.** However the two cases prove the central role of knowledge to the relevant timber sub-sector. Both new ventures **show high innovativeness rates** in the following years. These cases indicate that **even moderate transcendental capabilities can lead to the creation of strong initial competitive advantages and set the foundations for knowledge-intensive innovations.** The two companies also present higher MASR[155] than WCo6, WCo8 and WCo10. Still, they do not manage to change business ecosystems and enhance dynamism as much as the "big five" (i.e. WCo2, WCo6, WCo8, WCo9, WC10) do.

WCo3 is an exceptional case regarding transcendental capabilities. Although moderate, the initial concept is dynamic, knowledge-intensive, pioneering and risky. Yet, moderate transcendental conditions limit future plans in regional and national borders and diminish the potential of the initial concept. The company presents high MASR and CAGR (it is ranked second and first respectively) but it draws back very soon diminishing innovative competence and creativity.

All three ventures with **moderate transcendental capabilities** present increasing sales – at least till 2009, before the severe economic crisis in Greece - and create niche markets without however changing the business ecosystems they belonged. This indicates that ***moderate transcendental capabilities affect positively innovativeness and growth but cannot offer leadership.***

The **two "weak" cases (WCo5 and WCo7)** reveal the importance and the strategic role of transcendental capabilities among DECs. Both companies do not manage to survive (besides their novel concepts) and although they start as knowledge-intensive, they do not manage to cultivate an innovative culture. Weaknesses of transcendental

[155] Mean annual sales rate

conditions affect initial core choices regarding area of activation (spaciousness) and transcendental synthesis in a negative way, limiting innovativeness and choices. Weak transcendental capabilities result in many inconsistencies regarding competitive advantages, instability in strategies and incapability in communicating novelties.

A significant observation is that all successful new-to-the-world ventures have developed the **first type of knowledge-intensive entrepreneurship;** they have a more balanced emphasis on different dimensions of innovation and rely mainly but not solely on external knowledge seeking, trying to produce simultaneously product, process and administrative innovation. This has once again a lot to do with "the threshold that new firms have to reach which enables them to exist in the market" (Carrizoza, 2007). In such cases transcendental capabilities capture (and have to capture) all entrepreneurial sides of a novel concept. Thus, the first type of KIE seems to be the only one to guarantee at least survival in W&F industries. The two unsuccessful cases back up this assumption; they both developed and focused on only technical dimensions of innovative concepts relying only on external knowledge.

On the other hand, in cases of corporate venturing, there is more elasticity of choice although we have not observed any corporate case of the third type. World excellence and leadership seems to require again the first type of KIE. WCo10 is an excellent example of this assumption.

WCo2 turned mainly to technical innovation and excellence but this was followed up by parallel novel strategies such as a vertically integrated business model in cooperation with the rest SBUs of the sector, the unconventional marketing methods and flexible just-in-time production which is very unusual for the specific subsector. Still, all other novelties are supporting and complementary compared to WCo10 which invests equally on all types of knowledge and innovation.

WCo6 and WCo10 approach novelty and competitive advantage building in a more technical way, relying on the existing strong and successful organizations through both internal and external knowledge seeking.

Thus, the above observations indicate that former agents' condition (i.e. corporate or new-to-the-world venture) affects the quality of transcendental capabilities which in turn defines the type of KIE development.

The cases indicate that *it is easier in Greek W&F industry to reform an existing organization and make it knowledge-intensive than start a new one.*

Transcendental conditions turn up to play a key role in the configuration of the transcendental capabilities in all W&F cases. We have named **strong or high PEA** the capability of agents of a strong sensation of global facts and business ecosystems, their positioning and of a dynamic view of potential markets and opportunities. **Weak or low PEA** presents weaknesses on both the two above parameters.

In both our "weak" cases (**WCo5** and **WCo7**), weak PEA is a result of not knowing the relevant (or the most relevant) business ecosystems, being locked into national borders and trapped by their own beliefs. This weakness may have also created a feeling of insecurity (which contradicts the dimension of deeper conviction) and a hesitant prediction of market potential. Weak PEA seems to be further co-responsible for low after-venture creation novelty and mediocre business development. Innovative ideas are promising and bear the potential to trigger the development of the new ventures, but instead of being exploited in equally novel ways, they stay trapped in agents' moderate formation of transcendental capabilities. We remind that both ventures resulted in failure within the five following years.

On the other hand, our "big five" had already reached **high PEA**; the four of them due to the dynamic capabilities of the parent company and WCo8 through a combination of informal and loose sensing and seizing inherited by the family company and the entrepreneur's own tendency to purposefully develop this dimension (i.e. PEA). This was achieved through relevant PhD studies, work experience in international companies and a constant and well-controlled pursuit of information, knowledge and practices on all relevant to the initial, general and vague vision.

Yet, we can detect different levels of PEA also among the "big five" which can be divided into two categories: The *"cosmopolitans"* such as the agents of WCo2, WCo8 and WCo10 and the *"industry masters"* such as the agents of WCo6 and WCo9. The first ones have a wider approach around the phenomenon of their business concepts and are open to every chance offered independently of origins and initial relevancy. The second category involves the development of a higher PEA but only within the industry, focusing on mainly technical knowledge-intensive innovation and embracing parallel -novel or not- activities to support novelty such as top leadership models, quality excellence and novel training models. However, we should mention that this kind of limited PEA may constrain the search zone, reducing the ability to quest and use knowledge developed elsewhere. The cases indicate that this danger is

higher for new-to-the-world W&F ventures, while it can be a choice in corporate venturing. This aspect coincides with our conclusion about the most suitable type of KIE for nascent firms (as referred above); development and focus on only technical dimensions of innovative concepts relying only on external knowledge has led to failure the two W&F cases[156].

Higher PEA in the "big five" cases offered leadership by changing or challenging the relevant business ecosystems and through the creation of strong initial competitive advantages, increasing fame and expansion potential (the corporate ventures have also a strong export orientation) as well as significant sales.

Moderate PEA led to mainly technical knowledge-based innovation which however was not translated in a relatively advanced venture, since it was not deployed equally at the technology, market and business axe (WCo1, WCo3 and WCo4). Consequently, although the relevant three cases present high innovativeness and started with satisfactory MASR and CAGR, they did not manage to change (or challenge) their business ecosystems and produce rapid sales increase or a new trend towards their products. Actually WCo3 presented an impressive sales volume for the first two years but did not manage to keep following this trend. Agents had developed a very good sensation of their positioning but they had underestimated the difficulties of distance clustering and knowledge management processes. They were also trapped into their desire to get a piece of the existing national market pie and did not consider the perspective of creating a new niche market although they were conscious of their novelties and they had the opportunity and the potential to do it.

On the other hand, both WCo4 and WCo1's entrepreneurs have a very good picture of the sub-sectors they belong to, they purposefully develop product and process knowledge-based innovation but they do not have a panoramic view of the wood and furniture sector which would allow them to create more opportunities and new markets in more extensive ways (mediocre sense of spaciousness).

WCo8 can be seen as an exception since the two of the above companies (WCo1 and WCo4) are also follow-ups of a family company with a significant resource pool and knowledge of the entrepreneurial scene at national level. Yet, differences can be

[156] It is worth to note here the interaction, consistency and coherence of the conclusions regarding transcendental conditions and KIE types which actually exists among all DECs and strengthens the assumption that they constitute a set of dynamic entrepreneurial capabilities necessary to start a successful LT-KI venture nascent or corporate.

traced at the levels of former experience (both educational and professional) of the agents which offers a significant advantage to WCo8's founder regarding his global views and international experience as we have already mentioned. Thus, it seems that in the cases of start-ups entrepreneurs have developed a limited level of PEA which revolves around a domestic or even strictly local picture of the sector, local markets and certain knowledge limits and affects negatively transcendental capabilities and especially transcendental conditions.

In the wood and furniture cases **spaciousness** is sought to:

a) *innovative behavior of existing products* questioning weaknesses and improvements in known areas such as the novel fiberboard based on novel properties (WCo2), the innovative veneer and sea plywood stitching and forming for superior quality (as of WCo1 and WCo6 respectively),

b) *products patented by supplier multinationals used in pioneering ways* (WCo5, WCo7, WCo9)

c) *novel business models* (WCo3, WCo10)

d) *novelty around technology* (WCo1, WCo2, WCo4, WCo8, WCo9) and their combinations as already mentioned above.

Sense of spaciousness depends on the agents' attitudes and cognitive capabilities, knowledge as well as the search they do for the idea creation as it has been discussed in the previous section. The "big five" have presented strong cognitive capabilities and a long search for the idea and knowledge needed, devoting significant amounts of money and time. **WCo1** presents some weakness regarding PEA and sense of spaciousness since it starts with a local perspective. However, it will soon expand to broader markets and more innovative efforts. This is due to strong transcendental synthesis and the strong bricolage capabilities which, combined with the entrepreneur's deepened conviction, led to promising competitive advantages and survival even in the middle of the severe Greek crisis.

Regarding the two weak cases moderate to weak sense of spaciousness led to weak bricolage and improvisational capabilities thus defined a moderate width and quality of sources to seek, resources, ways and combinations required. **WCo5** rested on sources offered by the honeycomb provider and **WCo7** in technology and perspectives as given by the Italian technology providers. Italian customers were found through the connections and networks of technology providers again. Both

companies preferred to enter a secure existing business system; i.e. WCo5 trusted its novel idea to a big customer and WCo7 trusted the Italian customers. Both new firms missed the opportunity to create their own ecosystem with their own rules as pioneers.

Therefore, **transcendental conditions of a higher level allow for deeper and more creative and unconventional transcendental synthesis and consequently more effective use of the other two DECs.**

LT-KIE seems to start with a vague and not well-shaped idea (e.g. "sleep in nature" or "different snacks") which will gradually take a shape getting out of commonalities and familiar ways of thinking in order to produce novelty.

> *"We then invested in hotel-boutique idea. This was not even an integrated business idea till it was completed!" (Entrepreneur of WCo10)*

This coincides with Peter Senge's views who in his fine work "The Fifth Discipline" highlights the importance of transcendentalism itself. He states:

> *"New insights fail to get put into practice because they conflict with deeply held internal images of how the world works; images that limit us to familiar ways of thinking and acting". (*Peter Senge, 1990).

This is also the reason of the low interest on **patents and intellectual property protection.** Business concepts are built around the agents' own transcendental thinking and unique architectural mechanisms and realized by bricolage and improvisation capabilities. The result is not a single technology or a mere family of innovative products to be copied and reproduced. Agents of wood and furniture sector stated their belief in the strength of what is called "transcendental synthesis".

> *"You ask me if I have any secrets to protect. No! I haven't, because I built something totally mine. It bears my own, unique hallmark!"*
>
> *(Entrepreneur of WCo10)*

Regarding **transcendental synthesis**, once again, established companies of wood and furniture sector show up to develop stronger TS than new-to-the world ventures. This is a natural aftermath of their excellence in transcendental conditions as well. Objections to this observation can arise if the novel ideas are seen strictly from the point of product or process novelty. In such cases both WCo1 and WCo4 come up with more innovative ideas than WCo6 and WCo9. Yet, even by definition all DECs address **KIE** and not only innovativeness, which is a parameter but not the sole one of

KIE. Thus, the dimension of **Transcendental Synthesis affects the whole business concept** and as such, established companies once again take the lead. We always consider WCo8 in this category, since it is a special case as we have many times mentioned above. Therefore, it seems that **strong transcendental synthesis supports the production of strong LT-KI business concepts that cover the whole new entrepreneurial activity and not only the novel product/process/service concept.** Consequently it is not only innovation but the whole *entrepreneurial schema around it* that judges the produced advantages as competitive or not.

We have already mentioned that W&F sector cannot present radical breakthrough innovation and surprise markets as high-tech industries usually do. Yet, in these KIE cases all novelties can be considered radical according to Liefer et al.'s (2000) definition which has been considered as one of the most precise ones (Benedetto et al., 2008) and is in line with relevant literature[157]. Following it, a radical innovation project is one with the potential to produce one or more of the following:

a) an entirely new set of performance features such as WCo4, WCo5, WCo6, WCo10
b) improvements in known performance features of five times or greater: WCo1, WCo6, WCo7 and WCo9
c) a significant (30 % or greater) reduction in cost such as WCo2, WCo3 and WCo8

According to findings, productive TS[158] is not easy to be developed at least in the W&F industry[159]. Although all new ventures support radical innovations, most of them (seven out of ten cases) present reproductive TS and only three of them present productive TS[160]. Among the three productive, two of them, WCo8 and WCo10 are

[157] Radical innovation is the novel, unique or state of-the-art technological advance in a product category that alters significantly the consumption patterns in a market (Abernathy and Utterback, 1978; Gatignon et al., 2002). A **radical innovation** is a product or process with either unprecedented performance features or familiar features that offer significant improvements in performance or cost that transform existing markets or create new ones (Dosi, 1988).

[158] We remind that Productive TS is the power of exhibiting and producing an original concept prior to experience (*exhibitio originaria*) and Reproductive TS the power of producing it on a derivative way by bringing back an empirical intuition (business idea) previously held by the organization (*exhibitio derivata*) and then we refer to adaptive or similar types of innovation. It is also partly conceptual as it connects directly with the determination of the form of a sensing opportunity.

[159] During the analysis, it was really exciting to expect the results and compare this with the other two sectors.

[160] The definition of TS is actually stricter than existing definitions of radical innovation. A radical innovation is a product, service and process with entirely unique or significant improvements in existing features which improve the cost and performance (Leifer et al., 2007). Productive Phantasia refers to only *exhibitio originaria* (see Note 78)

cases of well exploited **productive TS** which did not rest on a novel process/product but covered all three axes of business activity; namely technology, marketing and business models. WCo4 presents radical innovation but cannot develop equally all three axes within this novelty (and more precisely marketing and relative business model). On the other hand, the lack of original exhibition and thus the bringing back of an already existing knowledge-based innovation and its appliance in new markets and under new conditions while excelling it is a major feature of **reproductive TS.** WCo9 and WCo7 have introduced patented technology for innovative products into Greece and Balkans. WCo9 managed to adopt the product to local conditions, train customers and open markets while the new venture stimulated further research of the novel product which ranged from design to formulation and properties.

> "The truth is that he envisaged a new market. There was too much talk about wood, too many problems. And yet he (note: the entrepreneur) was the only one. WPC was totally unknown but even when he introduced it, there was no interest in the sector. They wanted to ignore it. But he did not allow it. He trained them…" (CEO of WCo9)

On the other hand, WCo7 was not able to do the same and got trapped into existing Italian markets. Contrary to the WCo9's entrepreneur's ability to see and create new markets, WCo7's entrepreneur seemed to present a lack of relevant vision.

WCo1s, WCo2. WCo3 and WCo6 innovate also on existing technologies and models. They produce rapid innovation according to Liefer's definition but they are not cases of pure original exhibition, since they are all based in former empirical business concepts which were excelled. WCo1 and WCo6 actually **advance quality** by innovative process methods. WCo3 takes further the notion of clustering and WCo2 reached the "more than 30% cost reduction" with its innovative technology. All ventures develop all three business axes at different however levels due to reasons mentioned above.

Therefore, reproductive TS is more common than productive TS in knowledge-intensive low-tech new ventures of wood and furniture sector. Actually, seven out of ten cases present **reproductive TS**. Among the 3 productive, 2 are well exploited. Analytically,

Productive and well exploited TS (strong TS): WCo8 and WCo10

Reproductive TS and well exploited (strong TS): WCo1, WCo2, WCo6, and WCo9

Productive but not properly exploited (Moderate TS): WCo4

Reproductive TS but moderately exploited (moderate TS): WCo3
Reproductive TS and poorly exploited (Poor, weak TS): WCo5, WCo7

It is quite interesting to note that almost all agents of the corporate venturing cases have a common feature: they had all been pioneers (not necessarily innovators) at least at local level in the past, before the knowledge-intensive venture:
WCo2's entrepreneur was the first to introduce MDF in Greece while all other entrepreneurs of the sector used particle boards. He narrates *"It (MDF) worked fine in Australia. I had the feeling that it would work in Greece as well"*.
WCo9's entrepreneur was the first to put edge grains on melamine by ironing them and cut pieces for furniture. His CEO narrates *"All were negative. 'No use', they were whispering. And yet, this was a radical innovation at least in Europe, as far as I know. He was the one to start it"*.
(Writer's note: Today there is only a very small percentage of melamine without edge grain. Technology and machinery has been highly developed to excel this process of Wood *grain PVC Edge* Banding).
WCo10's entrepreneur back in 1989 provided mattresses with a zip and "everybody was laughing" according to his sayings; still this was a worldwide innovation that introduced transparency and opened a new section in mattress technology by involving nature. The entrepreneur was also the first (at least in Greece) to question the need of a mattress to be hard.
Although it is quite early to name this former "experience" in pioneering as a "necessary" pre-condition for KIE in LT industries, it can surely be considered as an important element of strengthening the "judgment dimension".

In both **WCo5** and **WCo7** cases, weak judgments combined with weak receptivity and spontaneity led to rather mediocre transcendental syntheses and unsatisfactory and incomplete plans and business visions. Weaknesses are once again attributed to agents' human capital (e.g. characteristics, previous experience, knowledge etc.), initial resources and transcendental conditions.

The dimension of transcendental synthesis seems to affect significantly the business concept formation in all of these cases:

- **Strong transcendental synthesis** supports the production of strong business concepts that cover the whole new entrepreneurial activity and not only the novel product/process/service concept.
- **Weak transcendental synthesis** supports the production of business concepts that are not able to equally cover the whole new entrepreneurial activity resting only upon product/process or service novelties.

All W&F cases revealed that besides seeking knowledge, a major and common trait of successful KIE is **deepened conviction.** Previous experiences and successes together with the existence of strong networks or a strong starting knowledge pool impact the level of this entrepreneurial trait. It actually seems to be a moderator of *how much challenging* the business concept will finally be. More precisely:

WCo2 drew on the significant business success of the mother company since 1989, its strong position in the Greek and Balkan market, existing contacts with world leaders all along the value chain (creating high level PEA), the flourishing economy by then, easiness to invest and HR commitment to new vision.

WCo6's deepened conviction sprang from their long term leading presence and their significant success in the sector.

WCo8's deepened conviction derived by the family entrepreneurial milieu, the strong and international educational background, the actor's experience at the two multinationals and his personal abilities and characteristics combined with his strong basis on industrial design, economics and programming.

WCo9's creator owned a spherical knowledge of the specific LT sector, affiliated sectors and relevant knowledge bases due to the mother company's absorptive capacity and dynamic capabilities. The company's story since 1980 reveals a high level of PEA within all the spectrum of furniture sector, a deep knowledge on both solid and non-solid wood (e.g. MDF) a dominance in Greek market and an aggressive development in other markets. It also reveals strong sense of spaciousness with a strong tendency towards gap creation; the entrepreneurs has been a pioneer in several innovative efforts such as the "element systems", "soft forming", and modular and then knock-down furniture etc. We should also mention that he was among the few to foresee IKEA's threat.

WCo10: A significant increase in sales since 1989 and the enthusiastic acceptance of the new way to see the phenomenon of sleep supported the company's deepened conviction together with the entrepreneur's strong devotion to nature, his unconventional character and passion.

However, very strong deepened conviction has been traced also in the cases of **WCo1** and **WCo3**. Both new ventures presented a dynamic start-up phase with WCo3 to hold the first and second position in CAGR and MARS respectively and WCo1 to follow the big five in total efficiency.

A careful study of the cases shows a further gradual development and increase of deepened conviction when the agents received favorable attention for their initial vague ideas which however did not necessary came from customers. **WCo1** enjoyed acceptance and support by relative firms in Germany and France which assisted in integrating the agents' novel concept. **WCo3** got knowledge and technical support by the Italian furniture cluster. Such agreements increase significantly deepened condition and assist the further development of the initially amorphous idea.

WCo4's conviction is deepened due to the growing trend towards quality and ecology as well as ecologic composite materials.

As a matter of fact the actors' Deepened Conviction that *"resource scarcity and energy efficiency could be drivers of innovation in the 21st century"* was traced in almost all cases. WCo10, WCo4, WCo7 and WCo9 presented the stronger commitment to address these challenges and take advantage to build successful ventures.

WCo5 relied on the fact that a strong technical knowledge pool was found, which was partly true but not enough. Limited experience gave birth to some teleology (which can be a pitfall as we have mentioned in the relative theory). Otherwise, the agents would have seen that this kind of assistance could not be enough for such novel uses of honeycomb and could have turned at least to the material producer. Although conditions were perfect (chipboard had made its cycle in 90s and by then there was no direct competitor since *Rxxx* Company that produces honeycomb as raw material got interested in the Greek market only in 2008) the agents did not manage to create an adequate market or relevant conditions to ensure success.

Low conviction is also traced in the case of **WCo7**. Afraid to expand more to the "unknown", the actors got trapped in covering needs in the existing Italian market which actually offered no real and unique advantage to the Greek venture.

Furthermore the entrepreneurs did not take the risk to adopt the novel product to Greek conditions, although they were given such an opportunity by the relevant regional Technological Institute (WFDT department). The agents were also hesitant to risk an aggressive market entrance at national level due to certain institutional limitations in the area of Attica which they did not even try to overcome. The case supports the assumption that deepened conviction is partly a trait of entrepreneurs but it also depends on previous experiences and successes, strong networks or a strong starting knowledge pool that secures the idea support. Neither experience, nor former networks of any kind existed to support it in this case.

Consequently, it seems that l**ow level of conviction hinders entrepreneurial novelty and creativity of ventures in wood and furniture industry.**

Discussing the two weak cases a little bit further, we could say that weak DECs are partly due to human capital and resources including specific attitudes of the entrepreneurs. In both weak cases the entrepreneurial teams did not satisfy the basic traits and characteristics which were located in the other cases and considered as a minimum pre-condition for KIE in low-tech industries. They did not have an extensive experience in the sector and their academic background was irrelevant of it. They neither tried to "learn all about it" as stated by WCo10's entrepreneur who could be also partly considered in this category (of no relevant education). He actually narrated that he spent many years in learning all about sleep, worked on conventional mattress production (i.e. cotton and wool) for about a decade and then turned to KIE. The agents of the two weak cases did not experience this *transitive phase*. In these two cases we detect a quite significant receptivity but very low spontaneity and judgment which led to poor TS. They try to find easy answers to the significant questions they have initially set when creating the problem; e.g. they rely on specific customers to produce answers which become in this way and quite wrongly the "fruit of hopes" for both of them. They respond to arising needs with limited networking and limited knowledge seeking.

These two cases present also a negative reaction to time pressure together with ambiguity and uncertainty; while in the eight cases these conditions stimulate transcendental capabilities and improvisation it is not the same with WCo5 and WCo7, where knee-jerk reactions and unreasonable grounding led to false decisions.

Transcendental capabilities - stronger or weaker - were found in all ten W&F KI cases. Entrepreneurs of the sample admitted to have started out of the tight local and sectoral limits, with an unshakable belief in something without need for proof or evidence. Transcendental capabilities seem to guide and direct the rest two DECs defining the depth, the impact and the degree of novelty of the knowledge-intensive business concepts. They seemed to be responsible for the positioning of the new venture within the existing or the newly created business ecosystem and the new venture's dynamism.

Former agents' condition (i.e. cases of corporate or new-to-the-world venture) affected the quality of some of the dimensions of the transcendental capabilities which in turn defines the type of KIE development; more specifically, Greek W&F KI established organizations manage easier to develop transcendental capabilities of far higher levels and apply them in more controlled ways than most new entrants when realizing KIE through corporate ventures. Established companies present more organized and well-built functioning of all DECs. The superiority in human and other resources is evident in all corporate cases too.

On the other hand, Greek W&F KI nascent entrepreneurs seem to have a limited picture of the sector which revolves around local markets and certain knowledge limits and affects negatively transcendental capabilities and especially transcendental conditions. They have to spend more time and money to learn about and collect the relative pieces of the knowledge puzzle, form more precise questions and locate the areas needed to realize their initially vague vision. They have a looser framework (and fewer candidates) for judgmental decisions and lean more on personal experience and their own judgments.

It is quite notable that for the nascent ventures WCo1, WCo3 and WCo4 the big experience of previous business activities was not enough to produce results as corporate venturing does. WCo8 is not considered an exception since it is the natural follow up of a family company with a significant resource pool and knowledge of the entrepreneurial scene at national level, combined by the personal world view of the new entrepreneur and the significant assistance of the entrepreneur's family at all levels (e.g. networks, financial, knowledge).

Since the entrepreneur of **WCo10** was the one to inspire the author the concept of transcendental capability, a reference to the case seems to be a proper way to close the section.

The entrepreneur created a need to combine the phenomenon of sleep with nature. He created literally "something out of nothing"; novel products made of sea grass and horse-hair are disposed in novel ways promoting a strong commitment to nature and human being. Global energy crisis, ecological problems as well as the financial crisis constitute real challenges triggering the entrepreneur's creativity. WCo10's innovative business model remains unique at global level surpassing actually Slywotzky's (1996) definition of business model at the strategic level; ''*the totality of how a company selects its customers, defines and differentiates its offerings, defines the tasks it will perform itself and those it will outsource, configures its resources, goes to market, creates utility for customers and captures profits.*''

The company today competes in the high end of the mattress market and is a leader in the fast-growing 'eco-bedding' category which leverages both the 'sleep awareness' and 'natural living' trends that are prevalent, especially in export markets.

As an American journalist puts it "Combining human and environmental sensitivity with profitability needed not only a strong and persistent will, but also a great deal of **imagination, open-mindedness and research** (author's note: i.e. transcendental capabilities; bold added by the author)".

> "There are a thousand things you don't know in the beginning. You may go under… Ok! This is the risk! But … this is the ability to see behind things. It is not only a talent. You have to work on it constantly!"
>
> (WCo10's entrepreneur)

Summarizing the nature, dimensions and impact of transcendental capabilities as observed in the W&F cases, the following observations can be stated:

- Transcendental capabilities guide and direct the other two DECs. Bricolage and improvisational capabilities perform executive functions while the transcendental are strategic directional capabilities.
- Transcendental capabilities define the depth, the impact and the degree of novelty of knowledge-intensive business concepts; i.e. the initial competitive advantage, the position of the new venture within the existing or the newly created business ecosystem and the new venture's dynamism. Consequently,

- Strong transcendental capabilities lead to strong business concepts with unique characteristics which create in turn strong initial competitive advantages.
- The stronger the transcendental capabilities, the better and wider the formation of the new business ecosystem around the new venture
- Moderate transcendental capabilities affect positively new knowledge-intensive low-tech venture's initial competitive advantage as well as its innovativeness but cannot offer leadership.
- Weak transcendental capabilities result in many inconsistencies regarding competitive advantage and business ecosystem, instability in strategies and incapability in advancing and communicating novelties.

- The level of human capital of the entrepreneurial team will moderate the relationship between transcendental capabilities and the building of a strong initial competitive advantage at least in wood and furniture industry.

- Former agents' condition (i.e. cases of corporate or new-to-the-world venture) affects the quality of transcendental capabilities which in turn defines the type of KIE development at least in wood and furniture industry.

- In wood and furniture sector in Greece established organizations manage easier to develop transcendental capabilities of far higher levels and apply them in more controlled ways than most new entrants realizing knowledge-intensive entrepreneurship through corporate ventures.
- In wood and furniture sector in Greece in the case of start-ups the agents usually have a limited picture of the sector which revolves around local markets and certain knowledge limits and affects negatively transcendental capabilities and especially transcendental conditions.
- The dimension of transcendental conditions has a significant impact on core choices and development of innovativeness in new low-tech but knowledge-intensive ventures and at least in wood and furniture industry.
  - Weak transcendental conditions affect in a negative way initial core choices regarding area of activation (spaciousness) and transcendental synthesis and consequently levels of innovativeness and choices.

- Higher level of transcendental conditions allows for deeper and more creative and unconventional transcendental synthesis affecting positively levels of innovativeness and choices.

- The dimension of transcendental synthesis affects significantly the business concept formation in new low-tech but knowledge-intensive ventures and at least at least in wood and furniture industry.
  - Strong transcendental synthesis supports the production of strong business concepts that cover the whole new entrepreneurial activity and not only the novel product/process/service concept.
  - Weak transcendental synthesis supports the production of business concepts that are not able to equally cover the whole new entrepreneurial activity resting only upon product/process or service novelties.
- Reproductive transcendental synthesis is more common than productive in knowledge-intensive low-tech new ventures of wood and furniture sector.

- Established companies present more organized and well–built mechanisms of transcendental capabilities in corporate venturing than new-to-the-world ventures in low-tech industries and at least in wood and furniture sectors. .

7.3.2 FOOD AND BEVERAGES SECTOR

7.3.2.1 Bricolage capability

Bricolage in the F&B sector engages mainly technology developers, which sometimes are well out of the sectoral boarders such as the pioneering technology of climate neutral oil (environmental engineering, **FCo10**), innovative packaging for more than one cases (**FCo1, FCo3,FCo8**), including mechanical engineering, IT and chemistry (almost all cases). Regarding the cases of radical innovation, other and mostly high-tech sciences are engaged such as biotechnology, pharmaceutics, human pathology (e.g. celiac disease, diabetes etc.) and biochemistry. In parallel, bricolage includes many other fields such as mechanical engineering, automatization, marketing and design. Various sub-sectors are well engaged such as food technology, covering other areas than the main production; some examples are botanology in cheese production and food chemistry and technology in staffed vegetables.

The "hunt" of knowledge on both relevant and irrelevant sub-sectors still regards more the "new in the shape of the familiar"; it is this paradox combination of innovating on traditional products. The actual target is to ***produce novel products*** at least in nine out of ten cases. Innovations of the field are all knowledge-intensive, target in their major percentage global new niche markets, cannot be characterized incremental and some of them are patented.

In contrast to W&F sector, **in food and drinks industry both established and new-to-the-world** ventures get out of the limits and try to surprise the world (FCo1, FCo4, FCo5, FCo7, FCo9, FCo10) or capture excellence (FCo6 and FCo8) by innovative products and respective processes.

F&B KI-cases of the present research form three groups regarding bricolage capabilities:

a) Cases with strong bricolage capabilities: FCo1, FCo5, FCo6, FCo8, FCo9, FCo10
b) Cases with moderate bricolage capabilities: FCo4, FCo7
c) Cases with weak bricolage capabilities: FCo2, FCo3

40**Table 7.8: F&B bricolage capabilities**

Bricolage capabilities	**FCo1**	**FCo2**	**FCo3**	**FCo4**	**FCo5**	**FCo6**	**FCo7**	**FCo8**	**FCo9**	**FCo10**
Type*	N	N	N	E	E	E	E	N	N	E
Repertoire Building	strong	weak	weak	strong	strong	strong	strong	strong	strong	strong
CCN	strong	weak	weak	weak	strong	strong	weak	strong	strong	Very strong

**** N= startup, E=established***

Note: capabilities with one strong and one weak dimension are characterized as moderate

Regarding corporate venturing**, FCo5** produces radical innovation and **FCo10** develops further its innovative business model with innovation and knowledge based complementarities. They both target internationalization and care for their image worldwide: Both companies develop **strong bricolage capabilities** without resting on existing networking although it is already large and extended.

Trans-sectoral knowledge plays a central role in both entrepreneurs' culture; they both invest money and time to seek knowledge in various scientific, industrial and functional areas. FCo5's agent is more science-focused than all other cases; CCN

turns mainly around scientific contacts as well as customer target groups (to cooperate in R&D projects). On the other hand, FCo10's agent exploits the company's already extended networks and stretches further in new areas and directions such as technology providers (climate neutral olive oil success with a Swiss company, water saving with an Israeli expert etc.), package designers, marketing experts, chefs, research institutes and academia. The entrepreneur builds strong and coherent teams considering former experience and background of all members as well as their attitudes and culture. *"I think that partners play a very important role. G (i.e. FCo10) actually relies on their experience, knowledge and capabilities"*.

The **CCN dimension of FCo10 is among the strongest of all cases (of all three sectors)** and is then transformed and incorporated in sensing and seizing capabilities. Proximity is really built in an exclusive way by the agent who turns out to be an expert in co-operations of all kinds.[161]

Once again we are in front of two cases with totally unconventional and with an open attitude types of entrepreneurs who are though completely different[162]. More human – centric and cosmopolitan, FCo10's agent builds on innovative image collecting pieces of all areas (marketing, package, technology, production, R&D) while FCo5's agent focuses on R&D innovation, novel products and excellence in science through co-operations with Academia and (later) the new spin-off (a research institute).

The ***rest corporate ventures*** regard two cases with strong DECs and one with moderate ones. However all three rest mainly on existing networking and people they trust and develop new ventures on known paths and courses; i.e. quality by novel processing in all cases resulting in novel production technologies, two of which are patented. Within venturing, CCN and knowledge searching expands in already known areas although novel concepts engage unknown elements which contain risk and opportunity benefits as well. **FCo7's** "Achilles heel" seems to be actually the CCN dimension, which is significantly related to the entrepreneur's weaknesses regarding PEA of the Transcendental Capability. The company's weakness is translated in slow rates of growth and more careful growth strategy, while the company has not yet attempted networking with academia or other type of research institute.

[161] Among his latest successful achievements is "dual branding", based on fruitful co-opeations with other famous Greek traditional products

[162] We remind the case of WCo10 and WCo2 in W&F sector

FCo8 and **FCo6's** slight weakness is not due to the same reason. *It is more a matter of choice than inability.* The entrepreneurs *chose* to stay within known network cycles but they co-operate with the best of the networks' partners to realize their unconventional ideas. The high performances of growth and innovativeness that follow justify their choices. On the other hand, innovative activities and growth activities in their lifespan to date prove their ability to extend networking even to completely new and out-of-the-sector territories. Such attitudes can be attributed to their significant experience and an excellent combination of DCs and DECs as it will be later discussed. Strong sensing and seizing revealed the need to stretch to this new venturing. In order to realize it, the companies let again DECs emerge (engaging the proper human capital) with the effort to return the expected results.

In all five cases the ***characteristics of the entrepreneurs*** play an important role: all are leaders of the corporate venturing, unconventional, totally involved and with an open attitude towards all input. Yet, other ***resources*** and abilities are also important: strong existing networking cycles and existing or easier prepared teams to work, richer capital resources and already existing capabilities for bricolage (money, human resources, contacts, and firm's reputation among suppliers and/or customers).

Regarding **new-to-the world firms**, strong bricolage capabilities affect the results the agents expect. Among the five cases the two with **strong bricolage capability (FCo9 and FCo1)** create strong competitive advantages in global markets. Innovative concepts are multifaceted and spread in many areas such as R&D/NPD, process methods, novel machinery, design and promotion. In both cases the entrepreneurs find ways to realize their novel concept by leveraging existing networks and extending to new ones. It is quite remarkable that there was no co-operation with Academia for the very first business idea. Networking was clearly a matter of personal contacts. Former experience and family occupancy within the sectoral value chain are valuable in providing existing networks and social ties, a major advantage in case of corporate venturing.

The two brothers of **FCo9** start the networking cycle with relative technology providers. *"We relied on the ability to develop desired novel technology abroad… The developers have an R&D department for such purpose….Although there is a written contract about the exclusive use of the equipment developed; now it is not*

really important for us". Knowledge on food technology and for the purposes of R&D is initially developed by partners, such as food technologists, operations engineers specialized in the field and chemical engineers. Difficult problems are confronted by specialists found in internet "*a leading R&D company abroad which specializes in our sector. We had no relative Greek company in mind then. This option did not belong to our inner cycle of acquaintanceship"*. It is important to mention that in the very beginning the specialists' opinions on the business idea ranged from negative to skeptical. In its lifespan, the new firm builds its own strong R&D Department and CCN is expanded not only by seeking contacts but by also accepting relative requests. *"We are approached by many University Departments and other institutes.*[163]*. We do know now that our next co-operations show the direction of Academia"*

FCo1 is a quite similar case. The entrepreneurs extend networking cycles around their initial vision: process innovation with relevant experts, supplier innovation to solve transportation problems, co-operations to realize equipment needed. CCN is of major importance for the entrepreneurs in order to surpass any obstacles that stand between the idea and its realization being considered a means to save valuable time.

> *"Time matters. To create a successful new-to-the world venture, you have to achieve early profits. You cannot afford two or three years".*

On the other hand, **FCo4** presents moderate bricolage capabilities with CCN and "resourcefulness" to be the major weaknesses. Limited knowledge (in relation always to KI cases and not the sector in general), limited financial resources are main reasons for moderate bricolage capabilities. The entrepreneur also lags behind regarding former experience and involvement in the sector, thus transcendental conditions.

Weak bricolage capabilities (in combination with the rest DECs which may be also weak) are traced in **FCo2** and **FCo3**. CCN is not expanded on a research basis while ***pieces of information and knowledge are limited and insufficient for creative combinations***. Both companies' agents are too ***introvert and not really unconventional***. Their academic studies and background are not really on the concept's subject. Moreover, in the case of FCo2 the entrepreneurs ***lack former experience and knowledge of the sector.*** Actually, they ***do not collect and exploit***

[163] Examples: R&D project with EKETA and Biotechnology Dpt, New cooperation on an R&D basis for an American company with cooperation with an English research company,

pieces of knowledge; they "hang on" others and let them produce both knowledge and the business concept.

Both companies contented themselves to the technology initially adapted to local conditions without seeking any new skills, capabilities or novelties to add and incorporate during the starting stage. While in 2002 (foundation year) hydroponics was totally unknown in Greece and just starting to show their potential in Europe, the actors of **FCo2** did not manage to exploit properly the first-mover advantage by e.g. creating an eco-image and enter relevant research projects. The entrepreneurs were trapped in the conventional ways of running a firm. Within the next years several other farmers turned to relevant activities and some of them created big units and reaped the benefits of the innovative method.

FCo3's weaknesses are more due to the fact that there is no former relevant experience of the sector and the markets as well as that the two brothers did not really satisfy a minimum of the "transcendental conditions" dimension. There was too much time lost in learning from zero, while there was **no initial network pool** as key point for networking to start unfolding in a concentric way (CCN). Even the *repertoire building* was more a matter of solving problems than of creating ones. We do not claim that this is bad (conventional bricolage supports it) but it is not enough for an agent to create a new knowledge-intensive venture. We can easily notice that there are actually weaknesses and deficiencies in all bricolage dimensions of FCo3.

In both cases the resulting concept was the expected one but both ventures did not result in real first-mover competitive advantages. Although the innovative ideas created new markets at national level, initial competitive advantage collapsed very soon, did not manage to bring satisfactory sales growth and proved unable to support the companies in crisis periods. The question is now if these two companies will manage to survive.

Resourcefulness seems to play also a significant role regarding tangible or intangible assets or both of them. It is quite notable "the obvious difference between the resources of founders with a limited private capital background (as FCo2, FCo3, FCo4) and firms setting up KIE on the basis of satisfactory resource existence (as FCo1, FCo6 and FCo8). It actually seems that limited initial resources such as lack of economic and infrastructures, human and social or even political capital lead to weaknesses in properly applying all DECs. For example limited economic resources

led to a very moderate expansion of FCo4 and FCo7. In all cases of limited resources which regard the two cases of moderate and the two of weak DEC, there is also a further significant shortage of intangible assets and more precisely knowledge, skills and capabilities compared to the rest of the cases. Both categories of moderate and weak bricolage capabilities presented resource shortage in one or more aspects, such as physical, human or social capital, existing knowledge of the sector and ability to reach information, combined with weak mechanisms for resource-seeking and networking. Thus, *we assume that the amount and quality of existing resources affects bricolage capabilities.*

Interactive Learning is also here a highly dynamic process: Almost all entrepreneurs collect, combine and generate knowledge while embedding a relative culture of constant learning. FCo5 uses knowledge from various scientific areas to realize its novel concept. FCo6 invests mainly in technological knowledge to intervene in innovative ways to known processes offering novel products while increasing productivity and focusing on ecological aspects, energy savings and recycling. In all cases learning comes besides conscious knowledge generation, through trial and error and experimentation. However, both FCo2 and FCo3 show a weakness in further adding knowledge while FCo7 presents a reluctance to develop research-based networks in order to expand knowledge limits.

All cases engaged more or less all bricolage dimensions and created the environment for problem-making, dealing with difficulty and trying to be flexible. However, the status and former conditions of agents imposes restrictions. Even *proximity* has a different meaning in the CCN context for a big established company (e.g. FCo8), a new entrepreneur with relevant family business (FCo1) and a nascent firm (e.g. FCo3). As in the W&F sector, suppliers and other stakeholders "gather" again easier around an existing and known company while there are core difficulties to trust and be close to a new one. The case of FCo4 is a typical example: the entrepreneurs tried to come in contact with a University professor with no success, while, in the beginning, no Italian company would undertake the special machine manufacturing. On the contrary there were no such difficulties in the cases of FCo9 or FCo10.

All agents are engaged in ***real problem making*** which required a big variety of types of knowledge and turned to a "hunt" of knowledge, at different levels though. They all gather information and knowledge for later use, arranging and re-arranging the accepted pieces while at the same time they apply degrees of freedom to add new inputs. Yet, once again we observe different levels of synthesizing with a clear but flexible orientation and focus, with bricolage capabilities to rank from very strong (FCo5, FCo10) to very weak (FCo3).

Among entrepreneurs' characteristics we assume it is not irrelevant that "weak ventures" are established by agents with no ***previous experience and knowledge*** of the sector **as in the W&F weak cases as well.** It is clear that *differences in prior business experience influence the choices as well as the ways and mechanisms engaged.*

Therefore, knowledge-intensive F&B entrepreneurs, similar to W&F ones, develop bricolage capabilities to disregard the limitations of commonly accepted definitions mainly of technology and standards, insisting on trying out solutions, collecting knowledge from diverse areas and combining resources for new purposes to fit their business concepts. Moreover, a stronger focus on science and technology which transcends the sectoral borders is observed in the F&B cases.

As in the W&F cases, the bricolage capability in F&B KI-cases is affected by the pre-existence of resources while the level of the entrepreneurial human capital and the initial knowledge assets together with prior business experience of the entrepreneurs impacts it. *Bricolage capability therefore appears to have a positive effect on making progress in the emerging stage of knowledge intensive venture creation, the initial innovation and the creation of initial strong competitive advantage in F&B sector.*

7.3.2.2 Improvisational capability in the F&B industry

Even in the F&B cases where in-house research is advanced in relation to W&F sector, KI startups are seldom founded on the basis of "out of the lab" results. Therefore, the whole concept is built around a core idea which has to be constantly revised since new information, knowledge and other resources gather around it.

41**Table 7.9: F&B improvisational capabilities**

Improvisation	FCo1	FCo2	FCo3	FCo4	FCo5	FCo6	FCo7	FCo8	FCo9	FCo10

al capabilities										
Type*	N	N	N	E	E	E	E	N	N	E
Information flowing	strong	weak	weak	moder ate	strong	strong	moder ate	strong	strong	strong
Provocative organizational competencies	strong	moder ate	weak	moder ate	strong	strong	Moder ate	strong	strong	Very strong

**** N= startup, E=established***

Improvisational capabilities serve again different but complementary targets, such as

- ***pursuit of more novelty and differentiation*** at all stages. This is the main target of all cases of the sector; some of them present excellent performances such as **FCo5** and **FCo9** by taking advantage of every single piece of new information, knowledge, contact and other resource to develop the ever changing idea further, blending cutting edge technologies with lab results and niche market creation.

> "Gluten-free products were not our initial target. It was difficult enough to think on products based on cheese instead of the usual staff – which was our first idea to innovate. Then, when we reached the results in the lab and connected it to cheese as a basis, there was the challenge of mass production and of niche market creation. That became our strategy because we saw a relative strong trend abroad for such products and we reshaped our strategy accordingly. We reversed our plans and of course we knew the dangers. What I mean… We began to do something and we ended to start a new research for about 10 months till we end up to what we were initially looking for…"
>
> (Entrepreneur of FCo9)

FCo5 is a similar case. An accidental reference to celiac disease and a phone call for gluten-free products leads to extensive research on gluten-free buckwheat flour. Inspirations of the moment, accidental new contacts, patient reactions and lab findings change the initial strategy of production of health and wellness products to high bio-functional food production and the creation of a strong R&D Department.

- ***Moving on the line between restrictions- limitations and wish for differentiation:***

FCo8 imposes deliberately restrictions on quality to overcome, displaying exceptional improvisational capabilities with gradual addition of unique characteristics, adoption of technology innovations, inventive solution of arising problems and persistence in the real-time interaction with the environment. Several restrictions are imposed in the cases of radical innovation (**FCo5, FC9**), in the cases of innovative processes (**FCo6** and **FCo7**) or even initial wishes and failures

(**FCo4**). Inability to organize production with stevia did not disappoint but drove **FCo4** creators to intensify efforts.

> "The idea was to provide pure "home-made" chocolate bars – uncompromisingly and completely pure chocolate with novel and alluring tastes. So we posed limitations from the very beginning: no lecithin or chemical preservatives, no oleaginous, sugar or preservatives. Searching for alternatives we would crosscheck with Mr L. (the expert) all possibilities. It is not that easy. You have to find the best balances in many parameters. We became engineers, food technologists and designers. We spent hours in mixing ingredients. Results would be tested and back again. Changes over changes... And when the final product came under our limitations, then it was the problem of equipment for mass production".

FCo1 wishing to innovate faces physical and commercial restrictions in filling vegetables with feta, transportation restrictions as well as even bureaucracy obstacles. Yet, due to strong improvisational capabilities the entrepreneurs manage to extend CCN, revise plans, find innovative solutions and communicate their vision to the relative stakeholders creating at the same time a promising niche market worldwide. *"Our initial idea was to provide products which did not exist. … After our first product we had to be more flexible. Ideas are easy. Yet, implementation is not that simple…"*

Although not obvious to the consumer, the firm extended cooperation in the area of applied science to solve certain NPD, process and package problems exercising in an excellent way fluid interaction with the environment and constant learning.

Typical cases of restriction /limitation - driven improvisational capabilities are **FCo2** and **FCo3** where development was mainly due to obstacles because of limited knowledge on process as well as machinery equipment handling and maintenance. All sub-dimensions appear ***rather faint***, such as continuous learning, real time information and communication and flexibility[164]. They actually move more towards adapting solutions to differentiate in order not to abandon their novel business idea when problems arise.

- ***due to a strongly embedded improvisational culture*** which is however motivated by the entrepreneur. An exemplary case of this category is **FCo10** where the improvisational capabilities seem to support the strong transcendental capabilities of

[164] Once more we remind that comparisons are among the cases and not to the mean attitude and practice of the sector.

the company and especially the entrepreneur's. The entrepreneur and his team after the decision to broaden the business scope and scale of the company and widen the range of stakeholders, reworked pre-composed material, plans and designs under the special conditions of pushing the boundaries of innovations all along the business's value chain. They were constantly adding unique features building an unconventional image, engaging information and knowledge and turning them to strong advantages. More precisely, they engaged rebranding, retro-innovation, experimentation and production and technology changes, Eco friendliness and innovative marketing when suitable to their targets. The entrepreneur engages customers, partners or even researchers in his projects or ideas, making them stakeholders in order to solve problems or make the most of inspirations. This is a fine way to have real time information and promote and improve or abandon initial concepts. After long R&D programs the company became a pioneer worldwide regarding ecological, packaging and energy saving issues in its sector. Promotion and marketing innovation followed too. The entrepreneur claims that improvisation happens for the sake of improvisation and not for specific targets. *"We should be flexible enough to create a basis of constant development and idea generation. We can always find ways to realize a good idea"*

The company continues to be highly innovative.

Entrepreneurs in all cases seem to ***constantly reform the initial business idea even after establishment.*** Variances in strengths and extends to which this dimension of DECs is developed are again detectable.

FCo5 exploits its bricolage capability (e.g. the resourcefulness, contacts, human and physical capital, knowledge and the ability to learn) to maneuver among ideas, demand and obstacles. With scientific innovation as leitmotiv, business networking with the chemical industry due to the previous industrial activity of the family enabled co-operations in preparing the desired reagents and enzymes for the innovative methods. The case displays a full spectrum of improvisational prowess enabling creative solutions around the main challenge, as well as around other knowledge problems arising such as patients' and non-patients taste and tolerance of the new

product[165], ways of solving the mass production without the need of totally changing production lines, new opportunities by testers etc. Besides consumers, real time information comes from partners (e.g. the new lab) and employees (the research team). Knowledge flows in the whole process starting form designs till the pilot production. Malfunctions and problems quite often produce new knowledge and sometimes FCo5's new solutions are adapted by the manufacturing companies. Info on flour prescription led to drugstores[166]. "Messages" by all possible sources internal or external turn to business ideas and experimentation developing and embedding a culture of constant interaction with environment.

Using their amazing powers of creativity, ingenuity and improvisational prowess, the two young entrepreneurs of **FCo9** create a globally innovative company with an excellent rate of penetration in foreign markets. Real-time information and communication on market issues leads to idea upgrade, turning the product from "a different tasty snack of 40-45% cheese" to a healthy snack for all, but especially for gluten-free product buyers, targeting a bigger market share. Constant reshaping enacts whatever mechanism is in place to bring knowledge from other parties to the company (e.g. raw material, promotion, marketing, branding). Production process is especially affected since it depends on the transfer from lab to plant, interactions with manufacturers, and insertion of different parameters as the idea is evolving. Real time information is both formal, through contracts, or comes from suggestions and even mistakes (e.g. the placement of the product next to tasty and relatively cheap children's snacks). It affects even the brand name of the company without hesitation[167]. For FCo9 flexibility and experimentation are gradually becoming imperative since an initially "easy" production turns to rather sophisticated and affects the entire value chain. Personnel's synthesis proves the importance of new knowledge excellent assimilation and manipulation. Initial food technology and relevant

[165] They kept in contact with the Association of celiac patients with workshops and questionnaires. The final products were at first tasted by most of the company's employees in order to improve the taste and find the best recipes not only for bread but also for cakes, pizzas, etc. Then these products were sent to the association's patients to test their reaction (if the products are tolerable by their body, as well as the taste).

[166] Since the flour can be prescribed in a pharmacy prescription book and the patients take their money back, they started ordering it through drugstores.

[167] Money has already been spent to establish the brand name. Yet, a new budget was devoted to develop the new name of the company which would denote the healthy and wellness side of the company.

knowledge comes through employees and partners but the entrepreneurs master all relative knowledge and deepen in it in order to manage efficiently the whole process.

In the case of **FCo6** and **FCo8** improvisational capabilities are characterized by a conscious and stable communication and interaction with the environment. Real -time information excelled the implementation and potential of the new technologies. Contacts are mainly formal but changes (mainly improvements) were free to be imposed by all team members. These are the two major cases of our food-industry sample where DECs seem to be overwhelmed by the strong routines and culture of their dynamic capabilities. Yet, DECs come back strong enough to build novelty and strong initial competitive advantages.

These two cases revealed certain dimensions of improvisational capabilities, such as diversity, a sense of urgency and flexibility, promotion of experimentation and strong action.

> *"I think we went rather fast. It took us 3-4 years to formalize the initial idea, experiment, make the plant and improve the product. It was quite an adventure!*" (Entrepreneur of FCo6)

Information flowing is achieved mainly through formal business contracts supported by a strong network that allows synergies and co-operations. Selected executive teams of devoted members were responsible for the realization of the business ideas. It is important to note the role of engineers especially in the case of FCo8; although successful by then, the entrepreneurs knew their weaknesses regarding the knowledge intensiveness of their new undertaking and engaged an impressive number of all kinds of engineers.

> *"We have an impressive number of engineers for a milk producing company. Knowledge is expensive! ... We bought knowledge through our partners."*
>
> (Entrepreneur of FCo8)

Still, according to our knowledge, the entrepreneurs are the ones to have their hand on the wheel. However, teamwork and collaboration support their initiatives. Unforeseen difficulties led to further investments and more research. Yet, improvisational capabilities appear in well planned reactions following an organized interaction with environment, be it suppliers, market, investment laws, surrounding culture etc. This is partly due to strong bricolage capabilities and extensive CCN. Deviations from plans are associated with arising opportunities, solutions to problems such as the product's behavior in Greece and alternative methods and uses of the new products.

Similar to relevant comments on W&F cases, both companies own ***a former innovation culture***; especially FCo6's first generation entrepreneurs had already acted as innovators and pioneers. One can recognize a constant bidirectional knowledge flow of both embodied and disembodied knowledge through skilled personnel, training, plant and equipment designs and descriptions, consulting, mutual experimenting, machinery and equipment. There are changes in the relationships with main suppliers both of raw material since there are new requirements set as well as supplementary ones. Improvisational actions are both exploitative (process methods, market penetration, raw material use) and explorative (creation of new knowledge for novelty, value adding a dynamic collage of knowledge, resources and ways of applying them).

As seen just two paragraphs above, ***information flowing*** is very strong in the cases of FCo5 and FCo9. In many cases the actors engage even customers in testing new products and methods assigning them the role of coordinators and close partners (e.g. FCo5 and FCo4). All cases include machine manufacturers as main stakeholders since many times such co-operations lead to innovative machinery. Many times innovative machinery is further used by manufacturers with the full consent of the entrepreneurs. Such real-time information and cooperation led to world patented machinery in the cases of FCo5, FC8 and FCo9.

Weak improvisational capabilities appear in cases of remedy actions and limited knowledge on process as mentioned above. In the two weak cases one can detect more an effort to solve unexpected or not well planned problems than creative improvising. In both cases entrepreneurs were the first to tap the related technology and adopt it to local conditions creating the new market segments. However, DEC weaknesses affected the ventures' choices and the sustainability of the initial competitive advantage they developed. Major weaknesses in improvisational capability that have been observed regard weak communication and interaction with the environment, a false approach to knowledge management and interactive learning and inadequate human capital. Weaknesses are also evident in the ways the actors approach experimentation and market penetration although they both manage to be pioneers in entering local and national markets with innovative and knowledge-intensive business ideas.

The two companies rank last in almost all rankings regarding innovativeness and viability. FCo2 is also the last one referring to the financial criteria used.

On the contrary, all new and established companies which developed strong and dynamic improvisational capabilities present a constant evolvement of action regarding innovation, core choices and arising problem solutions. Improvisational capabilities seem to boast innovativeness and increase the chances of strong initial competitive advantages. What is quite notable in the F&B cases is the fact that the development of strong **improvisational capabilities does not seem to depend on the initial resources.**

A core element of improvisational capability is the ability to sense the environment all along the value chain and be able to incorporate changes, trends and novelties even if the new venture creation had started with a different direction such as in the FCo1, FCo4 and FCo9 start-ups. In these cases market fitness was partly responsible for imposing flexible processes for the identification of market trends and gaps, try-and-error loops and the set-up of various collaborations with stakeholders all alone the value chain. Innovative products, processes or even models had to fit with the demands of the market environment either covering existing markets (FCo2, FCo6 and FCo8) or introducing new ones (FCo1, FCo5, FCo9 and FCo10). This seems to be almost imperative also in the cases of food and drinks industry[168].
It is quite notable that no entrepreneur among the ten cases prepared a complete and well-defined business proposal to present directly in the market. On the contrary there was a constant interaction with the environment all along the preparation and the creation stages. Actually FCo1, FCo4, FCo5, FCo8 and FCo9 are strong examples of shaping and reshaping initial product-and-process concepts many times, relying on the real-time information of manufacturers and potential customers. Especially **FCo9** experimented on many entirely novel ideas which however did not seem to fit with the initial target- markets and led agents to reshape even their initial business concept. They ended up by the creation of a core business based on high-value products targeting wellness and healthy market niches. **FCo10** started its long journey to eco- and retro innovation besides its high value luxury gourmet products lines by

[168] It was underlined in the W&F sector as well.

experimenting and many try-and-error loops regarding both eco-friendly processes and knowledge intensive know-how in relation to market reactions and responses. The dimension of establishing interactions with the environment affects mainly the seizing capability of the later formed dynamic capabilities.

Besides the importance of information flowing, improvisational capabilities are partly affected by the level of provocative competencies the agents own or develop. New-to–the-world companies do not have routines due to newness and improvisation appears as a normal attitude supporting both inspiration and problem-solution. On the contrary, well established large firms are purposefully committed not to use routines at the phase of starting up a new venture. **They deliberately activate provocative competencies instead**.

As in the W&F sector, across our case studies it was quite clear that while flexibility was quite normal and natural in new-to-the world firms, together with the other provocative competencies, they all had to be clearly defined and specified in the cases of corporate venturing. New **FCo8** worked with an extremely limited number of the former milk producing company employees and none by mother-company, while the two entrepreneurs were the only connection among the parent company and the new company. **FCo10's** strategy is strongly backed by the unconventional personality of the entrepreneur and the significant variance of the board synthesis. **FCo6** did not manage to get completely out of routines. **FCo5** was actually a new company (less than two years old), which had not carried any sign of former corporate culture as a tomato processing plant. **FCo7** was a very small company with no particular culture on developing any type of routines.

In contrast to W&F sector, where experience is a drawback for well-established cases, in F&D cases it seems to follow literature findings and thus it leads to better improvisation and consequently better performance (Arshad, 2011). Experience and past similar actions engagement encouraged spontaneity and immediate responses in many cases (e.g. FCo1, FCo5, FCo9).

Regarding ***provocative competencies and patterns***, we assume it is not irrelevant that among the two "weak companies", FCo3 is established by agents with low levels of creative dissatisfaction and obscure organizational patterns. In the FCo2 case, although one of the entrepreneurial team presents an unconventional and provocative character, it is clear that *one* (among four) is not enough. Entrepreneurs are central to

all types of companies and major moderators of all improvisation capabilities Here one can question the need of the entrepreneurial team's consistency and homogeneity in knowledge-intensive new venture creation.

A constant trend to dissatisfaction is evident in all cases at different levels though. It seems to affect the evolution of the initial competitive advantage, its quality as well as the paths the new venture will follow. Such dissatisfaction is very strong for FCo10, FCo5, FCo8, FCo6, FCo9 and FCo1. All these companies established a significant innovative and pioneering initial competitive advantage and a strong image in their markets and present to date an increasing rate of NPD. The same goes for FCo7 and FCo4 at slower however rates. Creative dissatisfaction was rather weak for the two weak cases. Besides the strong devotion to novelty, both new startups did not manage to develop concepts in creative ways. FCo3 tries more to solve problems than produce innovation as a strategy, while FCo2 did not manage to get further from the initial novel idea and was shortly overwhelmed by other similar ventures.

Although flat structures are common in all small companies and entrepreneurial start-ups, in all cases it was quite evident to the observer that although not clearly mentioned, the entrepreneurs are the creators, the animating spirits and the main actors for the business idea realization. What is of great importance it is the fact that in all cases members seem to be able to follow their leader's vision and act with well-defined roles and rules. Core members are essential for most cases, while individual characteristics of the entrepreneurs turn into values and routines for the new ventures; for example. FCo10 shares a more flexible structure while FCo5 has created a more organized and robust one.

FCo8 goes on relying on a strong team of engineers of different scientific areas; some of them work for the company and others are just field agents. The case resembles WCo2 of the W&F sector. This is not strange since both cases refer to corporate venturing where the entrepreneurs have no higher education but own well established companies. In both cases however strategic decision making belongs to the entrepreneurs *who seldom change their mind (teleology can be detected here).*

Strong believers of the significant role of science even in the processes of agricultural products, **FCo5** and **FCo6** form flexible small "technological-scientific" teams. The entrepreneurs play the role of mediator and scientific knowledge operator becoming

the representatives of the new shift of a low-tech industry to science. **FCo9** engages a small team of food experts to cover specific science-based knowledge gaps too. The entrepreneurs however avoid the creation of routines instigating creativity.
FCo10 and **FCo6** use more hierarchical structures with core members carefully selected according to previous experience and successful business course. All new-to-the world companies and FCo7 use simpler forms of decision making with the entrepreneurial team to be the core of the strategic decision making.

Altogether, it appears that in most F&B cases design and execution are almost indistinguishable due to highly developed improvisational capabilities supporting the other two DECs and thus, the constant refinement of the initial business idea. This can be

a) in pursuit of more novelty and differentiation: FCo5, FCo9
b) Moving on the line between restrictions- limitations and wish for differentiation: FCo1, FCo2, FCo3, FCo4, FCo5, FCo6, FCo7, FCo8, FCo9
c) due to a strongly embedded improvisational culture FCo10
d) due to the need of improvements and refinements: FCo3

In F&B cases improvisational capabilities seem to affect mainly the initial innovation, support the creation of future strategy and choices and at the same time shape the technological part of the business concept. Among the ten cases six of them presented very strong improvisational capabilities (FCo1, FCo5, FCo6, FCo8, FCo9 and FCo10), two of them strong (FCo4 and FCo7), and two of them weak ones (FCo2 and FCo3). **Strong improvisational capability appears to be irrelevant of company's size and former condition.** However, it is possible that in cases of corporate venturing, established organizations deliberately activate provocative competencies and the rest of improvisational capabilities.**The results coincide with the ones of W&F sector.**

As repeatedly mentioned above, all dimensions of the improvisational capability are affected more or less by the personal traits, characteristics, education and experience of the entrepreneurs. Even in cases that there is a certain number of executives to take over the new venture (only in cases of corporate venturing), entrepreneurs' contribution is significant. In all cases of corporate venturing enthusiasm for

innovation, entrepreneurs' attitude towards knowledge and novelty, their extroversion and their creative and provocative dissatisfaction produce **better improvisational capabilities that the ones presented in W&F sector where rather conservative attitudes are evident too.** The entrepreneurs of the weak DECs' cases are less aggressive and provocative and prefer to compete in well-defined areas.

7.3.2.3. The Transcendental Capability in F&B sector

As suggested in the above sections, strong transcendental capabilities lead to strong business concepts with unique characteristics which create in turn strong initial competitive advantages.

42**Table 7.10: F&B transcendental capabilities**

Transcendental capabilities	**FCo1**	**FCo2**	**FCo3**	**FCo4**	**FCo5**	**FCo6**	**FCo7**	**FCo8**	**FCo9**	**FCo10**
Type*	N	N	N	E	E	E	E	N	N	E
Transcendental conditions	strong	weak	weak	moder ate	Very strong	strong	moder ate	strong	Very strong	Very strong
Transcendental synthesis	strong	weak	weak	moder ate	Very strong	strong	Moder ate	strong	Very strong	Very strong

**** N= startup, E=established***

FCo10 with **very strong** transcendental capabilities produces worldwide pioneering results which create a totally new business ecosystem (at least in Greece) and novel niche markets worldwide. The company engaged knowledge–based innovation at almost all business functions of its value chain: R&D on several directions (eco-innovation, retro-innovation), product design applying to an expensive design company to reform products' image, production with a unique plant of cutting edge technology and marketing by introducing worldwide the *meze* concept and making products known in unconventional ways (e.g. through glamorous events and awards[169]). Under the company's ***"need-listen-create value"*** motto, the company embedded a culture of constant innovation investing heavily on all kinds of research. It is committed to new idea generation covering products, processes and services for the sake of economic and social prosperity, sustainability and environment protection. The venture opened a new way of adding value to traditional products. Knowing that

[169] It has even won an award before the product was launched in the market while at Oscar Award ceremonies FCo10's products are offered to all VIPs.

competitors will follow soon, the entrepreneur created sources of novel advantages expensive or difficult to be copied from the very beginning [170].

Transcendental capabilities' strengths are clearly presented in the **FCo9** case: A "why not" strong opposition against established perceptions for snacks. The "Copernican turn" was the idea of not imposing gluten-free products as medicine (even FCo5 used the channel of drugstores for its innovative products). The two brothers take the position of the consumers to produce gluten-free products for patients and non-patients promoting the notion of wellness for children and grownups. A slight weakness (*maybe due to age, to unfamiliarity of the snack world?)* in PEA causes misunderstanding and waste of valuable time[171]. Yet, all other dimensions and sub dimensions being strong, the two young entrepreneurs manage to patent a globally innovative product, open new niche markets abroad and establish a successful knowledge-intensive company.

In low-tech industries (at least) a business idea can have various innovative approaches. The gluten-free perspective of wheat-based bread and other pastry products was a novel business idea for **FCo5**. The conventional mill applies intensive R&D in developing advanced bio-functional products for specific target-groups. Taste is a major parameter but the emphasis is on the nutritional value of the products.

The two cases of **FCo5** and **FCo9** reveal the significant role of transcendental synthesis in the final business idea formation and how it is influenced by transcendental conditions and especially the sense of spaciousness. Both regard health as "A state of balance, whereas illness is a natural phenomenon" (Hippocrates). One side focuses on the word "natural" and the other on the word "illness". Both focus on the promotion of health through the emerging concept of wellness which reflects individual responsibility for health and well-being.

In the above three cases the agents have the deep feeling and conviction of creating the future. In the two cases of corporate venturing, the agents alter the relations with the suppliers, they move up the value chain and give new different and value adding meanings to conventional products **changing and challenging existing markets**.

[170] There was a gradual appearance of gourmet products in Athens airport where the dominant position is still occupied by FCo10's products

[171] Initial positioning of the products next to conventional snacks was a bad choice since in consumers' minds "it was another unnecessary expensive" snack. Initial name also was not suitable for the product "idea".

Olive oil becomes more than just "oil" and traditional products turn to medicines. FCo9 challenges the boundaries of food indicating powers inherited by Mother Nature, taste and common acceptance.

Two other corporate ventures are moving on a more secure road. They both want to master their eco-systems but in more conventional ways; i.e. by excelling in quality **(FCo8)** and through a clear technological orientation (**FCo6**). Intentions result in strongly exploited ***partly productive transcendental synthesis.*** The two companies challenged and changed their ecosystems advancing customers' requirements, methods and techniques. They also created strong bases for further innovation. **FCo6** turned to Academia for science-based novelties while **FCo8** tries further co-operations with both academia and manufacturers. They both invest in R&D and knowledge acquisition. Especially **FCo6** will later engage the slogan "nothing to be wasted" and will **get well out of the tight limits of the sector to enter high-tech areas**. Both companies present high revenues and keep increasing fame and securing leading roles in the relative subsectors at national level while are becoming more familiar in foreign markets as well[172]. These cases confirm the assumption that t***he stronger the transcendental capabilities, the better and wider the formation of the new business ecosystem around the new venture***

FCo1 presents also **strong** transcendental capabilities; backed-up with the privilege of a master and a successful relevant family company, the entrepreneurs deliberately shape a new ecosystem with traditional products as a core but at different basis than FCo10, curving in that way a completely diversified niche market. Competitors appeared again very soon, since foreign markets were promising. **Transcendental conditions are very strong**; the entrepreneurial team starts seeking novelty with an excellent knowledge of global markets on the products that interest them. Their initial vague idea turns around high-value agri-food products which do not exist till now and are not easy to be copied by foreign competitors. This idea starts with the selection of olives and cheese (as clearly traditional Greek products) as first raw-material to be used for the differentiated end-products. Then the idea unfolds supported by strong bricolage and improvisational capabilities. As the entrepreneur narrates

[172] E.g. FCo8: 2007 in Italy and Germany, 2012 in USA

"We had the first idea, questions to answer, such as how to sell and how to show it to consumers, as well as how to produce it; this was the most difficult of all: how to fill the olives with feta cheese (for the first product we thought of)".

This initial rough planning sets priorities and the foundations for further planning. Without attempting to judge priorities (after all they are the ones to own the successful firm and not the author) we can just notice that history fits to priorities.[173] The entrepreneurs believe in the importance of the initial competitive advantage and the early success of a new company;

"To be successful, your company has to do well from the very beginning. You cannot spare one or two years"

The new company has an impressive evolutionary path with aggressive NPD as a major means to be ahead of competitors.

FCo4 and **FCo7** present **moderate transcendental capabilities** and mainly transcendental conditions which cause a domino effect to the rest dimensions**.** The ventures although pioneers and innovators, do not manage to cause imperative changes to their business ecosystems and take a leading role in them. **They create a strong initial competitive advantage but they cannot work it out to capture leadership.** Moderate to relatively strong (but definitely not strong) transcendental capabilities lead to moderate development of business and market axes, translated mostly into rapidness of rate of market penetration and fame increase, as well as to R&D intensiveness regarding resources devoted. FCo7's weakness is translated in slow rates of growth and more careful growth strategy, while innovativeness is not yet connected to academia or other institute networking. FCo4 presents better sales rates than FCo6, FCo9 and FCo10 but this is quite normal for new-to-the-world successful firms. Both new ventures **show high innovativeness rates** in the years following establishment. This indicates that **e*ven moderate transcendental capabilities can lead to the creation of strong initial advantage and set the foundations for knowledge-intensive innovations.*** Still, they do not manage to change business ecosystems and enhance dynamism as much as the ventures with (very) strong transcendental capabilities.

[173] E.g. Participation in first trade show and first orders without existing production solutions

Furthermore, the two ventures with moderate transcendental capabilities present increasing sales, in spite the severe economic crisis in Greece, and have created niche markets without however changing the business ecosystems they belong. This indicates that ***moderate transcendental capabilities affect positively innovativeness and growth but cannot offer leadership.***

The **two weak cases** reveal the importance and the strategic role of transcendental capabilities among DECs. Both companies do not manage to prosper and although they start as knowledge-intensive, they do not manage to cultivate an innovative culture. Moderate transcendental conditions and weaknesses of transcendental synthesis affect in a negative way initial core choices regarding area of activation and consequently levels of innovativeness and choices. Weak transcendental capabilities result in many inconsistencies regarding competitive advantages, instability in strategies and incapability in advancing and communicating novelties. The two "not very successful" cases developed and **focused on only technical dimensions of innovative concepts relying only on external knowledge.**

Regarding the types of KIE developed by the food case-study ventures, one can clearly see that new-to-world innovation is significant for the creation of strong initial competitive advantage. The application of a more or less balanced emphasis on different dimensions of innovation combining external knowledge-seeking to in-house research and knowledge development is related to certain parameters such as choices and DC development. The only type which seems inappropriate to follow is when new ventures are supported exclusively by external knowledge with a mediocre contribution to knowledge generation (of any kind).

In contrast to W&F sector, the F&D cases do not reveal any supremacy of established organizations in stronger transcendental capabilities development regarding corporate venturing. Yet, there are significant indications that former condition of the agents *really* matters; that is, former condition affects the formation of transcendental capabilities, which in turn affect the other two DECs. This is due to former engagement through family companies, existing or on-hand resources and human capital which assist to develop far better and wider dimensions of transcendental

capabilities. So, it seems that *former agents' condition affects the quality of transcendental capabilities which in turn defines the type of KIE development.*

As we have just mentioned, **higher level of transcendental conditions allows for deeper and more creative and unconventional transcendental synthesis.** Even if in-house R&D is more evident in F&B industry than the other two sectors of the present research, it is again not only a matter of scientific knowledge that would allow a scientist to create a brand new product. In contrast to W&F sectors again, in F&B industry there is a significant interest on **patents and intellectual property protection.** Five out of ten cases have applied for a patent at national or global level at least once. Actually, the more science-based and the more "trans-sectoral knowledge-based", the novel business idea, the more important is appropriability for the agents. ***Still, the patented idea is the end and not the beginning of the low-tech, knowledge-intensive business creation journey.*** Again, business concepts are built around the agents' own transcendental thinking and unique syntheses and realized by bricolage and improvisation capabilities. There are results to be protected such as a novel technology (e.g. FCo6) or a family of innovative products (e.g. the wheat-based bio-functional food) but novelty covers much more than just lab tests. The new venture is not for the sake of the lab result; ***on the contrary the protected lab results cover some aspects of the novel idea.***

In the case of FCo6 the main idea turns around changing the company's strategy towards innovation and strong R&D; otherwise it creates a basis of shifting to **"knowledge verticalization"** as the entrepreneur characterized the undertaking. The initial concept was *"to be reinvented in order to suit to the new entrepreneurial international landscape*". The entrepreneurs create **opportunities** for a shift to innovative high technology food products which are both market driven (covering of existing markets) and technology driven (the following research work on rice byproducts and NPD as well). Innovative lab results were only one way to suit the new venturing purposes.

Transcendental conditions turn up again to play a significant role in the configuration of the transcendental capabilities as a whole and consequently the appliance of the rest DECs and the resultant venture in all these cases.

Compared to W&F sector, it is quite interesting the fact that in F&B weak cases we found **no case of weak transcendental conditions**. This can be partly due to the nature of the products. Food products are already internationalized while furniture is still a privilege of local activity in spite the increasing number of imports. That means that there are certain higher demands especially regarding the level of PEA. Moderate level at national boundaries is then considered insufficient for the F&B sector indicating weak cases.

Our six cases with all strong DECs have reached very **strong or high** PEA presenting a strong sensation of their positioning and a dynamic view of potential markets and opportunities. **FCo9** is the only exception indicating a slightly lower PEA than the other five cases. This is mainly due to the fact that the exact world of snacks entails far more products than just pastry products and partially due to the agents' age. Yet, as discussed above, all other dimensions and sub dimensions being strong, the two young entrepreneurs manage to escape danger and establish a successful knowledge-intensive company.

Still again we can detect different levels of PEA in this group, which can be divided into three categories (instead of two in the W&F sector):

- The "cosmopolitans" (Cs) such as the agents of FCo10, and FCo1, FCo9
- the "science approachers" (SAs) such as FCo5, FCo9, FCo6 and
- the "industry masters" (IMs) such as the agents of FCo6 and FCo8.

FCo9 can be placed in the mid of the SAs and Cs categories, while FCo6 can be added in SAs too. The first ones have a wider approach around the phenomenon of their business concepts and are open to every chance offered independently of origins and initial relevancy. The second group approaches R&D combining in-house efforts by creation of strong R&D Departments and by simultaneously developing high-level co-operations with agents of various other and mostly high-tech scientific areas such as biotechnology, pharmaceutics, organic chemistry etc. The third category involves the development of a higher level of PEA within the industry, focusing on mainly but not solely technical knowledge, intensive but usually incremental innovation and embracing parallel activities to support novelty such as top leadership models, quality excellence and strong NPD based on new concepts. However we should mention that limiting PEA into specialized technological bases may constrain the search zone,

reducing ability to obtain and use the knowledge developed elsewhere. This danger is higher for new-to-the-world ventures, while it can be a choice in corporate venturing. This aspect coincides with our conclusion about the most suitable type of KIE for nascent firms and the findings in W&F sector as well; development and focus on only technical dimensions of innovative concepts relying only on external knowledge has deprived our two cases from market leadership advantages.

It is worth to note the interaction, consistency and coherence of the conclusions regarding transcendental conditions and KIE types which actually exist among all dynamic entrepreneurial capabilities and strengthens the assumption that they constitute a dynamic set and framework of entrepreneurial capabilities necessary to start a successful venture nascent or corporate.

Higher level of PEA in our six cases offered leadership to the new ventures by strongly changing or challenging their business ecosystems. **Strong to very strong PEA at national level** led to initial advantage based on innovation which however was not deployed equally at the technology-market and business axe (FCo4 and FCo7). Consequently, although the relevant two cases present high innovativeness and started with satisfactory MASR and CAGR, they did not manage to change their business ecosystems. Agents had a very good sense of their positioning but at national level without inspirations to enclose global markets at the initial stages. They were trapped into their desire to get a piece of the existing national market pie although they were conscious of their novelties and they had the opportunity and the potential to do it. Both of them have a very good picture of the sub-sectors they belong to, they purposefully develop product and process knowledge-based innovation but they do not have a panoramic view either of the sector or the markets which would allow them to create more opportunities and new markets in more extensive ways.

In both our weak cases, **FCo2** and **FCo3**, **moderate** PEA is a result of not knowing the relevant (or the most relevant) business ecosystem, a feeling of insecurity (which further contradicts the dimension of deeper conviction) and a hesitant prediction of market potential which is further trapped within certain national borders. Initial innovative ideas are promising and bear the potential to trigger the development of the new ventures, but instead of being exploited in equally novel ways, they stay trapped in agents' moderate formation of transcendental capabilities.

It is evident that PEA in F&B sector relies heavily on the background of the entrepreneurs. Contrary to the W&F cases, in these cases we notice that established firms do not necessarily develop higher levels of PEA but its development depends on specific corporate characteristics such as corporate culture, size of the company and its resource pool, personal experience and positioning of the entrepreneur. Yet, differences can be ***again*** traced at the levels of former experience (both educational and professional) of the agents which offers a significant advantage to agents with global views and international experience. Thus, the cases of F&B sector confirm the fact that e*ntrepreneurs need to question or purposefully develop a higher level of PEA for concept-building. A limited picture of the sector which revolves around local markets and certain knowledge limits affects negatively transcendental capabilities and especially transcendental conditions.*

Spaciousness in the cases of the F&B sector is sought in different areas than in W&F sector and mainly in:

a) i*nnovative products at a global basis* (e.g. FCo1, FCo5 and FCo9)

b) *innovative process technologies at global level* (e.g. FCo6, FCo7 and FCo10),

c) *addition of innovative characteristics to products and processes* (e.g. FCo4 and FCo8),

leading to globally novel concepts such as quasi-pharmaceutical chocolate, carbon free olives and olive oil and non-existent mixtures (melityros, oxymelo etc).

In two out of ten cases spaciousness shows up in a form of an individual's question. FCo10 was established on a relevant question of a food guru. FCo5 turned to gluten-free wheat after a telephone conversation with a stranger. This can be considered the *reason*; the *cause* is traced in their own transcendental thinking: Science (e.g. for FCo5 and FC6), institutional settings and food trends towards new, life style and healthy products (e.g. FCo10, FCo9, FCo7, FCo4, FCo1), functional and organic food (e.g. FCo9, FCo7, FCo5, FCo4), established opinions and regulations, demographic data (e.g. more singles) and globalization, constitute major areas of spaciousness.

FCo6, for example, took advantage of most of the just above mentioned areas and created "space" in many areas: horizontally with new food combinations that suit different customers' needs and vertically with co-specialized products in intra-sectoral areas (Pharmacy, chemistry, construction materials, biotechnology etc.). In the weak

cases spaciousness is sought within tight national limits and regards mostly technologies (FCo2) and products (FCo3) not existing in Greek territory.

Thus spaciousness considers mostly radical innovation and invention instead of exploiting innovations produced in other links of the industrial value chain (raw materials, technology and equipment, upgrading of existing products) as in W&F cases.

Sense of spaciousness depends on the agents' attitudes and cognitive capabilities, as well as the search they perform for idea creation. Collecting experience abroad is also very important.

> "The abroad experience is of great value. What you've learnt overseas contributes to the shaping of a new culture and creates a mechanism of constant opening of new horizons. This counts more if you are a technocrat and have this abroad experience due to studies or other entrepreneurial activities". (Entrepreneur of FCo9)

Even in cases where initial PEA is not very strong, abroad experience assists upgrading and knowledge-intensive novel business ideas: *"Travelling abroad and my visits overseas contributed in a major way to the birth of these ideas on innovation"* (Entrepreneur of FCo7)

The very strong six cases have presented strong cognitive capabilities and a long search for the idea (knowledge, money and time, devoted). **FCo4** and **FCo7** lack in the sense of spaciousness starting with a national perspective although they later consider exporting as well. Still, they own strong transcendental synthesis' capabilities which together with much deepened conviction and a strong need for achievement led the entrepreneurs to promising competitive advantages. Actually, FCo4 is an excellent example of sensing spaciousness in a saturated market, dominated by big Greek and foreign companies. The entrepreneurs created novel differentiated knowledge-based products opening a high-quality niche market. According to the author's opinion it was actually a very "clever" strategy for a successful entrance to the chocolate market without spending too much on production facilities or initial R&D in order to excel in offering existing products.

Regarding the two weak cases, strong to satisfactory sense of spaciousness was combined with rather weak bricolage and improvisational capabilities thus defined a moderate width and quality of sources to seek, resources, ways and combinations required. FCo3 rested on sources offered by the Italian process technology

manufacturer and FCo2 in the use of hydroponics without further exploiting the pioneering method. Both companies challenged an existing business system but DECs were not strong enough to offer leadership and initial competitive advantage exploitation. Their sense of spaciousness was trapped within Greek borders as well. In all other cases a global view was adopted; even if the agents started from the national market as in the case of FCo4 and FCo7, they were targeting at globally novel ideas. This is a major difference with the W&F sector as well.

Therefore, the cases of F&B industry confirm the fact that t*he width and the quality of sources to seek, resources, ways and combinations are defined by spaciousness (and realized mainly through the bricolage capability). Still, the ability to realize intra-industry space in saturated markets is tightly dependent on the ability to view global markets in a panoramic way and be in the position to estimate value chains, intra- and inter-sectoral industry potential.*

Transcendental Synthesis (TS) is evident in all F&B cases; in most cases the agents' a priori knowledge enters into existing concepts (of processes, consumer tastes, technology and even products) and provides them with contents that they would otherwise lack. Rice and wheat keep on being rice and wheat but with unique characteristics and properties turning to health and wellness issues of innovation and engaging biotechnology and pharmaceutics in research and development. Feta cheese and olives are still feta cheese and olives but there comes a unique not-easy to imitate concept with the relative innovative technology, to combine these two products into one and produce them massively.
Categorization can then be made only according to the level of pureness and novelty of TS which is tightly connected to the way the manifold of knowledge is created; this can range from empirical to totally a priori ways. In contrast to W&F sector, **F&B KI- ventures develop very strong TS no matter if they are new-to-the-world or corporate**. Actually in our cases there is an analogy of 50%-50% between the two types regarding an excellent exploitation of a totally novel business concept.

On the other hand, there is no difference when it comes to the development of **weak TS**; in both sectors weak DECs are developed by new-to-the-world ventures. In both sectors initial innovations seem to be inadequate to create a strong initial competitive

advantage although they can ensure the opening of a niche market (FCo3, WCo5, and WCo7) or open a new business activity (FCo2). In both sectors the dependence of TS's sub-dimensions (receptivity, spontaneity, and judgment) on the transcendental conditions is evident. FCo7, FCo2, FCo3 and FCo4 present some minor or major lags regarding transcendental conditions which - as we have seen above – are not as strong as in the rest cases. This affects TS development in a negative way.

Therefore, the F&B cases confirm further our general finding that the level of TS depends on the level of the Transcendental Conditions, and it affects significantly the other two DECs; TS appears again as the capability responsible for the capture of the novel but initially vague idea which will build the new business opportunity.

However, the ten F&B cases present significant initial innovation and actually, following again Liefer et al.'s (2000) definition,

a) an entirely new set of performance features such as entirely novel and patented products / processes (FCo5 and FCo9 / FCo7), novel not patented products (FCo1, FCo4) and novel processes and business models (FCo10)
b) improvements in known performance features of five times or greater (FCo2, FCo3, FCo6 and FCo8)

As evident, productive **TS**[174] (appearing mainly in the form of radical innovation) is somewhat easier to be developed in F&B industry than in the W&F industry. Actually, all ten ventures support radical innovation according to Liefer's definition. Yet, four of them present **productive TS**[175] **and the other six reproductive TS**. All first four (FCo1, FCo5, FCo9 and FCo10) are cases of well exploited and purely **productive TS with world recognition.** Furthermore, in all four cases Productive TS did not rest only on a novel process/product but covered all three axes of business activity; namely technology, marketing and business models.

Among the six companies of **reproductive TS** two of them (FCo6, FCo8) have shown excellent ways of exploitation and have gained high performances and

[174] We remind that Productive TS is the power of exhibiting and producing an original concept prior to experience (*exhibitio originaria*) and Reproductive TS the power of producing it on a derivative way by bringing back an empirical intuition (business idea) previously held by the organization (*exhibitio derivata*) and then we refer to adaptive or similar types of innovation. It is also partly conceptual as it connects directly with the determination of the form of a sensing opportunity.

[175] The definition of Phantasia is stricter than existing definitions of radical innovation. A radical innovation is a product, service and process with entirely unique or significant improvements in existing features which improve the cost and performance (Leifer et.al 2007). Productive Phantasia refers to only *exhibitio originaria* (see Note 6)

reputational enhancement which exceeds national borders while they enhanced innovativeness in their lifespan extending to R&D experimenting. Two ventures (FCo4 and FCo7) present a moderate exploitation of the otherwise significant initial innovation. However, they were unable to develop equally all three axes within this novelty and thus to exploit it in the way FCo6 and FCo8 did, lagging behind mainly in the proper use of the strong advantage of their innovation in market penetration and pace of reputational enhancement. This confirms the fact that, at least in low-tech KIE, entrepreneurs must be knowledge operators in regard to all business activities. According to the young entrepreneur of **FCo9**

> "Innovation alone is not enough to bring commercial success, if it regards only the product. You must develop the ability to be an entrepreneur –whatever this means – and this refers to the knowledge for the team you select, the manager you hire (i.e. human resources), how you will communicate the product and more generally your communication strategy; your branding, the distribution channels, where you will position your product. If you don't have all the above… innovation alone can be the basis but it will never be adequate to make your business successful"

FCo9 actually presents an excellent coordination of receptivity, spontaneity and judgment; a priori knowledge enters in several ways such as the modulation of the product's essence itself, the positioning and the flexibility to change directions and reshape the initial concepts. Knowledge mechanisms entail briefing, try and error processes, incorporation of existing but scattered knowledge and information in novel ways, creation of culture and communication codes in terms of activating the mechanisms of comparison to other products and diverse combinations e.g. of health-nutrition-taste.

> "Of course there was an initial idea. But then, there were so many combinations to be made! It should be familiar and yet different. What seemed close to other products should be further reworked, developed, differentiated. And we should find the way to mass production. This is especially difficult…. We are not competitive -we are different!"

TS mechanisms end to world patented products as well as creation of relative concepts to support products and ways to communicate novelty.

The two weak cases present **reproductive TS** too, thus, they both embrace "the unknown" by streamlining the massive and relatively disorganized concrete informational intake into simpler concepts to fit their purposes. They both introduced novel technology into Greece. Yet, they did not manage to communicate novelty to

markets and stimulate further research focused on the novelty. FCo2 and FCo3 innovate on existing technologies and models not yet applied in Greece. They produce rapid innovation, new to the national market,. Still, lack of vision and spontaneity hinders further development. In terms of Malerba's definition[176], the agents were not able to turn the novel idea into an innovative opportunity.

In the same line with W&F sector, reproductive TS is more common than productive TS in knowledge-intensive low-tech new ventures of food and beverages sector. Actually, six out of ten cases present **reproductive TS**. Among the 3 productive, 2 are well exploited and one is almost lost. No relations were traced among levels of productive or reproductive TS and new or corporate venturing. Analytically,

Productive and well exploited TS (strong TS): FCo1, FCo5, FCo9 and FCo10

Reproductive TS and well exploited (strong TS): FCo6, FCo8

Reproductive TS but moderately exploited (moderate TS): FCo4 and FCo7

Reproductive TS and poorly exploited (weak TS): FCo2 and FCo3

In both FCo2 and FCo3 cases, relatively weak judgments combined with mediocre receptivity and spontaneity led to rather weak transcendental syntheses and unsatisfactory and incomplete plans and business visions. Weaknesses are once again attributed to agents' human capital (e.g. characteristics, previous experience, knowledge etc.), initial resources and transcendental conditions. These two F&B cases indicate further that weak TS development has a domino effect on the rest DECs. Actually, weak TS affected bricolage by limiting the areas to seek and search for knowledge and resources. It also hindered improvisational capabilities; weak TS means low-level receptivity and spontaneity which besides their ultimate aim of shaping the idea, influence interaction with the environment, flexibility and thus information flowing.

Moreover, in both weak cases the entrepreneurial teams did not satisfy the basic traits and characteristics which were located in the other cases and considered as a minimum pre-condition for KIE in low-tech industries. They did not have an extensive experience in the sector[177] and their academic background was irrelevant of

[176] "Innovative opportunities are a way of capturing the three key elements of the business model. The firm must identify the value to a customer, mobilize the resources, and capture the economic benefits from innovating". (Malerba and McKelvey, 2010)

[177] Even the extensive experience of the one member of FCo2's team was on conventional cultivation which does not guarantee satisfactory entrepreneurial experience if we consider the way agricultural

it. They neither tried to "learn all about it" as the entrepreneurs of FCo9, FCo4 and even FCo10 who could be also classified in this category (of irrelevant academic area). In these cases entrepreneurs either devoted time and money to "learn" or engaged specific human capital to cover such gaps. The agents of the two weak cases did not experience this transitive phase.

Similar to W&F sector, two out of four F&B agents of the corporate venturing cases have been pioneers (not necessarily innovators) at least at local level in the past, before the knowledge-intensive venture. FCo6's first generation had presented a series of innovations such as the upright paper-bag for rice packaging (1969) and the yellow parboiled rice with thermal production from husk combustion (1972) while it was the first company in Greece to turn to innovative marketing methods by being the sponsor of a TV music show in 1982[178]. FCo10's founder was the pioneer in transferring Greek gourmet tastes in high value products abroad. Although it is quite early to name this former "experience" in pioneering as a "necessary" pre-condition for KIE in LT industries, it can surely be considered as an important element of "judgment dimension".

Judgment in its more general meaning (as TS sub-dimension) is evident in all cases all along the path to venture creation such as what to promote and what to reject or to combine with. No matter if choices refer to knowledge, technology, market strategy or strategic positioning, rules are always exercised being based on the core objective determining grounds initially set by agents. Some particular patterns which could establish basic categories of reasonable grounding and justification as focal points for judgment and have been also traced in W&F sector are:

- opportunities that give rise to latent visions: FCo8 (as WCo2) and the bankrupted company
- the need for a new plant: FCo6 (as WCo4)
- sector-specific trends: i.e. trends towards health & wellness and indulgence food (FCo1, FCo4, FCo5, FCo7, FCo9 and FCo10) or convenience (FCo3 and FCo5) in correspondence to trends towards health & wellness, or aesthetics (WCo1, WCo4, WCo8, WCo9 and WCo10)

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products are sold to wholesalers in Greece. It is less than five years that a significant number of farmers try to find other channels to promote their products

[178] It was MOYSIKORAMA with the newest video-clips of contemporary music. I happened to be a fanatic watcher

- energy and ecology matters: FCo2, FCo6 and FCo10 as WCo2, WCo4, WCo7, WCo9 and WCo10
- market data together with favorable institutional settings: FCo1, FCo2, FCo3 and FCo10 (as WCo2, WCo7, WCo9)
- former success of risky ideas (FCo10 as WCo10) or,
- relative technology development (FCo8 as WCo6 and WCo9).

A new category which did not occur in W&F sector is the convergence of science areas (FCo5, FCo6, FCo9 and FCo10).

Furthermore, customer feedback has been valuable in TS together with the other DECs in all cases of the sectors and more clearly specified in FCo1, FCo5, and WCo5.

Regarding the two senses of "objective" determining grounds and contrasting W&F sector where it regards a few cases, most food cases refer to the second category; they are mainly connected to inter-subjectively "communicable" (*mitteilbarem*) assents (that is, any assent that is rationally acceptable by the entrepreneurial team and the interacting environment).

In the case of **FCo2** the idea although acceptable by the four entrepreneurs was initially rejected by the funding authorities and by the scientific community.

> *"Cheese-made snacks – how could one detect the difference? Gluten free and taste equals impossible. Yet, we were sure about our ideas' excellence"*
>
> ***(FCo9)***.

As seen in the W&F sector and will be seen in the T&C sector in next section, agents of **most of the food corporate venturing** cases endeavor to ensure certain resources before actual venturing. Resources refer mainly to financial and human capital, development of R&D departments existing network and knowledge pool. This is a way to support and secure novel just–born knowledge not yet accepted by the majority, since it is generated before relevant experience.

As in W&F cases, all food and drinks cases revealed that besides knowledge, **deepened conviction is** a major and common trait of successful LT-KIE, stemming from previous experiences and successes, strong networks or a strong starting knowledge pool that secures the idea support. It appears again to play an important role in the formation of challenging concepts and to depend on the rest transcendental

conditions as well. Very strong deepened conviction has been traced not only in the cases of the "strong six" but also in the cases of moderate ones. Yet, in these cases the rest of the pre-conditions mentioned above are evident.

FCo6 drew on the significant business success of the mother company since 1955, its strong position in the Greek market, existing contacts with world leaders all along the value chain (creating high-level PEA at global level), the flourishing economy by then, easiness to invest and HR commitment to new vision. Agents further are well educated and believe strongly in the contribution of science in enhancing performance. The gradual development of a strong R&D Department strengthens conviction of innovative performance of ever called mature rice producers.

This strong devotion to science and a relative R&D Department appears to strengthen conviction of **FCo5** arising from the challenge posed by a celiac disease patient. Of course strong knowledge and capabilities pool due to former entrepreneurial activities further reason confidence.

FCo8' deepened conviction sprang from their long term activities in the milk sub-sector, their positioning and the significant success. We should add our personal opinion that some teleology is outlined in this case *"For us FC8, a former bankrupt cooperative was a bet"*[179].

FCo1 and FCo9's deepened conviction derived by the family entrepreneurial milieu, strong and international educational background, international experience and personal abilities and characteristics combined with their strong basis on food sector, economics and management. In both cases – although more evident in FCo9 – deepened conviction is revealed by the application of the Copernican Turn; thus the quite risky **reversal of commonly accepted rules (e.g. gluten-free products are not necessarily tasty and are consumed by people with gluten intolerance).** Entrepreneurs stick to the possibility of such *"uncommonalities"* due to the extreme level of self-confidence which derives from their deepened conviction. As a reporter has stated *"This unconventional mentality has created a legend around their name and not without reason"(*Tsakiridis, mywaypress.gr**). According to our opinion this cases shows no signs of teleology.**

[179] Origins of entrepreneurs may affect DECs and deepened conviction. *(Vlachs groups are of special interest regarding entrepreneurship. To our knowledge the agents of many companies of the sample located in Thessaly and Epirus belong to this group)*

FCo10's agent is representative of the traits named above to profile entrepreneurs of deepened conviction: impressive academic and entrepreneurial background, strong networks and a well-built sustainable knowledge pool. Deepened conviction derives from success, experience, awards to secure worldwide recognition, but as the entrepreneur claims his deepened conviction comes mainly from his strong vision: «*The most important driver is a strong vision*».

As in W&F sector, a careful study of the cases reveals a further gradual development and increase of deepened conviction when the agents received favorable attention for their initial vague ideas. **FCo5** enjoyed acceptance and support by their target–groups and by academia which assisted in integrating the agents' novel concept. **FCo1's** pilot production was highly appreciated by a big foreign customer who placed significant orders and encouraged further creativity even before installation was completed.

FCo7's deepened conviction comes from a wide knowledge and experience of feta cheese sector and his awareness of the cheese sector in general since the entrepreneur is a fourth generation cheese-maker.

> "Many micro traditional introversive, old technology cheese-makers and 5-6 big ones who are too big to think of real innovation; their innovations turn around package, logistics and low fat".

Although cautious, he realizes that he needs to invest in knowledge in order to become differentiated and has a strong belief on the creative role of producers: "*consumers alone cannot define what they expect*". He claims that it is the producer's capability to anticipate consumers' latent demands. The agent deepens his conviction due to the support of foreign competitors (in USA) in his voluntary journey to unknown and the ability to start with reverse engineering. Such agreements increase significantly deepened condition and assist the further development of the initially amorphous idea.

FCo4's deepened conviction derives from the growing trend towards "traditional" and biological food and an extensive market research on chocolate bars in Greece[180]; consumers trust Greek chocolate more, drugstores are not popular for selling chocolates, an eligible number of imported fructose chocolate bars do not win consumers' preferences due to taste, and consumers prefer big known companies. As the family (of the agents) believed strongly in differentiation and the impact of knowledge, their choice to turn to more sophisticated chocolate bar production seems

[180] http://www.icap.gr/ECPage.aspx?id=1858&nt=149&lang=1&tabID=3

to be at any stage justified. Although they did not travel as much as the rest, they have spent many hours searching a lot in internet and academia sources. We should argue that their choice to cover local and –later – national markets through alternative channels (drugstores and bio-product stores) was a major differentiating decision since all transcendental conditions are mainly satisfactory at national level. Deepened conviction becomes stronger due to the new firm's acceptance, further networking and involvement in the sector of bio-food. We should mention that the agents could face foreign markets as well but they did not do it in the beginning.

In **FCo3** the two entrepreneurs build their conviction on the general assumption that food sector can offer unique opportunities since there is always spaciousness in it. Selecting the novel egg process was not a matter of any preexisting securing reasoning. It had actually nothing to do with the criteria set above but it was based on the mere fact that there was no other Greek competitor while "t*he right people appeared at the right moment"* as stated by one of the agents. The entrepreneur meant that the person who contacted the idea met them when they were searching for an innovative business idea and helped in finding a technology provider in Italy. Limited experience and false conviction gave birth to some teleology as in the case of WCo5. They surely managed to be the first in Greece but that was not enough to gain first mover advantages since the idea was almost simultaneously adapted by two large companies of the sub-sector.

A quite strong dimension of developed conviction is traced in the case of **FCo2**. The deep knowledge of earth cultivation created the basis of risking "the unknown" counting on the benefits of stable production and "clearer" products. The increasing interest towards ecology and healthy nutrition enhanced agents' conviction, at least, at national level. The fact that they were soon followed by a significant number of imitators justified their choices. Yet, deepened conviction was not developed enough partly due to the weakness of entrepreneurs regarding previous experience, success and level of PEA. If we dare a comparison to successful cases, the actors could develop novel concepts around the products of the innovative method, create contacts and networks to correspond to the novel concept they offered, or extend research among others.

Consequently, Deepened Conviction plays an important role in the formation of challenging concepts produced by mismatches of common and transcendent ideas being a moderator of "how much challenging" the business concept will finally be at

least in F&B KIE. On the other hand, low DC seems to hinder entrepreneurial novelty and creativity in F&B KIE.

7.3.3. TEXTILES AND CLOTHING SECTOR

7.3.3.1 Bricolage capability

Bricolage in the T&C sector engages mainly technology developers, which belong to all links of the value chain; i.e. they stretch from machine manufacturers and raw material producers (TCo1, TCo2, TCO3, TCo4, TCo6) to ICT and process technologies to fit their novel ideas (TCo5, TCo7, TCo9). Sometimes they even develop collaborations well out of the sectoral boarders such as the involvement of biotechnology, enzyme technology and nanotechnology (TCo1, TCO4, TCo6), antiballistic, composite material and plastic deformation technology for TCo2, biodiesel science organic waste treatment and technology in the framework of environmental engineering (TCo3, TCo6, TCo7). In this sector there is further a strong bricolage capability towards CCN and repertoire building regarding the areas of organization such as novel processes (e.g. mass customization, TCo5's "Consignment" Model), logistics, marketing, branding and even the creation of new administrative models. This is quite normal if we consider that it is a strongly fashion-oriented sector and that most cases are cases of corporate venturing.

Various sub-sectors of T&C industry are well engaged such as Textile Processing, chemistry and manufacture of fibers, denim production technology, washing-prewashing processes, design and garment finishing to name a few. Moreover, mechanical /electronic engineering, IT and design, fabric and yarn quality control were areas to search in and develop CCN and repertoire building in most cases.

Once again, as observed in the other two sectors as well, the hunt of knowledge on both relevant and irrelevant sub-sectors still regards more the "new in the shape of the familiar" and therefore this paradox combination of innovating on traditional products. However, while in F&B sector, the actual target is to ***produce novel products*** at least in nine out of ten cases, it is not the same with T&C. Actually, there are only two cases (TCo2 and TCo6) which target to the competitive advantage of novel products. Most cases target the production of novel methods of production, processes, novel techniques, or novel combinations in order to create initial

competitive advantages. Yet, innovations of the field are all knowledge-intensive[181], target in their major percentage global new niche markets, cannot be characterized incremental and some of them are patented.

43**Table 7.11: T&C bricolage capabilities**

Bricolage capabilities	**TCo1**	**TCo2**	**TCo3**	**TCo4**	**TCo5**	**TCo6**	**TCo7**	**TCo8**	**TCo9**	**TCo10**
Type*	E	E	N	E	E	E	E	E	E	N
Repertoire Building	strong	strong	weak	moder ate	strong	strong	strong	strong	strong	moderate
CCN	Very strong	Very strong	weak	Weak	strong	weak	Very strong	Very strong	weak	moderate

**** N= startup, E=established***

In contrast to W&F sector and resembling F&B industry **both established and new-to-the-world** ventures get out of national limits and try to offer added value innovative products, services and respective processes.

With the exception of TCo8, all cases target internationalization and care for their image worldwide. Trans-sectoral and trans-national knowledge plays a central role in all entrepreneurs' culture; they all invest money and time to seek knowledge in various scientific, industrial and functional areas, at different however levels. All of them own a strong experience of the sector, they have proved to be unconventional in the past and they are all involved personally.

Bricolage capability appears strong in the cases of **TCo1**, **TCo2, TCo5, TCo7** and **TCo10**. All five agents create dynamic problems and build their repertoire presenting a quite significant range of networking activities in order to address them. More precisely,

If Hans Hinterhuber (1992) wanted to prove his theory on the special relationship between the entrepreneurial vision and the person (entrepreneurial ideas, he says, are an expression of one's own life and professional experience), he could use **TCo7's** entrepreneur as an exemplary case study. Pre-existing contacts (initial network pool) and network bricolage are very important to him. "Everything is networks" he uses to say. He engaged in bricolage with regard to knowledge providers building strong bridges in order to reach them and collaborate with them: he actually used the jeans

[181] Contrasting the conventional type of T&C firms which are clearly technology adopters

fabric providers in Italy; being an important customer, he gained access to famous Italian jeans fabric providers, big dyeing plants, chemical raw material suppliers and the world of design in order to collect resources such as knowledge, material and contacts and offered lucrative salaries to Italian treatment specialists, designers and the engineers for the new plant. He achieved significant collaborations, got valuable advice and knowhow, and reached sources of financial capital due to former contacts. Cycle extended to equipment providers and control labs; this is where German technology enters. The entrepreneur adds links to the chain by extending to promotion networks. He uses interactive learning in an excellent way in order to build the new strong image; jeans treatment and the creation of a district culture around it becomesTCo7's strong competitive advantage. The new venture now can confront the mythical leaders such as Levis and Diesel. Interactive learning is gained by frequent and repeated visits to Italy, training within Italian plants, but mainly with the success of engaging the Italian specialists. The establishment of a personal friendship with F's[182] CEO further supports this dimension. From plain jeans sewing for the local market, the new TCo7 moves successfully to fashion, branding and high level fabric treatment.

TCo2 is also a very interesting case of CCN within the notion of knowledge. A conventional sheet maker turns to technical fibers seeking differentiation within the company's conventional activities. However, it is in 1998 that the construction of a new plant and the need of innovation in order to survive turn the three entrepreneurs (father and sons) to KIE. The two brothers create a problem around protection and the human-body putting it on a different basis of existing large companies with protection clothing. On that basis they seek to develop networks with firms of high-tech sectors well out of the textiles sector; they actually contact and develop collaborations with Gore for waterproof, windproof and breathable fabrics, DuPont for flame retardant fabrics and 3M for reflective material and clothing. This was the beginning of a long-lasting and close cooperation with these three leading and R&D intensive companies. In parallel reorganization turns company towards design knowledge, building a team of a designer, an engineer and a quality control executive and introducing CAD-CAM advanced system (the first in Greece in the sector). TCo2 establishes relations of trust

[182] An Italian leading company in jeans fabric production which actually leads globally the jeans fashion.

with the leaders in order to be the pilot user of new material but advances knowledge and performs in house R&D where sometimes suppliers act as complementors.
CCN expands to co-operations with technical consultants especially from Israel which develops significant relevant know-how.

Technical consultants were another source of knowledge from Israel that worked with the company and brought in their specialized know-how on composite materials for armor-plate or bullet-proof. They were proposed by a cooperator in Turkey while a partner in USA assured their quality.

Later bricolage will be embedded in DCs extending to other KI partners besides the leaders such as quality labs, other material and know-how suppliers (e.g. for the production of the innovative helmet, an R&D product of TCo2). It will also engage Universities for production restructuring and logistics, it will turn to promotion as well as the development of e-commerce and B2C.
By bricolage capability TCo2 developed a strong basis for knowledge seeking and creative recombination. A major tactic of the company is to establish long lasting relationships and to become a member of relevant networks.
TCo1 is also a very interesting case regarding bricolage capabilities. Here we can see two different initial network pools[183] and therefore CCN is developed around them in order to implement the business idea. Networking with equipment suppliers enables the choice and construction of original high-tech machinery and its combination in innovative ways (e.g. mechanisms for feasible tailor made solutions and special effects, the full-scale recovery of effluents for reuse in production, waste water treatment and energy saving) using ICT and other techniques. Networking with both chemical companies and the apparel industry enabled the application of the patent as an initial significant advantage. The two entrepreneurs invested also in building a strong team although they both remained in charge of the whole project. A mixture of ideas and applications has been elaborated with both foreign (mainly from Switzerland and Germany) and national companies.

"You have to foresee the next step and find the right partner. And Mr R can do that. He finds the missing link at the right moment"

(CEO of TCo1)

[183] Besides strong professional contacts, the Greek entrepreneur is president and member of many technological and entrepreneurial associations. The German entrepreneur was by then an important business of the sector.

The two entrepreneurs develop their bricolage capabilities mainly through CCN and repertoire building in Greece, Germany, Austria and Switzerland opening the perspectives of the parent company by establishing trust and using both formal and informal sources and contacts. The company builds co-operations with

a) big multinational chemical companies (such as Clarient) which will in future be strengthened by several fruitful projects.
b) Local manufacturers; the cooperation led even to innovative machinery presented at ITMA international trade show by the manufacturers after two years. However, it was clearly stated that patenting machinery did not interest TCo1.
c) specialized laboratories for all processes in Greece, Switzerland and Germany
d) a Greek automation company (and ICT) manufacturing companies

The entrepreneurs ensure the development of constant collaboration with most of the above created networks. Later they will turn to academia as well but not at the stage of the venture creation.

Accumulated knowledge and long entrepreneurial experience on the sector by both entrepreneurs enables the further development of resourcefulness. Interactive learning supports a constant bidirectional knowledge flow of both embodied and disembodied knowledge through skilled personnel, training, plant and equipment designs and descriptions, company visits, consulting and mutual experimenting. It is also supported by individual studies, technology literature research, patent searching and trade shows of different industry sectors (e.g. chemical, fiber, fabric and equipment). Some employees were further trained by the manufacturers' technical staff on maintenance and problem solving techniques. It should also be mentioned that in the case of TCo1 the entrepreneurs separated the technical part from the process part of the newly created problem under the umbrella of innovativeness.

The **CCN dimension of these three cases, together with TCo8's, are among the strongest of all cases (of all three sectors)** and are then successfully transformed and incorporated in sensing and seizing capabilities.

TCo5 owns also strong bricolage capabilities but it also presents a significant specificity. It is the only case of our sample **to turn to academia.**

> "We turned to SDA Bocconi in Italy. We participated in two of their training courses in Athens… we understood that what they teach is exactly what we want. We contacted them and we brought them to train some of

our company members. Then, they helped us specify what exactly we wanted and supported our effort to reach it"

In order to realize the continuously reformed initial idea the entrepreneur developed all bricolage dimensions selecting knowledge of many areas ranging from technology to logistics and sales restructuring. CCN was observed in the forms of co-operations, new joint projects and search for new partners. The idea caused a total restructuring of the company.

TCo10 is also a quite special case where KI innovation refers to fashion design. "Indeed, it could be argued that much of the clothing industry, and certainly the designer clothing sector, are based entirely on innovative design. (Hirsch-Kreinsen et al., 2003). With a career spanning 20 years and counting in the fashion editorials business, the entrepreneur collected pieces of knowledge in order to become the designer, stylist and boutique owner playing the double role of designer-manager. He has to combine knowledge on trends and designers, marketing, promotion, manufacturing but mostly consumer's behaviors.

Bricolage capability proves to be very important. The entrepreneur relied on his initial network pool as his primary means of access to the welter of resources needed during and after founding, whatever the limitations. He made use of an extraordinarily broad variety of means and resources at hand ("tools at hand") during and after founding: he engaged in bricolage with regard to knowledge providers such as

a) shoe producers exploiting former employers' resources and knowledge,
b) suppliers (e.g. fabric), customers (fashion world from fashion magazines where he was involved for 20 years),

and furthermore with regard to

a) financing as he looked and found a business angel
b) promotion using prior fellow workers "It is really very important that before even the opening and with zero advertising expenditure I was in all fashion magazines. This was a big success by its own!"

Resources "at hand" regarded even space since his first collection was actually hosted in a friend's atelier. **This case actually brings bricolage capability at the very basic literature on bricolage in general.**

The four cases left (TCo4, TCo6, TCo8 and TCo9) regard big, well-established organizations. They exploit the company's already extended networks and stretch

further in new areas and directions along the value chain. Three of them present rather mediocre bricolage capabilities, with a reluctance to widen the CCN and a rather reactive attitude preferring problem-solving than rather creating (TCo4, TCo6, and TCo9) which further seems to affect repertoire building. It is quite evident that bricolage as well as improvisational capabilities cannot escape the parent organization's path dependencies. All three are technology-based; CCN turns mainly around technological contacts and R&D co-operations.

TCo6 shows a high degree of innovativeness and knowledge exchange**.** However, bricolage was limited among already known knowledge providers which are mainly machine manufacturers, main customers and academia (the relevant technology department in Aachen). All of them belong to initial network pool and therefore **CCN is rather week.** Although the initially vague idea would allow for more unconventional ideas, the entrepreneurs stay caged in the power of technology. Thus **repertoire building is rather moderate** since the problem created (novel technology) although unorthodox seems to be rather limited. This can be due to the fact that core customers and existing markets indicated that new technology was all that they needed at that time. Therefore, **the entrepreneurs did not try to actually enter new markets or otherwise capture new groups with their new knowledge-intensive SBU[184].** The entrepreneur confessed that among the initial plans was a turn to technical textiles, but there was a hesitation due to non-existence of close market, the newness of relevant fields (*we talked no more about cotton*), and disorientation due to the existence of high promising markets (and existing customers).

However, **interactive learning is quite strong** especially among the company and leading European manufacturers (e.g. Rieter, Schlafhorst. Lenzig). All stakeholders come up with innovations. Indicatively, two of the manufacturers present the link system technology, while the third presents with TCo6 the innovative TENCEL fiber after **almost 3 years of experimentation. The new product will be called the "Harry Potter of yarns" in 2005.** Planned training sessions, practical and scientific knowledge and training (new know how, new production, new cotton cultivating and treatment and so on) were harmonically combined to experimenting. Results presented compact technology as the initial competitive advantage in 2 years' time

[184] We remind that this is a major characteristic of this group within the Greek national context.

followed by the production of Q-cotton the third year and the successful promotion of Tencell in order to achieve desired visions and targets.

For **TCo9 CCN and knowledge hunting was weak** and limited in known "network cycles" in an environment of rather problem-solving than problem-making. CCN is evident regarding only human resources with the engagement of specialists of the apparel sub-sector. Therefore, TCo9 searched for new knowledge within its existing networks in order to accomplish the initially vague innovative KI idea for more flexibility and emphasis on design. In order to finally apply the solution of mass customization[185], TCo9 needs strong repertoire building. High level of resourcefulness regarding all kinds of assets and especially knowledge is important. The company attempts a holistic renewal of capabilities and the application of new ones to fit mass customization. Through **strong Creative Resource Recombination and interactive learning**, new Knowledge and tangible investments touch everything: from new equipment, to logistics, marketing and organization. The company develops new processes of R&D and marketing, new production planning and a new philosophy of customer treatment. Synergies such as specialized HR employment, co-development of innovative products, co-operation with machine and automatization manufacturers are results of the bricolage capability. Both practical and management knowledge seem important to complement technical and scientific knowledge. It is important to mention that at the same time TCo9 verticalized with a cotton ginning mill. The company becomes knowledge-intensive and will soon turn to new aspects such as energy and nanotechnology.

TCo4 reveals an almost "stubborn" commitment to technology. The entrepreneur admits this preference of his, while during the interview the statement around ***investing in technology is repeated more than 5 times.*** There is also a confession that this commitment was not the best strategy to follow: "*All this machinery is brand new, but without value and any significance anymore…"* This "addiction" followed him even in 2009 when all signs were against such strategies and the entrepreneur himself knew that quite well[186].

[185] Appearing in literature in 1987, in early 1998 mass customization was almost an "oxymoron" between theory and practice and was partly applied in Japanese industries (cf relevant section in Appendix E) .

[186] *"Since 2006, the European production changed. It is not the production of innovative products anymore. It is complimentary to Chinese production"*

CCN was too weak. Although there was a significant knowledge hunting this was limited within known areas. This weakness combined with the teleology cultivated by the ten-year success in the sector did not allow for a wide and multifaceted search for information and knowledge. Restructuring involved a further focus on R&D; a new, strong R&D team of about 15 engineers and advanced R&D collaborations with suppliers higyly trusted due to long term relationships. The company worked on very specialized areas developing know-how even at scientific research level[187]. However, it seems caged in its former culture although the entrepreneur had decided to create something "completely different". We cannot deny that there was a deep pool of knowledge and strong networks mainly with suppliers but this was perhaps the core rigidity of TCo4.

TCo8 presents strong bricolage capabilities and an excellent case of knowledge seeking in diverse areas and knowledge bases. It actually fulfils the suggestion of Hirsch-Kreinsen and Schwinge on the importance of *LT-KIE capabilities to question existing knowledge and to identify and acquire (new) relevant knowledge from other knowledge bases*. The imperative need for survival drives to the idea of a complete reconstruction of the company's strategy and business model: from a top-quality white underwear producer based on automatization and technology provided by manufacturers to a modern fashion (under)wear solutions for younger target groups. This was translated to the need for knowledge, new organization, novel machinery and the creation of NPD departments. Therefore, TCo8 had to depart for everything known to the "unlimited world of unknown" as mentioned in the description of the transcendental capability and more precisely,

- create a fashion-centered NPD department and thus find, combine and create knowledge on fashion (non-existent by then)
- combine it with innovative material ranging from fibers to supplementary material (e.g. elastic waistbands and laces)
- Translate it into production with all changes (really important decisions on the automated mass production machinery). Indicatively, the company turned from 30 codes every three years to more than 8000 codes per six months. This meant flexible production systems (we remind that we refer to 1998), development of

[187] E.g. there was research on the parameters that affect certain types of fabric behaviour

logistics and ERP systems which were all just in the beginning of their development.

- Novel administrative models to support the above systems
- Engagement in the world of fashion marketing

> We invested mainly in innovative knowledge; fibers, spinning, knitting, and their innovative evolution. However, we were quite familiar with these areas. Then we had to invest in areas totally unknown to us; design novel material with specific treatment, novel business models and sales ERP … actually when we started we found no company to support the system. There were some Israeli systems that were promoted by an American company and the Adoniadis' Computerland".
>
> (Entrepreneur and CEO of TCo8)

The analysis indicates a **strong repertoire building** with equally strong sub-dimensions such as resourcefulness, creative combination and interactive learning.

> "No matter the company's knowledge, if you want to enter some other area where new knowledge and information is necessary you have to come out of your shell and search… Initially we turned to innovative material approaching mainly raw material producers and visiting relevant trade shows. This is how we approached Lenzig and then we formed a joint-venture with T. "

On the other hand **CCN** is extending to diverse areas such as **raw material suppliers, designers, fiber suppliers (these were not former suppliers since the company's raw material was white cotton fabric till then), dyeing plants and waving plants (some of which will later turn to joint ventures).** Network extended to **control labs, new market channels and fashion marketing specialists**. Meanwhile new departments and new teams are created: a **creative Department with designers, modelists and patronists** working closely with **external European designers** and a strong ERP team (the head of the relevant Dpt is now a member of BoD). Sales department is also completely restructured since TCo8 turned from B2B to their own chain stores and shop-in-shop stores.

Keeping the leadership in technology till 2000, the company was already technology-based. However, technology would come almost ready and regarded only productivity and automatization. The KI venturing requited a broad selection of knowledge, consulting, training, technology and know-how transfer. Synergies and micro-processes of learning regarded collaborations with suppliers, joint projects (e.g. with

TCo4 for dyeing), famous designers, system producers (3 - system try-and error processes). TCo8 tried even new production systems (e.g. cells) and modern sales networks and techniques, in order to manage the complete business model restructuring.

> "We tried to enter lingerie in an innovative way. That meant knowledge, training, close co-operation with consultants and specialists and companies with the necessary know-how. We had to combine novelty in material-design –production and promotion!... That meant a significant combination of knowledge that even international companies did not owe by then…"

Weak bricolage capabilities (in combination with the rest DECs which may be also weak) are traced only in **TCo3**. CCN is not expanded on a research basis while pieces of information and knowledge are limited and insufficient for creative combinations. The entrepreneurs seem to "hang on" others for the eco-part of their novel idea while the one-piece dyeing novelty seems to be caged only for their own purposes. They mostly utilize existing network of suppliers, customers and other knowledge providers. They extend their network only in regard to biodiesel production involving academia (TEI of Thessaly) and with the engagement of three chemical engineers. On the other hand, the dyeing process was supported by the engineering teams of the dyeing plants of the 2 entrepreneurs. Although they extend to an innovative and knowledge-intensive area of bioenergy production by adding value to the conventional dyeing plant (eco-venture in parallel use of water and natural colors instead of chemical treatment), they do not manage to produce a coherent repertoire.

TCo3 became the first clean energy producing dyeing plant in Greece with piece-dyed products (and among the first in Europe). However, it did not manage to create the expected competitive advantage. It soon rested on it as well as on the existence of a critical mass of orders (by the two "parent" plants) and did not try to provide novel knowledge and skills along the three axes of a new-to-the-world venture.

In this case the resulting concept was the expected one but the venture did not manage to result in real first-mover competitive advantage. Although the innovative idea created a new niche market at national level, initial competitive advantage collapsed very soon, did not manage to bring satisfactory sales growth and proved unable to support the company in the crisis period.

Therefore T&C KI-cases of the present research form three groups regarding bricolage capabilities:

a) Cases with strong bricolage capabilities: TCo1, TCo2 TCo5, TCo7 and TCo8,
b) Cases with moderate bricolage capabilities: TCo4, TCo6, TCo9, TCo10
c) Cases with weak bricolage capabilities: TCo3

In all cases ***open attitude***, as well as ***deep experience*** of the sector are observable. Once again there are two types of entrepreneurs; a) the ***more human –centric and cosmopolitan***, who builds on innovative image collecting pieces of all areas (e.g. marketing, design, technology, production, R&D) such as in the cases of TCo7, TCo8 and TCo10; and b) the ***technology–based*** ones that focus on technology and R&D innovation such as TCo1, TCo2, TCo3, TCo4 and TCo6. TCo7 and TCo4 can be considered the two poles of the group while TCo2 achieves an excellent harmony between all three axes (i.e. technology-market and business model).

Interactive Learning is also in T&C cases a highly dynamic process: Almost all entrepreneurs collect, combine and generate knowledge while embedding a relative culture of constant learning. Most entrepreneurs use knowledge from various c areas to realize their novel concept. TCo4 invests heavily in technological knowledge to intervene in innovative ways to known processes offering novel products while increasing productivity and focusing on ecological aspects, energy savings and recycling while patenting innovative processes. In all cases learning comes besides conscious knowledge generation, through trial and error and experimentation. However, TCo3 shows a weakness in further adding knowledge while some cases present a reluctance to develop research-based networks in order to expand knowledge limits.

In contrast to F&B sector, not all agents are engaged in ***real problem making.*** **As seen above,** in some cases, entrepreneurs would actually engage bricolage in solving problems due to the need of survival; this limited the knowledge bases required for KIE. Therefore and in line to the other two sectors, once again we observe different levels of synthesizing with a clear but flexible orientation and focus, with bricolage capabilities to rank from very strong (TCo7, TCo8) to very weak (TCo3).

Since T&C cases are mostly cases of corporate venturing and regard well-established and large companies, cases of moderate and weak bricolage capabilities do not present resource shortage in any aspect (i.e. such as physical, financial, human or social capital) or weak mechanisms for resource-seeking and networking. Thus, *we cannot comment on its impact on bricolage capabilities.* However, in its general form, *Bricolage capability therefore appears to have a positive effect on making progress in the emerging stage of knowledge intensive venture creation, the initial innovation and the creation of initial strong competitive advantage in T&C sector.*

7.3.3.2 Improvisational capability in the T&C industry

Improvisation here is less fancy than in the other two sectors. Yet, the idea is again constantly revised while improvisational capabilities serve different but complementary targets, such as:

The pursuit of more novelty and differentiation: more evident in the cases of **TCo1** and **TCo2** where information flowing is very advanced.

Changes can also occur due to restrictions and limitations: typical examples among the T&C cases are **TCo10**. The entrepreneur improvises in order to suit existing plant with his own vision with limited initial financial and human capital. A special category here can be considered the cases of TCo5, TCo8 and TCo9 where improvisational capabilities enable changes required due to the implementation of the novel models. TCo5 uses improvisational capabilities to solve arising problems mainly due to the implementation of the novel hybrid model and the subsequent novel changes in equipment and overall organization. In the same line, improvisational capabilities prove significant in the cases of the novel mass customization model of TCo9 and TCo8 shift to fashion lingerie providing solutions to know-on effects of arising needs for change on multiple levels.

> "So you invested on technology although the decision was not to invest…"
>
> (Interviewer)
>
> "Yes! This need arose during implementation. Existing technology could not support the new model. Things indicated that this investment could help. Yes, it was not scheduled. The arising market needs supported the choice, too. Yes, we had decided to stop with technology before 2000"
>
> (Entrepreneur of TCo9)

Improvisation can also happen just ***due to a strongly embedded improvisational culture*** which is however motivated by the entrepreneurs. An exemplary case of such

improvisational capabilities is **TCo7**. The improvisational capability actually supports the transcendental capabilities of the company and especially the entrepreneur's. After the decision to broaden the business scope and scale of the company to widen the range of stakeholders, the entrepreneur and his team engaged in reworking pre-composed material and existing knowledge on denim culture, excelling where necessary manufacturing installations and knowledge on adding-value processes., Formal and informal ways of getting real-time information are observed which redefine and improve the initial concepts. Networking played a vital role on obtaining and exploiting real time information and more precisely knowledge. TCo7 is actually the T&C case where there is a constant improvement based on knowledge and "always en route to the better" (Kant). The entrepreneur started from the idea to excel in denim treatment. Getting knowledge on innovative methods, the entrepreneur and his team presented a significant level of improvisational capability

> "Design may spring from special treatment. This is what I thought and this is what I did (author's note: by bricolage capability as explained above). Our first creative (i.e. Department) was located in Florence. However, since I started developing design, I turned to branding and that brought the inspiration of a unique culture around my own denim… It was not planned as you see…"

TCo7 believes in the inspiration of the moment and invests strongly in creativity. He engages customers, partners or even researchers in his projects or ideas making them stakeholders in order to solve problems or make the most of inspirations. This is a fine way to have real time information and promote and improve or abandon initial concepts. The entrepreneur claims that improvisation happens for the sake of the special, the different.

> "On the job, things come up that introduce innovation. The special is added to the general. This is the one that will add value and you often meet it on the "road". Yes, improvisation is a matter of the team, of the entrepreneurs… Business and vision go together…"

44**Table 7.12: T&C improvisational capabilities**

Improvisational capabilities	**TCo1**	**TCo2**	**TCo3**	**TCo4**	**TCo5**	**TCo6**	**TCo7**	**TCo8**	**TCo9**	**TCo10**
Type*	E	E	N	E	E	E	E	E	E	N
Information flowing	strong	strong	weak	weak	moderate	moderate	strong	moderate	moderate	moderate
Provocative organizational competencies	strong	strong	weak	Weak	moderate	moderate	strong	moderate	moderate	moderate

**** N= startup, E=established***

It has already been mentioned that improvisational capabilities exist, are effective but are not so strong as in the cases of the other two sectors. Thus, in most cases, entrepreneurs would ***reform the initial business idea but in rather scheduled ways and thus missing the existing stories of inspiration observed in both W&F and F&B cases.*** In most cases reforms refer mainly to improvements and refinements, as well as problem solving deviations. Perhaps TCo7 together with TCo1 present the strongest improvisational capabilities while TCo2 presents also strong capabilities.
On the other hand, TCo4 and TCo3 present the weakest of all. All other cases present rather moderate improvisational capabilities. More precisely,

TCo4 cannot escape routines and well organized procedures even at the stage of founding. Even information-flowing seems to have been applied more as a sub-process of regular NPD than the specific dynamic entrepreneurial capability as described in the relevant section. The trend of dissatisfaction is evident; however the entrepreneur accepts the one and only way of fulfillment and this is "cutting edge technology". We should mention here that the company goes on with heavy investments all years ever till today and tries to catch up with innovative fabric treatment (2013) targeting EU markets in order to survive.

Weak improvisational capabilities appear also in **TCo3** with major weaknesses to be weak communication and interaction with the environment and among the teams and a false approach to knowledge management. Almost all improvisational dimensions are weak and this in turn created significant disadvantages to further development despite the rapid sales growth the first three years. Resembling the WCo7 case, entrepreneurs were the first to tap the related technology and adopt it to local conditions creating the new market segment. However, they did not engage real-time information or any type of flexibility besides the adequate development of provocative competencies. Although they have developed a strong experimental culture which led to the creation of further technological innovation during the implementation phase, they did not do the same regarding the other two parameters of market and business model; they stuck to their initial strategy while they could for example improvise on the basis on the newly developed know-how. Furthermore according to the author's personal opinion, the new company did not manage to escape the custody of the two "parent" companies. Such weaknesses of

improvisational capabilities drive the company in very fast obsolescence, although it was a pioneering business idea.

TCo1 revealed **strong dimensions of improvisational capabilities**, such as diversity, moderate use of regulation and control with a tolerance of mistakes, a sense of urgency, information flowing, promotion of experimentation and action. Real-time information is achieved through formal or informal business contracts supported by a strong network that allows synergies and co-operations. Indicatively, during the whole process, manufacturing knowledge is developed by emerging problems and a close co-operation of the entrepreneur (who is a mechanical engineer) with the company's engineers and manufacturing companies in Greece and abroad. When probing the new production lines, absence of routines and the strong experimental culture enables fruitful interaction and knowledge transfer among raw material suppliers and TCo1 through exploring and experimenting. This results in significant process and technology novelties using patented material in order to cover the specific needs of the company. One of them (innovative machinery) was presented at ITMA international trade show two years later as the manufacturer's innovation.

Avoiding routines was a main guideline of the entrepreneur in order to establish a successful new venture. The initial idea being the verticalization of mother company moving up the value chain, the entrepreneurs selected a flexible team of a few members (in terms of minimal structures) to join the effort and capture as much extensive knowledge around the new dyeing plant as well as ways to collective activities. Teamwork and collaboration support one another's initiatives. Deviations from plans are associated with arising opportunities such as the possibility to cooperate with Greek supply companies, solutions to problems such as the incompatibility of innovative material with the conventional dyeing production lines and alternative methods and uses of the new lines. Based on improvisational capabilities, some malfunction during erection let to the innovative variable loading[188], a customer's observation led to the anti-smell product in collaboration with a big chemical company, a Swiss world leader in specialty chemicals.

[188] Trying the production line with Clariant's novel product, the engineers found some difficulty and improvised developing excellent information flowing with Clariant's chemists and Sclavos's engineers (The Greek manufacturer who later presented the innovative technology at ITMA). The narration of the two engineers Mr B and Mr G was quite long; e.g. they talked about the tolerance of mistakes and the quite fast decisions on treatments and new equipment constructions and the many try and error

In the case of **TCo2**, improvisational capabilities are characterized by a conscious and stable communication and interaction with the environment. Real-time information excelled the implementation of new technologies and co-operations. Contacts are mainly formal but changes were free to be imposed by all team members. Although an SBU, TCo2's DECs are not affected by the parent company's culture. This is due to both physical distance and the fact that besides the two entrepreneurs, no member of parent company was involved.

Improvisational capabilities for example led to the addition of a special customization line; a need that emerged by a three-piece order at the mother company during the erection phase. However, this resulted in further modifications regarding policies, organization and collaboration with Gore-tex, an advanced logistics system. This new production capability in combination to a call of a policeman for a special order led to the creation of the "personal consulting service", a unique customer approach besides B2C and e-commerce. This led further to a new sub-market named by the interviewee as "individual sports, protective clothing and casual". Meeting the policeman and on the basis of the new capabilities of the new plant under construction the entrepreneurs thought of a new direction towards bullet proof accessories innovation which called for design upgrade and further organization of their R&D department [189].

The cases indicate that an important dimension of this DEC is the capability to derive and exploit ***real-time information*** which however is not planned or structured. It is the ability to exploit arising opportunities or new information and knowledge. Or it is the ability to engage customers in testing new products and methods assigning them the role of coordinators and close partners (TCo9). Almost all cases include machine manufacturers as main stakeholders since many times such co-operations could lead to innovative machinery – the case of TCo1 is quite an exemplary one; real-time information and cooperation led to a new machine good enough to be presented at the most important international world trade show.

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loops due to the fact that temperature, time of application and other parameters were complicated functions of other parameters such as the length and the velocity of the thermal stabilization machine, (while treating very expensive raw material).

[189] Improvisation: Create and execute new plans on the fly (Hmieleski, and Corbett, 2008) using resources available at the moment opportunities that arise suddenly, pieces of knowledge that were offered unexpectedly or exploiting new environmental data.

This dimension will later be embedded in the ability to sense the environment all along the value chain and be able to incorporate changes, trends and novelties even if the start-up course had started with different directions. Innovative products, processes or even models had to fit with the demands of the market environment thus covering existing markets (all cases) or expanding them. This seems to be imperative in the cases of T&C industry.

Improvisations were observed regarding mainly processes and models. Improvisational actions are both exploitative (process methods, market penetration, raw material use) and explorative (creation of new knowledge for novelty, value adding a dynamic collage of knowledge, resources and ways of applying them). TCo1 actually shaped and reshaped many times its initial process concepts relying on the real-time information of manufacturers and raw material providers. TCo2 created an impressive (according our opinion) number of new plans in a short time taking advantage of new resources, capabilities, information and knowledge. TCo7 seeks for and takes advantage of all information around denim treatment and improvises no matter the costs by **experimenting and many try-and-error loops** regarding both processes of elaborating materials for mattresses and reactions of customers.

Provocative competencies appear in all cases at different however levels of intensity. Most founders revealed that flexibility and working out of routines, budgets and estimations was crucial for the realization of their concept. TCo10 and TCo3 do not have routines due to newness; improvisation appears as a normal attitude supporting both inspiration and problem-solution. On the contrary, most established firms of corporate venturing appear to be purposefully committed not to use routines at the phase of starting up the new venture. This seems to be quite easy for smaller and newer companies such as the parent companies of the TCo1, TCo2, TCo5 and TCo7 cases. However, it appears quite difficult in the cases of large, well-established older organizations with significant presence at global level. TCo4 does not manage to escape routines and procedures. TCo6, TCo8 and TCo9 react to needs for changes in a more organized manner; they do not present a strict commitment to initial plans but the fleur of “on the fly” plans is not that evident. TCo6 seems to exploit new opportunities and does not hesitate to experiment on new products not initially thought of. TCo8 and TCo9 appear to make “deliberate efforts to interrupt habits" (Barret, 1998). TCo8 uses consultants and trains personnel on changing the current culture of the company. Both cases actually attempt corporate venturing in order to

restructure the organization towards more flexible, fashion-oriented and faster changing operations.

Creative dissatisfaction is evident in all cases, at different levels though, affecting the evolution of the initial competitive advantage, its quality as well as the paths the new venture will follow. Such dissatisfaction is very strong in all cases but for TCo3. All these companies managed to establish a strong innovative and pioneering image in their markets followed by an increasing rate of NPD to date. Creative dissatisfaction was very weak for TCo3 which did not manage to get further from the initial novel idea and was shortly overwhelmed by other similar ventures.

In line with the other two sectors, in all cases it was quite evident to the observer that the entrepreneurs are the creators and the main actors for the business idea realization. In all cases of corporate venturing enthusiasm for innovation, entrepreneurs' attitude towards knowledge and novelty, their extroversion and their creative and provocative dissatisfaction affect improvisational capabilities in accordance with the cases of the other two groups. Core members are carefully selected according to previous experience and successful business course in most cases, while individual characteristics of the entrepreneurs turn into values and routines for the new ventures; for example the experimental nature of the two **TCo2**'s entrepreneurs formed a relevant culture of the company.

TCo7's entrepreneur is also considered a "man with the gift" as in the cases of WCo2 and FCo10. He shapes roles and rules for all. He conquers the principles, poses the challenges, curving the ways and lets execution and details to the personnel. He exercises strong leadership that inspires executives, makes risky and complex decisions and transfers the power of a leader to the company as well. The focus on denim value as well as the company's culture and "way of life" is well communicated both to employees and customers.

TCo4 goes on relying on a strong team of engineers; some of them work for the company and others are just field agents. The case resembles WCo2 and FCo8. This is not strange since all cases refer to corporate venturing where the entrepreneurs own well established and successful companies and strategic decision-making belongs to the entrepreneurs *who seldom change their mind (teleology can be detected here).*

Altogether, it appears that in T&C cases improvisational capabilities enable mainly design and execution convergence supporting the other two DECs and thus, the constant refinement of the initial business idea. This can be

a) in pursuit of more novelty and differentiation: TCo1, TCo2, TCo3, TCo4 and TCo6
b) due to restrictions and limitations : TCo5, TCo8, TCo9, TCo10
c) due to a strongly embedded improvisational culture TCo2, TCo7
d) for solving problems and obstacles: all cases

Sometimes it can be a combination of the above reasons. Among the ten cases three of them presented strong improvisational capabilities (TCo1, TCo2 and TCo7), two of them weak (TCo3, TCo4) and the rest ones moderate.

Strong improvisational capability appears to be irrelevant of company's size and former condition. The results coincide with the ones of the other two sectors. Thus, it is possible that in cases of corporate venturing, established organizations deliberately activate provocative competencies and the rest of improvisational capabilities while the dangers of not escaping well-established routines are also evident. T&C cases support further the findings of the other two sectors that **resources alone are not sufficient to create strong improvisational capabilities or build strong initial competitive advantages in knowledge-intensive ventures.** However, the level of human capital of the entrepreneurial teams seems to be significant for the development of strong improvisational capabilities.

7.3.3.3. Transcendental capability in the T&C sector

As discussed in the other two groups, low-tech agents produce a whole new system around their idea. A typical example of unique novel business concepts in the T&C sector is Inditex (the mother company of Zara, Massimo Dutti, Pull and Bear and Bershka). According to Gany Jacobs (2013) the real innovation in such cases lies in new original ways of composing a value chain and thus linking innovation in various fields; these combinations as a whole are more difficult to copy. As Joan Magretta (2002) describes and also confirmed here, innovation in such cases lies partly in product/ process innovation and partly in the business model and the market axis and is produced by the interaction of these aspects. This is quite evident in the cases of TCo7, TCo2 and TCo1.

45**Table 7.13: T&C transcendental capabilities**

Transcendental capabilities	**TCo1**	**TCo2**	**TCo3**	**TCo4**	**TCo5**	**TCo6**	**TCo7**	**TCo8**	**TCo9**	**TCo10**
Type*	E	E	N	E	E	E	E	E	E	N
Transcendental conditions	strong	strong	weak	weak	moderate	moderate	strong	moderate	moderate	moderate
Transcendental synthesis	strong	strong	weak	moderate	moderate	moderate	strong	moderate	moderate	moderate

**** N= startup, E=established***

TCo7 with its strong transcendental capabilities is a representative example of the above theory; the company managed to produce significant results which do not rest only on product-process and model novelties but have impacted the relative business ecosystem mainly at national level but also at a European appeal at least being included among the jeans "giants". Based on knowledge and transcendence the entrepreneur states that his business idea was a combination of deep knowledge of the jeans market and his personal views on differentiation. "You have to ask yourself what the customer will *dream in the future*" says the entrepreneur to highlight the essence of KIE. He has been called "the King of jeans" and his story delineates a rather unconventional attitude and a deep need of achievement. During venturing, the company engaged knowledge–based innovation at almost all business functions of its value chain: R&D mainly on jeans treatment, significant product design, production with a unique plant of cutting edge technology and marketing by introducing worldwide the *TCo7 jeans culture.* Methods and strategies used are rather unconventional at least at sectoral level.

The entrepreneurs of **TCo2** turn the company form a linen producer to an R&D company for antiballistic products! The "Copernican turn" was quite the same with …Copernicus! Instead of being suppliers of low-value fabric to specialty foreign companies, the entrepreneurs decided to "move with the stars" and become co-developers or even developers by their own. More precisely, sensing the need for sharp differentiation and based on their gradual involvement in special clothing turn to high-tech co-operations and R&D projects while they develop in parallel the market and business model axis. The two entrepreneurs manage to establish a successful knowledge-intensive company, open a new niche market in Greece and export in several countries.

The same goes for **TCo1**; the entrepreneurs build on innovative technology but taking care to build novel collaborations and a new way of SBU's interaction with the market. The agents have the deep feeling and conviction of creating novelty. In all these cases of corporate venturing, the agents alter significantly the relations with the suppliers, they move up the value chain and give new different and value adding meanings to conventional products **challenging existing markets at least at European level and certainly changing them at national level.**

The **other four corporate ventures** are moving on a more secure road. They all want to challenge their eco-systems but in more conventional ways; i.e. by excelling in mainly technology-based solutions challenging existing relevant capabilities and by creating even patented technologies and products (**TCo4, TCo6** and **TCo9**). Actually, KIE in TCo4 and TCo6 is only based on technology while the other two cases show a tendency of a more holistic knowledge-intensive concept which transcends conventional ways of thinking, at least within Greek boarders. Intentions result in moderately exploited reproductive transcendental synthesis. However all companies managed to challenge and even change their ecosystems advancing customers' requirements, methods and techniques (e.g. clothing industry worldwide).

The two new-to-the-world ventures present transcendental capabilities which range from moderate to weak. **They create a strong initial competitive advantage but they cannot work it out to capture leadership.** The two companies present also higher CAGR and MASR[190] than the others. Still, they do not manage to cause significant changes to their business ecosystems and take a leading role in them.

TCo10 is an exceptional case regarding transcendental capabilities. Although moderate, the initial concept is based mainly on a combination of creativity and creative design which can be considered by definition "transcendental". Yet, moderate transcendental synthesis regarding the whole concept limits the levels of the capability for this case.

TCo3 is the "weak" case. The company does not manage to provide a concrete answer to "what-happens-next" question and thus the business and market axes to sustain its progress (besides the novel concept); although it starts as knowledge-

[190] Compound Annual Growth Rate and Mean Annual Sales Rate

intensive, it does not manage to cultivate it further to sustain its leadership in this new niche market. Weaknesses of transcendental conditions affect in a negative way initial core choices regarding area of activation (spaciousness) and transcendental synthesis limiting innovativeness and choices. Weak transcendental capabilities result in many inconsistencies regarding instability in strategies and incapability in advancing and communicating the initial novelties.

All corporate ventures with **moderate transcendental capabilities** manage to survive and are ranked at the top of the "survivors" in T&C Greek sector. This may indicate that even ***moderate transcendental capabilities affect positively innovativeness and sustainability but cannot offer leadership at least in the T&C industry.***

The successful cases confirm the findings of the other two sectoral groups that the **first type of knowledge-intensive entrepreneurship is the preferred one;** they present a more balanced emphasis on different dimensions of innovation and rely on both external knowledge seeking and in-house development, trying to produce simultaneously product, process and administrative innovation. In such cases transcendental capabilities capture (and have to capture) all entrepreneurial sides of a novel concept. Thus, the first type of KIE seems to be the only one to guarantee at least survival in T&C industries. The unsuccessful cases back up this assumption; they developed and focused on only technical dimensions of innovative concepts relying mainly on external knowledge (TCo4 and TCo3).

In this group we cannot make any assumptions on the role of the *former agents' condition (i.e. corporate or new-to-the-world venture) and its impact on the quality of transcendental capabilities.* This is due to the fact that there are only two special cases of new-to-the-world venturing; they cannot allow for any argument on the issue.

Regarding **patents and intellectual property protection,** it seems that T&C sector stands in the middle of the other two groups; while W&F sectors is not particularly interested in appropriability issues, F&B seems to care a lot. Three out of ten T&C cases have applied for a patent at national or global level at least once. ***Still, the patented idea is the end and not the beginning of the low-tech, knowledge-intensive business creation journey.*** Again, business concepts are built around the agents' own transcendental thinking and unique syntheses and realized by bricolage and improvisation capabilities. The new venture is not for the sake of the lab result; ***on the***

contrary the protected lab results cover some aspects of the novel idea. In the case of TCo9 the main idea turns around reconstruction towards strong R&D, innovation and fast fashion. It is both market driven (satisfaction of existing demanding customers) and technology driven (R&D for novelties).
However, in accordance to the other two sectors (with some exceptions in F&B), there is again low interest on **patents and intellectual property protection** regarding the developing machinery and production technologies. The result then is not a single technology or a mere family of innovative products to be copied and reproduced but a rather complicated mixture of all of them.

Transcendental conditions seem to be quite strong in all cases as in the F&B cases and contrasting W&F cases. In the context of the extremely "crowded" T&C sector, all ten cases exposed **PEA** and spaciousness of high level. This is mainly due to the well-established organization behind the corporate venturing in nine-out of ten cases and the deep experience and involvement at the sub-sector in the case of TCo10.
Of course, we can detect different levels of PEA and spaciousness among them. Regarding PEA we can again trace two categories: The ***"cosmopolitans"*** such as the agents of TCo1, TCo2, TCo3, TCo7, TCo8, TCo9 and TCo10 and the ***"industry masters"***. The first ones have a wider approach around the phenomenon of their business concepts and are open to every chance offered independently of origins and initial relevancy. The second category involves the development of a higher PEA but only within the industry focusing on mainly technical knowledge-intensive innovation and embracing parallel -novel or not- activities to support novelty such as top leadership models, quality excellence and novel training models. However, we should mention that this kind of limited PEA may constrain the search zone, reducing the ability to quest and use knowledge developed elsewhere. This aspect coincides with our findings in the other two sectors as well; development and focus on only technical dimensions of innovative concepts relying only on external knowledge seems to be quite dangerous.
Here we should specify why entrepreneurial experience and education have not been mentioned so far (in contrast to the other two sectors). The main reason is the fact that it regards mainly corporate venturing of well-established organizations as just mentioned above. However, there is a personal involvement of all entrepreneurs in all ten cases. All of them have a significant experience of the sector with six of them to

have been raised in a relevant entrepreneurial milieu. Most of them have relevant and very specific studies ranging from mechanical engineering to textiles and fabric engineering and masters in manufacturing systems engineering. Most of them have become or are presidents in several associations or other relevant or irrelevant Greek or European organizations. Therefore, they all have exceptional professional and educational backgrounds.

If we would like to be even stricter there are two cases of some "inconsistency". TCo4's entrepreneur has studied physics while TCo7's agent has not a higher education degree. However both of them had a long experience and successful involvement in the sector and they were aware of this drawback. Thus, we have already mentioned the weakness of TCo4's entrepreneur in technology and the engagement of engineers. On the other hand, TCo7's agent invests heavily on knowledge; he trusts a friend of his who is a mechanical engineer working as a freelancer by then. He sends him to Italy to excel knowledge on jeans treatment production lines and hires a chemical engineer as well. Yet, he further invests much of his own time (and money) in being "educated" on "all about the sector".

Thus, by way of consequence and in accordance with the other two sectors, it is confirmed that e*ntrepreneurs need to question or purposefully develop a higher level of PEA for concept-building. A limited picture of the sector which revolves around local markets and certain knowledge limits affects negatively transcendental capabilities and especially transcendental conditions.*

Therefore, ***sense of spaciousness*** seems to depend again on the agents' attitudes and cognitive capabilities, knowledge as well as the search they do for the idea creation as well as the company's culture. Almost all cases present strong cognitive capabilities and a long search for the idea and knowledge needed, devoting significant amounts of money and time. T&C agents sought spaciousness in

a) *areas of quality and novelty in technologies and services* (TCo1, TCo3, TCo4), ecology (TCo3, TCo6),

b) *design and fast fashion (*TCo5*,* TCo8, TCo9 and TCo10),

c) *new rules in production or other functions of the firm, raising established limitations* such as TCo3, TCo5, TCo8, TCo9

d) *new market segmentations and innovative products or novel uses of innovative material* (TCo2, TCo7) and

e) *novel business models* (TCo5, TCo7, TCo8, TCo9)

f) *novelty around technology* (all cases) and their combinations as already mentioned above.

Therefore, it seems that in T&C sector, too, **transcendental conditions of a higher level may create positive conditions for creative and unconventional ideas and consequently effective use of the other two DECs.**

In accordance with the other two groups, LT-KIE seems to start again with a vague and not well-shaped idea;

TCo4's entrepreneur admits that the initial idea was "differentiation based on knowledge and a strong ability to synthesize".

TCo1 starts by the observation that knowledge will assist moving up the value chain and thus create the opportunities for more differentiation and innovation.

TCo5 starts from a rather abstract idea of novel business model creation that would enhance the company's new image as a fast fashion company and solve the problems of franchise and corporate shops. The entrepreneurs focus on deliberate and organized knowledge acquisition and creative recombination to support corporate venturing.

TCo6 delineates the initial idea in the triptych "innovative high-value products, other than cotton, for the European markets – ecology – novel production technology for cotton"[191] At this very first stage the entrepreneur admits that there are no plans.

> "We actually did not know what we were looking for, but we were sure that it was the only way to redefine our existence in the sector and survive…. Even after the agreement at ITMA we did not actually know what we would produce!" (Entrepreneur of TCo6)

The idea will gradually take shape getting out of commonalities and familiar ways of thinking in order to produce novelty.

> "Starting with erections we sent "signals" in Europe. The German LG approached us to co-operate on some innovative fiber. […] It was a beautiful confusion of priorities and decisions which would create the final concept. We should constantly, learn, discover and …search…" (Entrepreneur of TCo6)[192]

In accordance, **TCo7** builds around the initial idea of *surplus value of branded jeans* and around multiple sources (i.e. technology, design, branding, logistics, sales networks, marketing).

[191] Novel technology is different than novel products. The first one (compact)

[192] We should however mention that according to the entrepreneur's remark "all this novelty and pioneering potential has been unfortunately swallowed be the Asian sales"

Thus spaciousness in T&C industries coincides more with spaciousness in W&F industry than in F&B. It considers mostly exploiting innovations produced in other links of the industrial value chain (raw materials, technology and equipment, upgrading of existing products) and design than radical innovation and invention. However, in all cases the entrepreneurs adopted a global view even if some of them started from the national market as in the case of TCo2 and TCo7 and TCo9, they were targeting global novelties and markets. ***This is a major difference with the W&F sector as well.***

Therefore, in accordance to the other two industries, the cases of T&C industry confirm the fact that t*he width and the quality of sources to seek, resources, ways and combinations are defined by spaciousness (and realized mainly through the bricolage capability). Still, the ability to realize intra-industry space in saturated markets is tightly dependent on the ability to view global markets in a panoramic way and be in the position to estimate value chains, intra- and inter-sectoral industry potential.*
The level of transcendental synthesis is quite decisive for the capability as a whole in the cases of T&C sector and regards (in accordance with the other two groups) the fact that by definition DECs address **knowledge-intensive entrepreneurship** and not only innovativeness. Furthermore, the T&C cases confirm further our general finding that the level of TS depends on the level of the Transcendental Conditions, and it affects significantly the other two DECs; TS appears again as the capability responsible for the capture of the novel but initially vague idea which will build the new business opportunity. Thus, the dimension of **Transcendental Synthesis affects the whole business concept** and as such it becomes the point of difference. Therefore, repeating the relevant argument as it was presented in the other two sectors; it seems that **strong transcendental synthesis supports the production of strong LT-KI business concepts that cover the whole new entrepreneurial activity and not only the novel product/process/service concept.** Consequently it is not only innovation but the whole *entrepreneurial schema around it* that judges the produced advantages as competitive or not.
As in the W&F sector, there are no radical breakthrough innovations which will surprise markets as high-tech industries usually do. Yet, in these KIE cases novelties can be considered radical again according to Liefer et al.'s (2000) definition which has been considered as one of the most precise ones (Benedetto et al., 2008) and is in

line with relevant literature. Following it, a radical innovation project is one with the potential to produce one or more of the following:

- an entirely new set of performance features such as TCo1, TCo2, TCo3, TCo4, TCo6, TCo7, TCo8, TCo9
- improvements in known performance features of five times or greater: all cases
- a significant (30 percent or greater) reduction in cost such as TCo5

Yet, taking into consideration its definition, productive TS is not easy to be developed at least in T&C industry (similar with the W&F cases and contrasting F&B cases). Although all new ventures support radical innovations, all cases present **reproductive TS**. The lack of original exhibition and thus the bringing back of existing concepts and their appliance in new markets and under new conditions while excelling are the major features of T&C **reproductive TS.** Most cases innovate by presenting novel technologies and models but based in former empirical business concepts.

Among them, **TCo1, TCo2 TCo7** and **TCo8** are cases of **well exploited reproductive TS.** These cases have presented reproductive TS which did not rest on a novel process/product but covered all three axes of business activity; namely technology, marketing and business models.

On the other hand, **TCo3** and **TCo4** were not able to do the same and got trapped into existing markets and customers. The cases indicate a lack of relevant vision, a certain level of teleology which leads to false judgments and a series of inconsistencies regarding the receptivity-spontaneity sub-dimension. **Transcendental synthesis** is rather weak: the entrepreneurs expect technology to bring innovation and –in turn- innovative products to bring customers. There are no signs of efforts to use and combine knowledge mechanisms in forming pioneering business ideas; quite the opposite has happened in the case of TCo1 where the entrepreneur uses technology as a medium to build his novel business idea. The production of "new experiences" is not really among the entrepreneurs' plans; they actually seem to be afraid of them. (Note: this appears to be a common characteristic of former successful firms of the sector). There is also a false use of experience. The entrepreneurs of the two cases counted on their experience to "improve and advance" know-how. In the case of TCo4, even Werner were contracted to offer solutions on a ready plan that regarded advanced technology. Furthermore, weak TS development presents also here a

domino effect on the rest DECs (as observed in the weak-TS cases of the other two sectors regarding both bricolage and improvisational capabilities).

TCo10 is an exceptional case of attempting to combine creativity and production through knowledge. However, besides the inspiration and the knowledge required for the new venture, TS seems to be rather mediocre.

The other three cases are cases of corporate venturing with also moderate TS.

TCo6 was trapped to reproduction due to the safety provided by big customers such as Triumph and high-fashion global leaders. According to the data, the company did not develop strong TS due to path dependency and strong procedural memory which did not allow for significant changes or unconventional thinking.

TCo9 shows also rather moderate reproductive TS, although the undertaking entailed a great amount of new knowledge and innovation. Provocative competencies were also weak due to strong procedural memory and a well-build management system inherited by the Dutch company. The pioneering application of mass customization was a significant innovation but it was rather a "child of need" and not a result of uncommon thinking. However, it came to be realized due to the exceptionally high transcendental conditions of the organization.

In sum, the cases present

Reproductive and well exploited TS (strong TS): TCo1, TCo2, TCo7, and TCo8

Reproductive TS but moderately exploited (moderate TS): TCo5, TCo6, TCo9 and TCo10

Reproductive TS and poorly exploited (Poor, weak TS): TCo3, TCo4

It seems that large T&C established organizations tried to achieve a complete restructuring through KIE corporate venturing but did not manage to escape strong path dependencies and the attractiveness of the existing markets. Thus, they missed the opportunity to create their own ecosystem with their own rules as pioneers.

However, in relevance mainly to the W&F sector, it is quite interesting to note that almost all agents had been pioneers (not necessarily innovators) at least at local level in the past, before the knowledge-intensive venture:

TCo2's entrepreneur (first generation) was the first to introduce fire retardant fabric and clothes in Greece while all other entrepreneurs of the sector went on with conventional linen. **TCo9's** first generation created the pioneering denim production becoming the main supplier of Levis at a time that Levis was the global undeniable

lieder. **TCo6** is the first textile industry in Greece to develop an R&D department and experiment with fibers. **TCo7** is the first to brand jeans in Greece and develop a strong culture around it.

Therefore it seems that former excellence can be a pre-condition for KIE in LT industries and as in the other two sectors, it can be considered as an important element of strengthening the "judgment dimension".

In both **TCo3** and **TCo4** cases, weak judgments were mainly responsible for the rather weak transcendental syntheses and unsatisfactory and incomplete plans and business visions. Weaknesses are once again attributed to agents' human capital; all three entrepreneurs bared certain levels of teleology due to former success and existing adequate safeguards each case had.

Among the particular patterns which could establish basic categories of reasonable grounding and justification as focal points for judgment and have been also traced in the other two sectors are:

- opportunities that give rise to latent visions: TCo3 due to common interest and local proximity of two strong export-oriented companies of different sub-sectors, (as FCo8 and WCo2 with the bankrupted company)
- the need for a new plant: TCo4 as WCo4 and FCo6
- sector-specific trends: mainly design, fast fashion and health and regards all companies in accordance to. trends towards health & wellness and indulgence food (FCo1, FCo4, FCo5, FCo7, FCo9 and FCo10) or convenience (FCo3 and FCo5) as well as towards health & wellness, or aesthetics (WCo1, WCo4, WCo8, WCo9 and WCo10)
- energy and ecology matters: TCo1, TCo3, TCo4, TCo6, as FCo2, FCo6, FCo10, WCo2, WCo4, WCo7, WCo9 and WCo10
- market data together with favorable institutional settings: TCo3 as FCo1, FCo2, FCo3, FCo10, WCo2, WCo7 and WCo9
- former success of risky ideas TCo2, TCo4, TCo7 as FCo10 and WCo10 or,
- relative technology development TCo1, tcO4, TCO6, TCO7, TCO8 and TCo9 asFCo8, WCo6 and WCo9.

Furthermore, customer feedback has been valuable in TS together with the other DECs in all cases of the specific sector

Regarding the two senses of "objective" determining grounds, T&C cases belong rather to the first type; i.e. acquiesces that are grounded on experiences and/or other established assents (e.g. existence of technologies, raw material, established trends etc.) that are, in turn, evidentially connected *to the objective* in question. This is in the same line with W&F, contrasting F&B sector.

In accordance with the other two sectors, the dimension of transcendental synthesis seems to affect significantly the business concept formation in all of these cases:

- Strong transcendental synthesis supports the production of strong business concepts that cover the whole new entrepreneurial activity and not only the novel product/process/service concept.
- Weak transcendental synthesis supports the production of business concepts that are not able to equally cover the whole new entrepreneurial activity resting only upon product/process or service novelties.

Furthermore, **deepened conviction** and **the need for achievement** are evident in all cases (again as in all cases of the other two sectors). Especially in this group of mainly corporate venturing of established and successful organizations, previous experiences and successes together with the existence of strong networks and strong starting knowledge pools impact the level of this entrepreneurial trait. However, in certain cases it appears to play a rather negative role in the formation of challenging concepts. It actually seems to be a **moderator** of *how much challenging* the business concept will finally be posing at the same time the question of critical levels of conviction which turns to teleology. This is quite evident in the cases of **TCo4** and **TCo3** as mentioned just above.

TCo6, TCo8 and **TCo9** belong also to the category of strong and globally known parent companies with important success regarding all performance measures in the past. **TCo1, TCo2, TCo5** and **TCo7** are cases of a gradual success of small to medium Greek T&C firms that managed to grow in the 90s developing in parallel exports. All entrepreneurs are deeply involved in this success and upturn and managed to differentiate in their sub-sectors. **TCo10**'s creator owned a spherical knowledge of the specific LT sector, affiliated sectors and relevant knowledge bases due his long-term experience in the sector by multiple positions (i.e. as a fashion designer, a decorator, a fashion consultant, a stylist and a fashion magazine director).

Transcendental capabilities of different levels were found in all ten T&C KI cases and once again they seem to guide and direct the rest two DECs defining the depth, the impact and the degree of novelty of the knowledge-intensive business concepts. However, in this group they seemed to be responsible for the *repositioning* of the new venture within the existing or a newly created business ecosystem and the new venture's dynamism.

Discussing **the cases of moderate transcendental capabilities** a little bit further, we could say that we detect a quite significant receptivity and spontaneity but very low judgment which actually led to poor TS. However, this was mainly due to the existing teleology of former success, which was not that evident in the other two sectors. This can be assigned to the significant history of the T&C sector in Greece and the former global success of the non KIE-model for most of the sampled firms. Therefore, it seems that **strong path dependencies may hinder the shift to KI corporate venturing if DECs are not deliberately developed.**

This danger was also evident mainly in the other two sectors. However, as in the W&F sector, Greek T&C KI established organizations present organized and well – built functioning of all DECs. This is quite expected since they have already developed routines, they usually own dynamic capabilities, they are richer in experience and structured ways of operational efficiency and can devote more resources (either tangible or intangible) in order to get creative answers. The superiority in human and other resources is evident in all corporate cases too.

In the more capital intensive T&C industry, knowledge-intensive venturing seems then to be more technology-oriented (in accordance with relevant literature). Thus, **novelties are mainly answers to already –more or less – formed needs of existing markets, while KIE happens for maintaining shares of the market instead of creating new markets.** New knowledge-intensive business ideas are innovative, but they do not create *a priori* knowledge. As discussed in the relevant section, the entrepreneurs are in all cases personally involved, own deepened conviction (which becomes even teleology in some cases) and develop high-level PEA but

transcendental synthesis then is reproductive[193], while bricolage and improvisational capabilities cannot escape the parent organization's path dependencies.

We should further mention that all T&C knowledge-intensive cases of strong and moderate DECs managed to survive the crisis up to now and are indeed successful compared to the national and European situation of the sector. Besides the significant losses in sales, TCo4 works on highly innovated products[194] ; for example it presented a highly technical product that interacts with the body by stimulating blood microcirculation and thermoregulation at the Munich Fabric Start fair in September 2012. Today, TCo4 continues to export its products to Europe, Israel, South America and Hong Kong[195].

In his report to the European Commission, Sheffer (2012) highlights restructuring as "the successful strategy of [TCo9]" and comments that the company "is somehow less vulnerable to the crisis because of a combination of vertical integration and international leadership in the niche of high-end denim".

Figure 7.4: TCo9's strategy

Table 1: Transferability of technology and business models

	Easy						Difficult
Technology	CAD/CAM	Digital printing	E-commerce		Mass customization	Technical textiles	Biopolymers
Business Models	Two string strategy	Delocalisation	Co-contracting	Specialisation	Export	Consolidation	Verticalisation Value chain control

Source: Sheffer (2012)

The above cases realized in 2000 the later suggestions and recommendations of the High Level Group on textiles and clothing[196] in their "Vision for 2020". They have achieved a complete restructure turning even more towards specialty products, new

[193] One should be conscious here. The result may be novel innovative products and even patented; but the idea synthesis is based on existing concepts by bringing back empirical intuitive business ideas (*exhibitio derivata*)

[194] The company today has reduced the number of chemical engineers to 7 and of designers to 3

[195] In 2002 a subsidy for the new installation was approved. The money was never granted to the company. Actually in 2009 the state denied to give the money because the company had less employees than in 2002

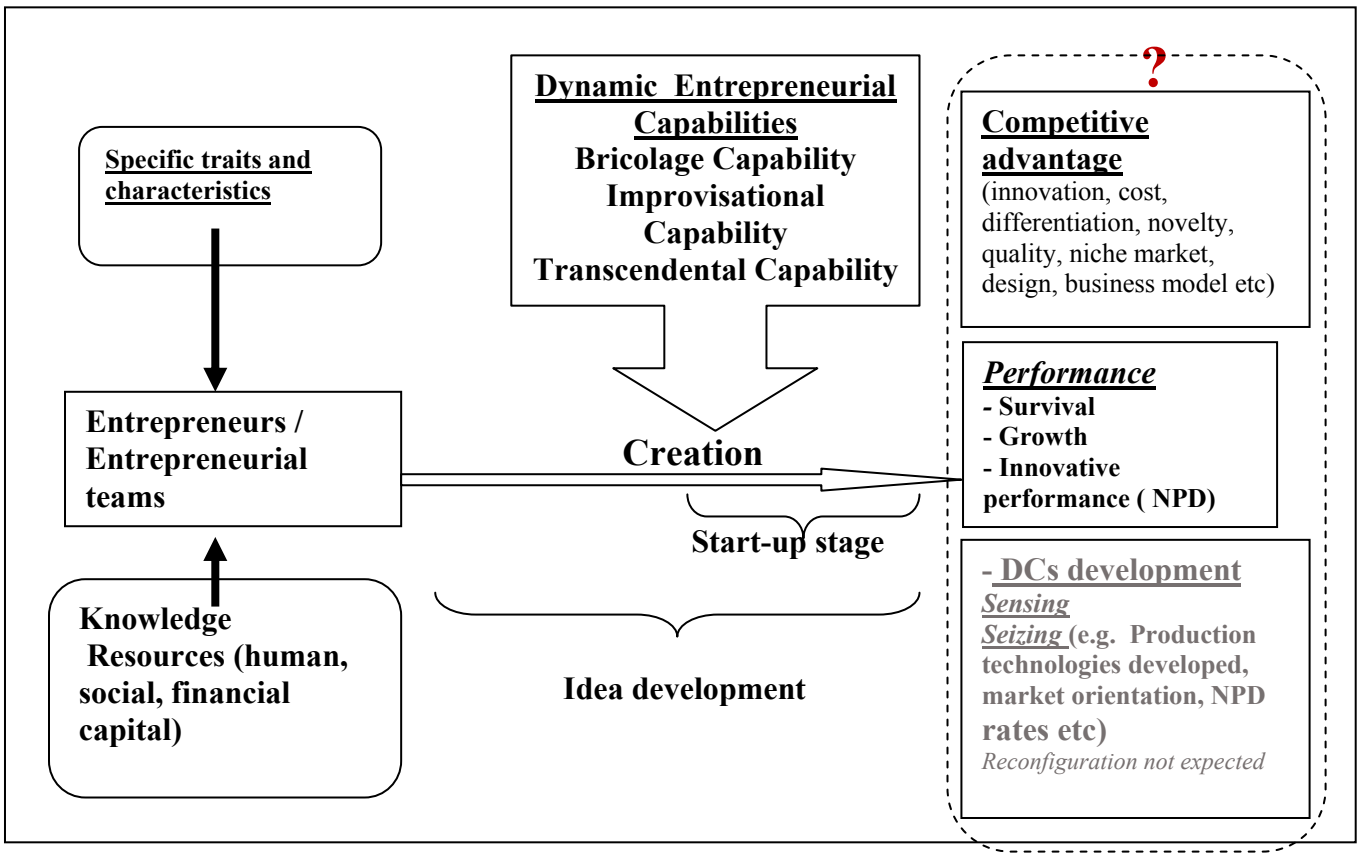
[196] http://ec.europa.eu/enterprise/sectors/textiles/documents/high-level-group/index_en.htm

applications and mass customization placing knowledge-intensiveness in the core of their business.

7.3.4. Epilogue

The section indicated that KIE type and DECs' development are differentiated across the three low-tech sectors. Differences have been also traced between new-to-the-world ventures and corporate venturing. However, in all cases it appears that DECs can be developed and harnessed to create unique asset bases and challenge existing or shape new business ecosystems through novelties in products, processes and business models. Thus, DECs framework may be able to partly explain the sources of initial competitive advantage in cases of low-tech KIE. Quoting Teece (2007) "A framework, like a model, abstracts from reality. It endeavors to identify classes of relevant variables and their interrelationships. A framework is less rigorous than a model as it is sometimes agnostic about the particular form of the theoretical relationships that may exist".

Figure 7.5 : Conceptual framework after the development of DECs



The proposed framework (Fig. 7.5) supports the analysis's findings that indicate certain relationships between KIE and DECs as well as the impact of entrepreneurial characteristics and the role of knowledge.

The following section will try to show the impact of DECs on the knowledge intensive firm's competitive advantage and performance.

7.4 Sub-Section 3:

Hypothesis 2: DECs have a positive impact on new LT-KI ventures' performance

H 2.1.: DECs have a positive impact on new LT-KI ventures' competitive advantage
H 2.2.: DECs have a positive impact on new LT-KI ventures' survival
H2.3.: DECs have a positive impact on new LT-KI ventures' growth
H2.4.: DECs have a positive impact on new LT-KI ventures' innovativeness

7.4. a) Some Explanatory notes

Entrepreneurship characterized by knowledge intensity has been suggested to have a certain impact on the firm's performance, which is really the major criterion of KIE's evaluation and justification (Audretsch, 2005; McKelvey and Heidemann Lassen, 2013). The first data analysis confirmed to a large extent the relevant literature. It actually indicated the importance of a significant initial competitive advantage which was usually related to the initial knowledge-based innovation of the new venture both in cases of new-to-the world and corporate venturing. In accordance to both theory and the relevant findings of the thirty cases, we expect DECs to be related to successful venturing in LT-KIE cases, where success is described in terms of survival, new venture growth and the provision of strong initial competitive advantages. Furthermore, we expect that DECs will have an effect on the new ventures' innovative performance since the relationship that exists between KIE and innovation seems to be straightforward as this form of entrepreneurship is by definition innovative.

As shown above ventures pursue different strategies, have different priorities and differentiate in DECs' development due to the fact that industries (and namely W&F, F&B and T&C) differ considerably in their modes of KIE. The necessity of the sectoral perspective (together with the national perspective) has been often mentioned in several relevant efforts (e.g. Europe Innova paper, 2008). Therefore, it would be quite difficult and unorthodox to compare venture performances of different sectors in the terms of the case study analysis method. Thus, the relation of DECs and performance was analyzed and discussed at a sectoral basis while inter-sectoral comparisons and discussion follow at the end.

Therefore, the present section combines the previous sections where DECs were developed and analyzed in detail per case and sector with the indications of successful venturing in our thirty low-tech but knowledge-intensive cases. Success is described in terms of survival, new venture growth, the initial competitive advantage and the innovation basis created during venture creation adopting a sectoral perspective. For the measurement of the above parameters the following criteria were selected in accordance with the relevant theory of Chapter 2:

New venture survival means the existence of the venture over certain period of time after the actual start of the business (Kessler et al., 2012) or "the opposite of failure" taking into consideration that a venture fails when it ceases to exist as an economic entity (Chrisman et al., 1998). According to our literature review, the five years period is rather universally accepted and frequently used as a suitable survival criterion (Ensley et al., 2006).

New venture growth: A review of the relevant literature suggests that the most important measures of new venture growth are in terms of sales, employment and market share (e.g. Gilbert et al., 2006) with sales to be the most commonly used indicator (Murphy et al., 1996; Weinzimmer, Nystrom, & Freeman, 1998). *Market share growth* provides further an indication of the acceptance of the venture's products or services in the market. However, it can be better evaluated only based at the level of a given product category (Higashide & Birley, 2002; Kerin, Varadarajan, & Peterson, 1992) which constitutes a drawback compared to the other two measures.

We should state that it was rather puzzling to set comparisons among the cases and their sales and form conclusions due to a series of reasons:

- The cases addressed different markets regarding products and sizes and different economies (from local to global).
- They were not all created in the same period; for example some of them were established in 1998-1999 and some of them around 2006 to 2007 since the criterion used accepted firms which were established within the decade 1998-2007. Thus, the different environmental conditions for certain cases made conclusions more difficult; for example one cannot expect similar evolution courses for two cases - even of the same sector - when the one was established within the favorable environment of the 2000 and the other on the verge of the financial crisis (2006-2007).

- Certain differences were expected (and found) between start-ups and corporate venturing

This is precisely the beauty of the case study research. While statistic models try to explain firm behavior in a stylized way and may sometimes be too unrealistic or too rigid, case study method offers the researcher the potential to search for deeper, non-statistically proven answers considering the case-specific data analysis. Furthermore, empirical evidence has introduced different variables into the analysis of firm growth. Consequently, growth was measured with sales, their annual percentage change, their mean annual growth rates of the years of survival (first five years) and their compound annual growth rate (CAGR) for the first-three year-time period. CAGR regards the year-over-year growth rate of an investment over a specified period of time. It is calculated by taking the nth root of the total percentage growth rate, where n is the number of years in the period being considered.

$$CAGR = \left(\frac{\text{Ending Value}}{\text{Beginning Value}}\right)^{\left(\frac{1}{\#\text{ of years}}\right)} - 1$$

CAGR isn't the actual return in reality. It's an imaginary number that describes the rate at which an investment would have grown if it grew at a steady rate. It has been often used in literature as a new venture performance measurement (e.g. Freezer and Willard, 1989; Olson et al., 2008; Rose et al., 2006; Willard et al., 1992) and an indicator of venture growth (e.g. Gielnik et al., 2012; Weinzimmer, Nystrom, & Freeman, 1998). Barringer et al (2005) use it in their analysis of the characteristics of rapid-growth firms and their founders defining rapid growth with a 3-year compound annual sales growth rate of at least 80%).

Competitive advantage, the actual objective of strategy (Porter 1985) is described as the unique position a firm develops over its competitors (Hofer & Schendel, 1978). As described in Chapter 2, firms create competitive advantages by perceiving or discovering new and better ways to compete in an industry and bringing them to market which is ultimately an act of innovation. This can regard technology, methods, processes, new products and services, new approaches to the company's functions such as to marketing and distribution and even new concepts of scope. Strong competitive advantage is due to how it changes the ecosystem (Teece, 2007) and if its impact is increasing or decreasing with time (e.g. Rindova and Forburn, 1999). Multi-

dimensions of the construct include cost-based advantage such as leadership in product price by achieving lower manufacturing costs and developing economies of scale, product-based advantage through product differentiation, product quality and accessibility, niche marketing or servicing of niche markets, and supplementary novelties in packaging, design and style, or service-based advantage; i.e. regarding product line breadth, reliability, flexibility, delivery speed etc. (e.g. Morgan et al., 2004; Ray et al., 2004). The main elements to measure competitive advantage as defined by Byrd and Turner (2001) and Chuang (2004) include level of innovativeness, market position, and difficulty in duplicating.

The interview did not actually provided the interviewees with any listed types of competitive advantage or relevant questions. The initial competitive advantage would derive from the description of how the new venture changed or tried to challenge and change its business ecosystem after its creation, in combination to other sources which would support the unique position the new venture had developed over its competitors. Financial data would further support the sayings. Descriptions of competitive advantages were then categorized according to the existing dimensions of competitive advantage in relevant literature and the ones referred in sectoral reports. A further distinction regarded the context within which the new venture placed its competitive advantage and more precisely it regarded national, European and global level.

However, it is not that easy to measure competitive advantage in isolation, or even only in relation to direct competitors (Day and Wensley, 1988): one does not hold full knowledge of the competitors' achievements and potential (Tan and Smyrnios, 2006). It is rather risky to accept the word of the interviewees when asked to determine if they are the lowest cost producers or whether they utilize the most technologically advanced machinery. One can only infer competitors' strengths/weaknesses from industry talk, websites, and other indirect means (Tan and Smyrnios, 2006). In order to address the difficulty of the competitive advantage evaluation, a scale of 1 to 10 was created with 1 to correspond to exceptional initial competitive advantage and 10 to low-level and weak CA. The evaluation would take into consideration the level of change that the new venture would bring to its business ecosystem such as the creation of a new niche market and at what level (national – global), the existence and the number of direct competitors or creation of competitors, the sales growth, the

recognisability of the new company at national/global level, the radicalness of knowledge-based innovation as well as how much it boosts the new company's fame and success (in terms of awards, sales, expansion, new investments, exports and internet and press references).

Measuring innovativeness may take several forms: Besides the R&D expenses, numerous other methods have been used such as: highly educated personnel (Hage, 1980) and greater reliance on technically trained specialists (Miller and Friesen, 1982), the number of new product or service introductions and the frequency of changes in services or product lines (Covin & Slevin, 1989; Miller & Friesen, 1982), the achievement of competencies in the latest technologies and production methods and the development of advanced manufacturing processes (Lumpkin and Dess, 1996) as well as the tendencies of discarding old beliefs, exploring new alternatives and rewarding experimentation (Karagozoglu and Brown, 1988). Garcia and Calantone (2002) have identified 15 different constructs to distinguish between different types of innovativeness; product innovativeness, radicalness, newness to firms / markets/ of technology/ customer, product/market fit, synergy, product uniqueness/ type/ complexity, technical content, complexity and marketing task similarity. Scholars have also used combinations of the above (e.g. Klyver et al., 2008).

Furthermore, innovations in low-tech industries have been found to derive from both technological and market opportunities. **Technological opportunities** are related to the contribution of external knowledge sources to the innovation activities of firms and the quality of new technologies (Arvanitis/Hollenstein 1994; Becker and Peters, 2000; Cohen /Levinthal 1989; Harabi 1995; Klevorick et al. 1995). **Market opportunities** are based on the idea of information asymmetry (Shane and Venkataraman 2000; Miller 2003; Kirzner 1997).

We measure new firm innovativeness based on the generic scale developed and thoroughly examined by Dahlqvist and Wiklund (2011) and adapted for new firms by Senyard et al. (2014). Thus innovativeness regards: (1) product/service innovativeness (with creative design to be clearly distinguished); (2) process innovativeness and novel technology further developed; (3) marketing methods innovativeness; (4) target market selection innovativeness; (5) new raw materials; and (6) novel business models and concepts. Novel business models and concepts were added to cover initial

innovation as well. Product, process, and target market selection dimensions directly reflect dimensions in Schumpeter's (1934) delineation of five types of innovation. Following Dahlqvist and Wiklund (2011) and adapting AEGIS project definition, the level of innovativeness for each dimension was assessed as (1) new to the firm, (2) entirely new to the market, and (3) new to the world. These levels were assessed by the interviewees' sayings and relevant information derived by internet and press or discussion with sectoral experts in order to avoid respondents' exaggerations. Furthermore, traditional measures were also taken into consideration such as the number of innovations from establishment till the day of the interview together with patents and trademarks (e.g. Acs and Audretsch, 1987; Miller, 1983). Adding together the above dimensions of innovativeness for each case, we arrived at a summated scale with a theoretical range from 1 to 10 with 1 to denote high innovativeness.

Furthermore, entrepreneurship in general has been tightly related to a plethora of ***personality traits which*** have been considered and examined regarding their impact (direct or indirect) on the growth of the firms. According to the literature review (please refer to Chapter 2) educational background (e.g. Sapienza & Grimm, 1997), age (e.g. Evans and Leighton, 1990) and prior experience (industry related or not) and background (Baum et al., 2001; Box et al., 1993; Eisenhardt & Schoonhoven, 1990; Siegel, Siegel, & MacMillan, 1993; Thompson, 2002) of entrepreneurs and entrepreneurial teams have been considered among the most significant ones. The specialized competitive environment at founding has been also taken into consideration since together with the capabilities of the agents affect venture performance according to literature (e.g. Taylor, 2007).

In accordance with the former categorization, DECs are considered as "strong" when all dimensions and namely bricolage, improvisational and transcendental capabilities are strong. In the same line, they are called moderate if some dimensions present a moderate or weak development while some of them can be even strong. Weak DECs regard only sets of weak dimensions.

7.4. b) DECs and new venture's performance: a sectoral approach

I. DECs and new venture's performance: wood and furniture sector

Knowledge-intensive enterprises are rather rare in the Greek wood and furniture sector. Yet, during the last ten years there is a tendency of mostly young entrepreneurs of the sector to shift focus mainly on developed knowledge assets such as innovations on materials and fittings, ICT engaged on all links of the value chain (i.e. from 3D-design to CIM[197] in production), and external knowledge seeking, combining it at times with in-house research to differentiate and create competitive advantages.

In almost all ten case studies **knowledge seeking activities** refer partly to R&D in-house, but mainly outside agents' potential (e.g. by manufacturers, suppliers, other industry, other science etc.). Most innovative activities are combinations of various knowledge assets occupied by others along the value chain and regard formation of processes due to new knowledge produced (best explained in detailed reference to cases). Business scope (e.g. technology, new product and market developments), as well as organizational and structural knowledge-intensive innovations are the core ways to produce *strong initial competitive advantage* with knowledge and learning ability (bricolage capability) to be the main way to combine and transform all information and knowledge into transcendental thinking. External approach is mainly integrated through networking in a concentric-cycle way.

However, following these ventures and their evolvement over the years as new firms, it is quite notable that they do not change their internal or external approaches to innovation and knowledge management. Thus, in-house innovation is connected to year-to-year investment in technology, R&D and experimentation with novelties elsewhere produced, while new product and market developments focus on novel products as well as processes and process improvements and business models. In such efforts they form partnerships with university, technology centers, research associations, suppliers, customers and even competitors. They develop formal but mostly unwritten routines of knowledge creation, articulation and utilization based on human capital development activities.

[197] CIM: Computer Integrated Manufacturing

More precisely, **three types of knowledge-intensive ventures** can be traced.

- The **first type** shows a more balanced emphasis on different dimensions of innovation[198] and relies mainly but not solely on external knowledge seeking. **WCo1, WCo3, WCo4, WCo8,** and **WCo10** belong to this type.
- The **second type** develops only the technical dimension of innovation combining both internal and external knowledge development. This group contains only corporate ventures and namely **WCo2, WCo6** and **WCo9** raising certain questions on knowledge-intensive corporate venturing.
- The **third type** focuses again on only the technical dimension of innovation relying on only external knowledge. It is rather interesting to see that this category consists of the two weak ventures and namely **WCo5 and WCo7.**

The DEC analysis of the W&F cases also led to the formation of the following three categories

a) Cases with strong DECs: WCo2, WCo6, WCo8, WCo9, WCo10
b) Cases with moderate DECs: WCo1, WCo3, WCo4
c) Cases of weak DECs: WCo5 and WCo7 which lag behind regarding all dimensions of the DECs.

KIE and initial competitive advantage

Wood and furniture cases target more to differentiate in **functional parameters in order to produce initial competitive advantage, such as:**

46**Table 7.14: Mode of W&F cases' differentiation**

Functional parameters	**Cases**
Quality	**WCo1 , WCo6**
Functionality	**WCo2, WCo3, WCo8**
Exploitation of innovations elsewhere produced but adapted to local conditions	**WCo5, WCo7, WCo9**
Unique novel business models and methods of promotion together with product innovation	**WCo10**
Innovative products which however do not constitute the core strategy of the company	**WCo4**

[198] **Note:** Actually it covers the three axes of a new venture: *technology axis* which is relevant to the technical development of a novel concept up to full scale production, *Market axis* which refers to the interaction with the market and the *business axis* which includes the business steps needed such as commercialization and business scheme selection, business and relative model development and IPR protection.

DECs in the ten W&F cases regard knowledge assets and knowledge exploitation which however does not transcend the existing value chain (in comparison to the food cases as we will see later). New start-ups seek novel niche markets (WCo1, WCo4, WCo5 and WCo7) but they do not get that much out of sectoral limits which seems to constitute a major characteristic of W&F KIE. Yet, all ten knowledge-intensive cases developed DECs in order to produce innovation, differentiate and shape the initial competitive advantage and enter already saturated markets. Relationships have been found among DECs and the level of changes. **All ten new ventures managed to pose major or minor changes in their national ecosystem.** However, not all cases developed the three entrepreneurial dynamic capabilities equally. In fact:

As we have seen above, ***five of them, WCo2, WCo6, WCo8, WCo9 and WCo10, have developed strong dynamic entrepreneurial capabilities.*** They all presented parallel high sales as well as high rates of innovation and NPD performance during the first five years of life. Four of them are established companies which invested in new corporate venturing (WCo2, WCo9) and internal renewal (WCo10, WCo6) and have developed strong dynamic capabilities as well (as it will be discussed later). The fifth, WCo8, can even constitute a category of new-to-the-world firm by itself alone[199]. Although new, it sprang from a similar family company, was well backed and the entrepreneur had exceptional academic and entrepreneurial / managerial experience. He started with worldwide innovative ideas such as the novel "boxing concept", the development of new multi - machine which won a global innovation prize, and he pioneered in introducing CIM in the Greek furniture sector. **Thus, all five cases ("the big five" as it will be called from now-on) changed the existing (by the time of venturing) business ecosystems (Table B12a, Appendix B) at different levels and specifically:**

WCo2 causes significant changes mainly at national level. It becomes the first Greek company to produce MDF in Greece (all imported by then) by additionally introducing novel production technology (patented innovative process) and flexibility in final products (pioneer at least in Europe). The venture changed the perspectives of other wood and furniture subsectors offering a flexibility of dimensions and qualities which did not exist before and enhanced product design due to the new alternatives (at

[199] This category is found in the other two sectors as well.

least at European level as the entrepreneur claims but with certainty at national level). It also created new business (e.g. laminate flooring), new (local/national) suppliers of raw material, and changed the home produced/imported MDF balance since till its establishment, national furniture and other woodworking producers could buy only imported relevant raw material. The initial innovation provoked further R&D to the relevant Greek Wood and Furniture Department of the TE Institute and to suppliers of the Chemical Industry (new technology produced by Chimar[200] resins). The company achieved a share of more than 20% in the second year of sales, while the bigger competitor, a Swiss-Greek company, had achieved a share of 11% (ICAP, 2008).

WCo10 altered its relative business ecosystem at global level. In 1999, almost after a decade of existence as a mattress company with quality and transparency as main characteristics, cotton and wool as main raw materials and the use of zip as innovation, WCo10 decided to build an absolute ecological image (which would later affect all the value chain) extending at the same time to new natural materials. The innovative focus on environment and ecology would include formal R&D on all natural sources for mattresses, furniture and linen, introduction of new ways to transform them to products, human-centric perspectives and use of unorthodox methods in marketing, building in parallel a unique business model worldwide. WCo10 introduced its novel business model at strategic level that is *''the totality of how a company selects its customers, defines and differentiates its offerings, defines the tasks it will perform itself and those it will outsource, configures its resources, goes to market, creates utility for customers and captures profits''* (Slywotzky, 1995). WCo10's venturing reshaped an existing market and framed a new one. Its unique image worldwide is composed by quality, innovation, Corporate Social Responsibility, alternative management and marketing all based on the ideal natural way of living and the proper exploitation of mother nature. Although there are many competitors, the company competes with major global relevant firms and at global level. Indicatively, WCo10 prices are too high (they almost start from the highest prices of the other Greek companies) while there are the only mattresses that can be re-sold.

[200] Chimar Hellas SA is globally active in the field of chemical products dedicated for the production of wood-based panels (particleboards, fibreboards, plywood, OSB etc) http://www.exportleaders.gr/en/index.php?about=3&id=10

WCo9 causes certain alterations of the business ecosystem at national level and partly at European level. By the time of the establishment, the technology was new for European standards. The novel WPC (Wood-Plastic-Composite) products create niche markets as well as *new suppliers and activities*, such as plastic recycling to produce raw material (polyethylene), wood dust producers, specific color producers etc. There are also *new B2B "customers"* created who have to be trained by the company to use the products; deck and fence makers, architects and decorators are some examples. The company has to survive the initial mistrust and ignorance (which is a characteristic of the woodworking and furniture sector) as well as to invest in customer training to avoid mistakes in the use of its novel products. Meanwhile, there are certain new regulations and standardization. The new product has led to a COST European project on WPC research and has invoked further research in the area of composite wood products. WCo9 introduced the product in Greece and Balkans, while there is only one major competitor in Europe and three other relevant producers who however did not manage to solve major problems of technological nature.

WCo8 changes mainly the business ecosystem at national level and supports the R&D process at technological level. The entrepreneur is the first to introduce CNC machines and CIM in kitchen industry in Greece with innovative multi-machinery patented abroad (world innovation). Specifically, he is the instigator and a member of the design and realization team of the innovative patented CNC cutting machine of IMA Company (Bologna, Italy) with the parametric function as the main feature. The machine won the first award in technology in CEBIT HANNOVER 2000 Exhibition. Soon after, almost all Greek kitchen cabinet producers started investing in CNC although till today micro companies rest on conventional machinery. The decade 2000-2010 was actually devoted to CNC introduction (Note: many business contacts to Wood and Furniture Design and Technology Department (WFDT) of TEI of Thessaly were for CNC support as well as for students to assist CNC programming and relevant production organization). The young entrepreneur further introduces his "box concept", a different way of kitchen cabinet manufacturing to counterbalance flexibility and verticalization. The model is soon followed by the other two big kitchen companies in Greece which can see its advantages. The introduction of novel material is almost among the major pioneering efforts of WCo8.

> "I was the one to urge the manufacturers to dare use innovative materials. I was the first to bring Corian and man-made veneer in Greece. Corian, for

example, is a very flexible material but its users must be trained in ways to use it. I encouraged such efforts despite initial rejection. *In the country of marble and granite, why should we use synthetic material*" This was a usual reaction!"

(Entrepreneur of WCo8)

At the time of company establishment there was no local competitor of this level. The agent had to compete only imported expensive, high value kitchen cabinetry (mainly Italian and Spanish by then). In 2011, a new competitor appeared in the upper segment of kitchen production of Northern Greece[201].

WCo6 challenges the relative business ecosystem. WCo6 is one of the most complex firms in the sector of timber. In 2005 a minor production weakness triggered the company's redirection and complete reformation. The company, already known for its quality in Greece and abroad, decided to stop producing a big number of products and focused its strategy on wooden plywood (50%) with marine plywood and flooring as core products. Starting from own experience and know-how the entrepreneurs ***redefine quality at global level.*** Their new vision towards top quality marine plywood concentrates on innovative process technology with the development of novel stitching technology. This was further accompanied with new ways to innovative uses and complementary products targeting high value markets. Reformation is deeply knowledge-intensive and clearly export-oriented. Company changes from general *"conventional wood processing"* to *"high value top-class marine plywood manufacturing"*. Today it produces the best and most expensive marine plywood globally and possesses the 5th position in the sector. It is also one of the most advanced companies in quality and leadership worldwide

"Lately we were awarded among the most developed firms regarding quality and leadership worldwide. The criteria were the rate of growth during the last years and the market shares it has acquired. The ceremony will take place in Genève[202]" *Entrepreneur of WCo6*

The only Greek competitor was "Shelman" which closed in 2012. Still it was not that famous as WCo6 for the same quality of marine plywood.

[201] The young entrepreneur is a graduate of the WFDT department who turned to luxury kitchen production after his thesis. In 2013 he introduced his brand and has also taken more than 40% of WCo8's market.

[202] WCo6 was awarded the International Star or Quality Award, Gold Category in 2010 which was the year the interview was contacted. Every year BID presents an international quality award to cutting edge companies from around the world for their firm commitment to excellence, innovation and leadership. http://www.bid-org.com/

All the agents above (some of them in a much broader sense) have the deep feeling and conviction of creating the future. In the two cases of WCo2 and WCo10 the agents alter the relations with the suppliers, they move up the value chain and give new different and value adding meanings to conventional products. Mattresses become more than just bed accessories and the act of buying a mattress turns to an act of pleasure and return to nature. Melamine produced by WCo2 brings up the challenge of modularity and variety entering ecological sides in an artificial product. *"We have changed the Greek market! We invested in flexibility and try to discover needs of the Greek market."(Entrepreneur of WCo2)*

These cases indicate that ***the stronger the DECs, the better and wider the formation of the new business ecosystem around the new venture.***

Three of them, WCo1, WCo3 and WCo4, are new-to-the-world firms although all three entrepreneurial teams have been totally involved in former similar family companies. ***They do not present equally developed DECs*** and more specifically:

WCo4 presents strong bricolage and improvisation capabilities but rather moderate transcendental capabilities (regarding mostly transcendental conditions). The new venture does not manage to cause real changes to its business ecosystem but it proves the focal role of knowledge and innovation to the relevant timber sub-sector. But for knowledge and innovation, the plant would be "a conventional sawn-mill condemned to death" (according to experts' opinions as heard in "Building with wood" seminar, 2010, Thessaloniki). The initial innovation effort was multifaceted and spread in many areas such as quality, production processes, NPD, design, energy and ecology. Thus, the initial competitive advantage was the introduction of innovative sawing technology that enabled more flexibility and quality while it advanced efficiency and added capabilities for innovative products and penetration in niche high-value markets. The entrepreneurs added novelties in some parts of the equipment. They sought differentiation and had many innovative ideas which alone would not however be able to offer significant initial profits. Therefore, they invested in technology to be established regarding quality, precision and flexibility and soon after turned to the innovative products as we will see in the relative section regarding innovativeness.

The new firm presented a satisfactory sales rate following actually the three big ventures and it is rated forth regarding innovativeness. The new company managed to

start building a good image as an innovative company with differentiated products. In 2009-2010 their innovative glue-laminated products encountered for 8% of total production while the novel decorative parts reached a 2%. There are no competitors regarding these products at least in Greece.

WCo1 presents some weakness regarding PEA and suffers a shortage of initial tangible resources; the firm's initial invested capital is the lowest of all cases. It is further with WCo3 the newest company of the sample. WCo1 as far as we know had not received the subsidy's money till the end of 2010 (WCo3 has received the subsidy instead). It is a case of very strong bricolage capabilities. It presents a satisfactory sales rate and increases its personnel within two years. The new company was unlucky enough to be established just before the severe crisis that hit the wood and furniture sector (2008), followed by the severe economic crisis while its products are of high value. Still it manages to survive and has already turned to exports with the new firm's first exhibition in Dubai trade show. WCo1 based its entrance in local and foreign markets on innovative techniques, innovations on quality surface, products and design combined to eco-friendliness and flexibility in design and batch sizes. The entrepreneur tried to establish a good company image with increasing awareness. **The venture created a new niche market** in the Greek market and is **among the pioneers** at least at European level. It is the first company in Greece to produce such high-value products which are differentiated from the European ones, enclose innovative technology and can be offered in flexible batches. It is further the first of its kind to co-operate on design issues with architects and decorators in Greece and abroad. Besides the severe problems of the crisis which become worse if we consider the fact that the company was established in 2007 (i.e. the beginning of the crisis), the company survives and extends activities and co-operations.[203] There are no direct competitors in Greece; competitive products are imported while there is another Greek company to produce similar products but not of that quality.

WCo3 is a case of satisfactory dynamic entrepreneurial capabilities which create a quite strong initial competitive advantage resulting in rapid sales growth and satisfactory employee increase during the first years in spite the difficulties of the crisis. The initial vision of the entrepreneurs was the *production of "Italian made"*

[203] WCo1 is a family business. The son of the entrepreneur studies in Rosenheim (Germany) (third year of studies on Wood technology and industrial Engineering) following our advice, and his daughter in our department (WFDT) (first year of studies). Academic Year of this note: 2013-2014

kitchen furniture in Greece for middle class customers. This led to the development of an innovative model which appeared to work at least in the beginning. Well-developed bricolage and improvisational capabilities result in novel production processes, an innovative concept and a novel model. Transcendental dimension of the sense of the entrepreneurial spaciousness is also moderate and seems to limit future plans in regional and at maximum national borders. Still, the novel business model, *distance clustering* in the furniture sector combined with *modular design*, was initially properly exploited with significant profits but it was later (end 2011) abandoned. After the initial innovations, the company presented nothing new and today it is treated as a conventional kitchen cabinet producer with modern technology still exploiting modularization to achieve flexible production. It is worth mentioning that the time the company was at the founding stage, the relevant Department of TEI of Thessaly was trying to form wood and furniture clusters in Greece and Cyprus. WCo3's model was to be further studied but the entrepreneurs soon found that difficulties and obligations were too many to go on.

All three ventures with moderate transcendental capabilities presented increasing sales – at least till 2009 before the severe economic crisis in Greece - and created niche markets without however changing the business ecosystems they belonged. From now on we will call this group the one with ***moderate DECs.***

WCo5 and WCo7, both new-to-the-world firms, **developed DECs but almost all dimensions were rather weak** and affected in a negative way at both start –up stage and the later company course. Actually, WCo5 survives due to the trade of imported furniture since 2007 (80%) and WCo7 lost the privilege of being the first to enter the bio-fuel market and led to closure in 2012 (after 5 years from establishment). They both had developed interesting and innovative knowledge-based concepts which however did not manage to provide viability. This is in line with literature. Innovation often contributes to a competitive advantage, but there are other activities necessary to achieving such an advantage (Ireland et. al., 2012).

The innovative honeycomb concept of WCo5 was badly developed and wrongly communicated. WCo7 was the pioneer of the novel wood pellets production which started conquering European market in 2005. It created a new market in Greece and a new industrial branch. However, it did not manage to exploit the advantage of the

leader due to weak DECs. This does not contrast literature. Christensen, et al. (1998) argue that, in a fast-paced industry, firms should enter the market during the "window of opportunity", which is a bit after the first movers but long before many others. The company proved incapable to handle the mistrust of Greek customers and the negative institutional settings, while exports were at low prices due to the already existing relevant competitive environment in Italy. Additionally, five new plants followed between 2006 and 2010 and are all in the region of Thessaly (two in Karditsa, one in Volos and one in Nevrokopi which is an SBU of a big organization situated in Larissa) with much higher production capacities and a wider range of customers and contacts.

All cases, but the two with weak DECs, have trademarks. WCo2, WCo6 and WCo10 have received awards making them a privilege of only established organizations in wood and furniture sector.

The W&F cases confirm the hypothesis 2.1 that *DECs have a positive impact on new LT-KI ventures' competitive advantage. Actually, it seems that the stronger the whole set of DECs, the stronger the initial competitive advantage.*

DECs, survival and growth

Tables B1 to B3 and diagrams B1 to B3 (Appendix B) present financial data of the ten W&F cases. It appears that DECs affect the survival and growth of the case studies; and more precisely:

The only company that presents a rather declining course and **which eventually does not manage to survive** is **WCo7** which is one of the two companies with weak DECs. Although with good initial sales, it presented the lowest mean annual sales rate and the lowest compound annual growth rate. Established in 2006, it presented first sales in 2008 and closed in 2012 not being able to confront the arising competition of actors which followed its pioneering example and established relevant companies with better quality and improved properties making WCo7's technology rather obsolete (this is one of the "prices of pioneers" according to Kaličanin , 2008).

The second venture with weak DECs, **WCo5** survives but not due to the initial business idea. If it had not become a trading company of imported furniture, it would have also closed since 2006. Establishing the company in 2001, the agents tried to

take advantage of the unique uses of wood honeycomb in furniture manufacturing. Although knowledge based and innovative, due to extremely weak DECs the venture did not manage to develop the relevant market at local or national level, while the actors did not even try to approach other markets. It presented the lowest sales and the lowest sales rate after WCo7.

While it was rather easy to comment on sales, mean annual sales rate and compound annual growth rate of the two companies of weak DECs, things become more complicated for the rest eight ventures.

WCo2 is indisputably the clear leader among the cases. It presents the highest annual sales rate and the second best in sales. The new SBU starts with more than 100 employees. We should mention that WCo2's CAGR (Compound annual growth rate) gives a rather false impression of the company since both 2008 and 2009 were very bad years for the subsector worldwide. This is also supported by the fact that the following year (2010) sales presented an increase of 21,3% (more than 4 million Euros).

Actually, all four corporate ventures present higher sales than the others, but this was rather expected; the two of them do not start from zero since corporate venturing refers to total company reformation. We should make clear that *the two cases did not decide reformation due to crisis (contrasting T&C cases, as we will soon see) but mainly due to their strategy to excel and differentiate.* Both presented satisfactory sales before venturing. This dependence on previous successful entrepreneurial activity did not allow for rapid changes in sales as for completely new ventures, although **WCo6** stated that after two years of venturing they had the highest sales increase ever. The entrepreneur also added later that this reformation created the conditions to survive the crisis.

The opening to novel natural material and a different approach of the sleeping phenomenon and ecology led **WCo10** to become a leading global company since this reformation led to successful exports and later world recognition. Actually, today, WCo10 is one of the 500 nominated companies of Europe's fastest-growing entrepreneurial and job-creating companies, according to Europe's 500 listing. Furthermore, it is one of the 10 fastest growing companies in Greece (5^{th} in the furniture sector). It can be considered an example of how firms use business models to identify and frame or reshape new markets.

Besides the high sales, both companies present moderate MASR (mean annual sales rate) and CAGR. They are just above the two ventures with the weak capabilities, but this is quite natural as we have just explained. Rapid sales growth may be achievable in high tech industries with radical innovations.[204]

WCo9 on the other hand *was*[205] part of a very strong group, ranked second in the sector, capable to open new markets in Greece and abroad more easily than new-to-the-world-ventures. We should also mention that the group was by strategic positioning export oriented (with 60 stores in Greece and abroad reaching even Nigeria). The new SBU managed to present high MASR and CAGR (third and second respectively) by introducing an innovative product in European markets. However, WCo9 did not manage to survive the crisis; the group closed down in 2014. We cannot comment on the survival of the case since WCo9 was a part of the group; the shutdown was not due to WCo9's failure.

However, both corporate SBUs (WCo2 and WCo9) presented high sales rates (first and third) starting from zero sales. This, in combination with sales figures of the other two corporate cases, is an indication of the **supremacy of corporate knowledge-intensive venturing at least in W&F sector.**

WCo8 is an exceptional case of new-to-the world venture; due to the strong DECs developed, the venture manages to have high sales (rated fifth after the corporate ventures) and present an above average CAGR. The exceptional in this case is that the company addresses an already saturated market, offering a product which is by no means innovative for the final consumer (kitchen cabinets are kitchen cabinets after all), at a local level and during a period of major turn to imported and mainly Italian furniture regarding the higher-value market segment that the entrepreneur targeted. The entrepreneur had really significant DECs due to which he created a strong business concept; as we will see in more detail later in this chapter, he invested on knowledge and innovativeness after having created a unique initial competitive advantage which brought major changes to the existing ecosystem.

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[204] Of course both WCo6 and WCo10 present high sales, high innovativeness, strong competitive advantages and their history up to now justifies KIE in these two cases.

[205] The author had to change the tense of the verbs in spring 2014, since the strong group closed down due to the long and severe crisis and a number of other reasons. For more, indicatively http://www.newsbomb.gr/chrhma/story/253217/giati-i-neoset-eftase-sto-arthro-99#ixzz31r623jlt

The second group which has developed ***moderate dynamic entrepreneurial capabilities*** contains the three new-to-the world ventures WCo1, WCo3 and WCo4.
It is interesting to see that the initial competitive advantage of **WCo3** gave birth to significant MASR and CAGR (second and first respectively). The value of these two indicators is more significant if we consider that they have been formed during the crisis period (2009-2011). The same time a relevant company (WCo8) had suffered losses of -33,5% and 23%. Yet, WCo3 proved to be incapable to follow the path it curved and in 2011 turned back to conventional supply methods keeping only a tendency to renew design and work on modular production. Although it is too early to talk about the consequences of these strategic choices, the sales of 2011 have fallen at about 20%.
WCo1 and WCo4 are two companies which presented similar DECs and as expected present a parallel development in growth as well as innovativeness and fame. In both cases limited resources were well exploited through strong bricolage and improvisational capabilities while transcendental capabilities were rather mediocre. Thus, the two new ventures present low sales (8^{th} and 9^{th} position) but with medium MASRs (4^{th} and 5^{th} position) holding the same positions regarding innovativeness and fame; two cases of moderate DECs with relevant moderate results. Still, we should also take into consideration that both companies are established just before the crisis and offer "luxury" high value products not to final consumers but to industry customers. The only solution might be exports and that is a strategy that WCo1 tries to develop. Both business concepts could have possibly found better and more flourishing markets if they were established the same period as WCo8.

A first look at the overall results of the growth indicators might create questions on the positioning of the ventures with moderate capabilities. While the big five have occupied the first five positions in sales, it is not the same with MASR and CAGR increase. More precisely, regarding MASR only WCo2 and WCo9 are above the moderate three, while WCo9 together with WCo8 interject among them in CAGR.
However, it is quite normal for small new firms to have an above-average growth potential (Evans, 1987a, 1987b; Hall, 1987; Dunne et al., 1989) "because firms have to reach a size that enables them to exist in the market" (Carrizoza, 2007). In any case, there are certain thresholds to be crossed to ensure that the firm is capable to

survive. Carrizoza (2007) names it "minimum efficient scale (MES)" and states that it varies from sector to sector and Audretsch (1995) found a positive relationship between the MES and growth for various industries.

Respectively it is not strange that the moderate triad presents higher growth indicators than the corporate ventures. On the contrary it is quite normal and expected. Moreover it is worth mentioning that the cases which present higher indicators than the triad are the ones of brand new SBUs (WCo2 and WCo9) which introduce novel products not produced before by mother-organizations. Somehow, they are "new-to-the-world entities".

Taking into account the fact that the W&F sector was hit rather hard by the crisis with losses of more than 30% for the wood sector and more than 60% for the furniture sector (ELSTAT, 2011,2012, 2013) knowledge-intensive venturing seems to provide a solution to crisis periods, especially for small firms like WCo1, WCo3 and WCo4.

Therefore, **Hypotheses 2.2 and 2.3 seem to be confirmed** by the cases of W&F industry; *DECs have a positive impact on new LT-KI ventures' survival and growth.*

However, the crisis test lets us suggest that **the course of the sector as well as the national context has a significant impact on the survival and growth of knowledge-intensive low-tech ventures.**

Dynamic entrepreneurial capabilities and innovativeness

Knowledge-based introduction innovations of the ventures (see also Table 4.1b) cover all four categories of the venture idea newness in relation to the innovation categories as they have been described in the relevant literature chapter:

(1) *new to the world*: business concept of WCo10, patented technology by WCo2

(2) *new to the market (national/international)*: all cases except WCo3 and WCo8,

(3) *new to the firm*: all cases, and

(4) *a first mover or assigned to the most innovative companies in the market or product field*: all ten cases are first movers at least at national level.

Knowledge-intensive and innovative venture ideas of the ten cases have produced

(1) *products* : WCo1, WCo2, WCo4, WCo5, WCo7, WCo9

(2) *methods of production, processes and technologies* : all ten cases

(3) *methods of promotion* **:** WCo10 and

(4) *business models* : WCo3 and WCo10 formed on a basis of novel knowledge and initial uniqueness of products/processes/model/concept –niche market.

However, most of the initial innovations cannot typically be characterized as "breakthroughs" or "radical departures", since they more often constitute combinations of existing patents and innovations in general. Interestingly enough, it appears that all ten cases develop innovativeness at slightly different levels; for example, WCo10 is eager to present significant innovation every year (rated first in Table B12a, Appendix B). On the other hand, WCo7 presents no novelty at all after the significant introductory innovative idea. In most cases, new ventures create new niche markets at national, European or global level and the ones with strongest DECs change or challenge their business ecosystems. Lack of competitors or a very limited number of them is **a further indication of innovativeness**.

Strong dynamic entrepreneurial capabilities have led to strong initial novelties:

- **WCo10** presents strong *business* and *market promotion* global innovations
- **WCo2** produced technological and process innovations, again worldwide, sealed with a patent and global recognition.
- **WCo9** opened a new market in Greece, Balkans and Cyprus and even Europe (by then there was only one competitor) introducing an innovative product family.
- **WCo6** challenged the properties and quality of a very delicate product worldwide introducing process innovations and gaining global distinction and
- **WCo8** created a completely novel production concept for small and medium kitchen producers opening a new business production area at national level.

All cases are accomplished by technological novelties and development of relevant innovation capabilities. Moreover all have set bases for further innovativeness. If we look again at each company's description as well as Table B4 (Appendix B) we can see that almost each year they present novelties and more or less significant innovations at all levels.

It is also notable that all five companies introduce certain technological characteristics mostly invented in-house but with strong external support and many of them new to the world, in order to improve technological and process features. All entrepreneurs or senior managers of the "big five" cases have also claimed that their initial knowledge

management systems are constantly reworked and advanced, in order to capture a wider range of knowledge and opportunities all around the phenomenon of wood technology (WCo2), the phenomenon of sleep (WCo10), WPC technology (WCo9) and design and further manufacturing processes (WCo8) respectively. All of them are also interested in novel ways to communicate the firms' messages all over the world (or at national level in the case of WCo8) by completely different methods however.

WCo2 develops aggressive NPD by parallel investment in innovative technology; the company produces new products and improves the existing ones in regard of quality, appearance, new characteristics and properties as well as novelties in production engaging green technologies for saving energy and protecting the environment. In parallel it develops innovation in logistics and ICT and invests further in increasing productivity and entering markets abroad.

Placing the emphasis on the protection of the environment **WCo10** develops a series of technological novelties such as the achievement of 96% of rubber foam purity which is a worldwide record and the gradual adding of raw materials not formerly used (e.g. algae) after relevant R&D (innovation 2012). Since 1998 175.259 hours of research (till the end of 2011), product development, learning about nature and interacting with people drives NPD and innovation (company's source). New technologies turn mainly around the formation and realization of policy and strategy of environment protection; reducing harmful effects to the environment, waste of energy and of raw materials. R&D has extended to hospitals and reached even Miami hospitals' health research. Research has produced even new terminology as the "orthosomatic mattress"

Innovative promotion *trains consumers* on both living with nature and on the phenomenon of sleep. One of the company's latest innovation refers to the concept of boutique hotel to promote products including both hired hotel rooms in eco-hotels as well as the company's own hotels, where customers can stay for a couple of nights to try the product. The company is proud of its continuous diving into knowledge and the orgasm of novelties on business model reformation all around its human capital.

> *"Innovation in NPD and the company's philosophy have strongly supported its commercial success in Greece and abroad" (WCo10's entrepreneur)*

WCo10's concept revolutionized the mattress industry, and over the years, the company has won many prestigious awards and distinctions for its eco-friendly product, production and HR practices.

WCo8 developed innovation in the form of introducing novelties to solve specific problems of the "box-concept" and add further value as well as by introducing innovative material. They also developed strong design capabilities introducing a significant number of new designs at a yearly basis.

Undoubtedly differences can be also found among the ventures of the "strong DECs" group. **WCo6 and WCo9** did not develop concentric cycle networking to the extent the other three did. Therefore bricolage capability was strong *but* not equally strong with the others. The same goes for the improvisational capability as we have already seen and keeping comparisons strictly within the big five group.

WCo6 was only interested in moving up the quality value of marine plywood[206] although the entrepreneur sees it as an act of "offering to the world of marine". Intentions result in well-exploited reproductive Transcendental Synthesis (TS), the products of which produced satisfactory revenues for WCo6, increasing its fame and securing its leading role in the relative subsector worldwide.

A favorable institutional setting combined with wood shortage and increase of timber price drives **WCo9** to create the new venture. Transcendental capabilities although strong are limited to that direction resulting in reproductive but well-exploited TS. Rate of sales is satisfactory for WCo9 which invests in finding markets in Europe but DECs did not actually encourage dynamic innovativeness.

Both ventures present innovations the following years, but in a moderate way if compared to the formerly mentioned firms. Initial innovation in these two corporate cases was new to markets, but innovation for the sake of innovation is neither company's target; for both constitutes a medium. Moderate NPD and innovative activities are within the companies' strategy, targeting mainly "specific problems" such as the problem of quality and production efficiency for WCo6, and problems arising by the new product, certain design characteristics and rivalry for WCo9.

WCo1 and WCo4 present quite similar performances regarding innovativeness. They both present high innovation performance with a significant number of new to the

[206] "*κύρια στο εξωτερικό με προϊόν υψηλής προστιθέμενης αξίας"(in Greek)*

world innovations, although this does not result in relevant sales growth. Innovative attitude can be assigned to *the significant bricolage and improvisation capabilities* the entrepreneurs have developed due to the strong learning and experimenting dimension and the exceptional provocative competencies the agents own. Although moderate to relatively strong (but definitely not strong) transcendental capabilities hinder the further success translated into sales growth, they create a fruitful background for creative NPD and innovative culture. The two new firms present something new every year.

WCo3 belongs to the same group regarding initial performances. Innovative performance during the start-up stage is exceptional. Due to the agents' significant dynamic entrepreneurial capabilities, the agents create a novel business model while its realization causes further innovations such as a new process based on Swatch's modular design model, customized solutions in production and organization, flexible automatization and IT solutions for the modular design and production, acquisition of innovative equipment (first to install M80[207] machine). Transcendental capabilities are again rather moderate in relation to the first group. The agents are again interested only in regional and national market.

The two Companies with **weak DECs** (WCo5 and WCo7) do not manage to produce further novelty, although WCo5 tried hard to improve the initial innovative concept. They actually present a declining life course and survive till 2010 due to parallel activities. Yet the crisis of 2012 did not allow WCo7 to survive.

In the examined W&F cases, all innovations turn mainly **around the initial novel concept** (e.g. in the case of WCo2, MDF laminated, MDF fire-resistant, printing ability and novel process technology for MDF) although they are not mere improvements or additions to product families (e.g. fire-resistant MDF is a totally innovative product with much R&D) and can refer to process or concept innovations. WCo10 is an exception presenting innovation in multiple directions (models, concepts, marketing, image etc.). Furthermore, time to market ranges from one to three and a half years (Table B5, Appendix B).

[207] A novel type of machinery

Wood and furniture knowledge-intensive ventures are not breakthrough innovation cases as one can observe in high-tech sectors. Still, they manage to **change or challenge their ecosystems at least at national level** and some manage to make the difference worldwide altering the "rules of the game". There are certain sub-niche markets created such as veneer and veneer stitching design (WCo1), WPC in Europe (WCo9) and new standards for plywood top quality (WCo6) as well as innovations that failed to impose changes in the relevant markets or being successfully communicated (e.g. WCo5 and the novel products of WCo4).

It is also important to mention that all successful new-to-the-world ventures of the sample develop the first type of knowledge-intensive entrepreneurship; i.e. they have a more balanced emphasis on different dimensions of innovation and rely mainly but not solely on external knowledge seeking, trying to produce simultaneously product, process and administrative innovation. This can be attributed to the quality of the transcendental capability; its level of development seems to decide the degree of success. They also appear to develop a more intensive networking activity than the rest companies perhaps due to their strong bricolage capability. Consequently, WCo8 with strong transcendental capabilities present a wide range of initial and follow-up innovations with a major impact on sales and growth. WCo1 and WCo4 present a high degree of innovativeness but with no relevant sales performance. The case of WCo10 is again exceptional. It is the only established company to present a wide range of innovations but it is a case of highly developed dynamic entrepreneurial capabilities which deserves further research even as a single case.

The two cases of the third type prove again that devotion to technical dimensions of innovation based on sole external knowledge cannot provide strong advantages, as well as that DECs when strong are multidimensional and multifaceted.

Thus, the new firms seem to innovate in order to sustain leadership and appear to achieve it in their majority. Business scope innovations refer to year to year investments in technology, R&D, experimentation and new product and market developments. Organizational innovations turn around processes and process improvements activities, business models and firm structure. In such efforts they do develop collaborations of different types.

Therefore, it seems that the analysis of the W&F cases **confirms the hypothesis 2.4** that *DECs have a positive impact on new LT-KI ventures' innovativeness.*

As already mentioned, **patents and intellectual property protection** are not popular among the cases although they are knowledge-intensive and one would expect much more focus on protecting knowledge. Yet, the very nature of the dynamic entrepreneurial capabilities can explain this tendency. In the specific cases, business concepts are built around the agents' own transcendental thinking and unique architectural mechanisms and realized by bricolage and improvisation capabilities. Among DECs' dimensions one can find mechanisms as well as specific traits and characteristics. The result is not a single technology or a mere family of innovative products to be copied and reproduced. The agents believe in the strength of what we have called "transcendental synthesis". "No one can really copy the whole package" according to some of them. The entrepreneur of WCo10 states that it is not enough even to see the way an entrepreneur makes his/her strategic moves. The entrepreneur of WCo2 patented the novel technology but he is revealing its secrets to everyone who asks about it. *"I gave the technology to them. I will have more novel ideas. This is a way that we became famous. This is how they all visited our plant!"*
Only the two cases of WCo2 and WCo4 have applied for patents to secure specific technologies which **however is not a major concern for none of them**. The agents of all cases find the patenting procedure time-consuming. In WCo8's case, machinery developed during the planning phases was patented by the manufacturing company (this will be found in the other two traditional sectors as well) with no benefits for the entrepreneur of the case. However, it indicates that low tech knowledge-intensive entrepreneurs are no more passive receivers of technology and know-how.

Initial conditions

Entrepreneurial profile: three categories of ventures were recognised regarding origins of entrepreneurs before venturing:

- established firms which applied corporate venturing (4 cases),
- new-to the world firms established by entrepreneurs grown up in a relevant entrepreneurial milieu and own professional background (4 cases) and

- new-to the world firms established by entrepreneurs with no family backup (2 cases) or former direct relation to the sector (one of the last two cases).

An important factor of knowledge intensiveness in W&F cases appeared to be **human capital** which regards the entrepreneurial team as well as the members used in corporate venturing. It refers to education, former experience and variety of different sciences represented.

All case-study firms are established by agents over 30 years old (Table 4.1b) which strengthens the assumption of the significance of prior entrepreneurial experience and knowledge in order to build a higher PEA and thus to have developed an enhanced transcendental capability. The only exception is WCo8 (the entrepreneur was 26 years old by the time of venturing). However, in this case there existed a strong relevant family company as a sectoral background, important knowledge background and a sense of worldview on economic and other specific knowledge since the entrepreneur was a PhD holder and prior member of two international large organizations.

Actually, the ages range from 34 to 42. The two cases where the entrepreneurs are older than 50 years old regard corporate venturing where other company members (mostly engineers) take over the realization of the novel business concept.

In all ten cases human capital covers all stakeholders' **educational level** and involvement in science or industry knowledge and plays an important role in the venture development. It is worth mentioning that all entrepreneurs were quite different in attitude and knowledge, and above the average furniture manufacturer (Table 4.1b). This can be easily understood if one has a picture of the average level of the sector's human capital. The big part of the industry is dominated by micro family and craft-based firms and remains not competitive, unable to face the radical global changes and / or correspond to the specifications and terms of investment motives exploitation. Most entrepreneurs have only finished the primary school, do not have any other kind of training except for a practical learning of carpentry, are introvert and afraid of novelties[208].

The cases reveal certain relationships between the educational level (Table 4.1b) and its impact on DECs. Eight out of the ten actors own a higher education degree (at least TEI diploma). The fact that two among the biggest venture creators (the ones of

[208] For more, please refer to the industry review

WCo2 and WCo9) have only finished a technical school, can be reasoned by their strategy to use well educated staff (both engineers and economists) for the KI venturing, although it was *them* to create the novel idea. We should mention that their first venturing goes back to 80s and although conventional and not knowledge-intensive, it enclosed novel pioneering ideas.

WCo8's case presented the strongest DECs among new-to-the world companies. Its entrepreneur is a PhD holder and five of the company's initial 30 employees are diploma holders. WCo7's and WCo10's entrepreneurs are University diploma holders but of irrelevant sectors. Additionally, WCo7's entrepreneur has no former experience in the sector. All other agents are TEI-diploma holders. The only PhD holder is the one to have caused major changes to its business ecosystem by a new-to-the-world start up. According to our opinion, the impact of the academic and professional background of the entrepreneurs in low-tech knowledge-intensive entrepreneurship *deserves further qualitative and quantitative research*.

Established companies and WCo8 have also invested in employees with a higher education (AEI) diploma while the rest have occupied only TEI –diploma holders. All ten cases have a relatively high percentage[209] of educated staff which strengthens their characterization as knowledge-intensive and it is highly unusual in W&F industry.

All the cases which developed strong DECs are related to agents with a higher education diploma, master or PhD. Agents are either the entrepreneurs themselves, or the organization members responsible for the new venture. However we cannot claim that an irrelevant diploma is an obstacle to successful DECs or to the venture's success regarding survival, growth or innovativeness. The two cases of this kind (WCo10 and WCo7) refer to diametrically opposite results regarding both sales and innovative performance, adding the fact that we refer to an established versus a new-to-the-world company. Therefore, we can detect that there are also other parameters to shape the successful profile besides the educational level and relevance; e.g. in the case of WCO10 the entrepreneur had developed an exceptionally high level of spaciousness and receptivity.

[209] *Note: percentages are not considered by the author a proper measure here since sizes range from 8 to 90 and a firm with 4 diploma-holders would present a percentage of 50%. This is however one of the beauties of the case study method; i.e. the ability to escape statistics*

Among entrepreneurs' characteristics we assume it is not irrelevant that the two cases of weak DECs and consequently the creation of "weak ventures" are established by agents with ***no previous experience and knowledge of the sector.*** It seems quite clear that differences in **prior business experience** influence the choices as well as the ways and mechanisms engaged. It is also significant the fact that experience covers the whole range of relevant entrepreneurial activities, management, technical industry experience and a deep involvement in the sectoral at least environment.

Resource availability is a major determinant for the development of all dynamic capabilities. Notable is here the supremacy of corporate venturing where all resources are richer and abundant, networking and contacts are easier and transcendental conditions are superior. This is in line with literature which states that corporate ventures can benefit from their parents' resources, which are an important requirement for enhancing the innovation process (Thompson, 1965). Thus, besides human capital, social and financial initial capital can be moderating factors on the effects of DECs on new venture survival and growth.

The role of **social capital** is evident in all new-to-the world cases while formal networks and business contacts are the main parts of networking and thus bricolage capability for the cases of corporate venturing. The four cases which refer to entrepreneurs grown up in a relevant entrepreneurial milieu (i.e. **WCo1, WCo4, WCo5** and **WCo8)** engage family suppliers and customers (the role of the existing relevant entrepreneurial milieu), friends, foreign collaborators and contacts with relevant university departments. Family supports further with financial backup. The two cases left are quite different. **WCo3's** entrepreneurs have a former experience of the sector and therefore have already developed networks (e.g. the Italian cluster). They had further long collaborations with customers and suppliers, as well as with the relevant WFDT department which is situated in the same area.

Regarding **financial capital**, there is also an obvious difference between the financial resources of new-to-the-world founders with a limited private capital background and existing firms setting up KIE as corporate entrepreneurship. This is in line with literature. Chaddad & Reuer (2009) state that new ventures and firms with stronger

financial positions in early developmental stages are more likely to survive, grow, and experience higher performance. Whereas a clear majority of new firms used public support, for three out of four of the established firms this comes not into question. These firms rather try to finance their founding innovating and knowledge-based activities internally. In cases of cooperation with research institutes the new firms often benefited from the knowledge about policy measures by experienced institutes in this matter (five out six new-to-the world ventures were closely cooperating with TEI of Thessaly).

The cases reveal that it is easier for existing Greek W&F organizations to apply KIE through corporate ventures. They can develop transcendental capabilities of far higher levels than most new entrants, while bricolage (which is tightly connected to knowledge "hunting" and networking) is easier due to the richer pool of resources, social and human capital. This can be attributed to the traditional focus on internal market (these companies produce bulky products with high transport expenses) which is rather small and slow in embracing innovation in the sector, as well as the fact that, innovations although knowledge-intensive and value adding, they are not "breakthroughs" to entice customers. More often these innovations do not even reach final consumers.

Thus, **we could conclude that in the wood and furniture industry knowledge-intensive entrepreneurship favors corporate venturing and consequently the transformation of existing non knowledge-intensive firms to knowledge-intensive and innovative ones.**

Location of new ventures does not seem to have significant impact on the start-up performance. Still, problems when opening markets or attracting public interest are greater in cases of new-to-the-world start-ups that are away of big urban centers. All five new firms have stated that they encountered difficulties to promote their products due to their location. This may, however, be a sole Greek phenomenon. On the other hand, we have already observed that in corporate venturing it is much better when the new venture is not created "within the yard" of the mother company.

The cases are in line with various studies which have shown that regional proximity of various players is only important for some entrepreneurial activities. In some cases (and mainly in the cases of WCo3 and WCo5) this factor was responsible for blocking

successful cooperation activities, while in others (WCo7 and WCo8) it caused important delays. However in the first two cases cultural and organizational proximity (e.g. harmonization of the level of technology and approaches to quality) were more important than spatial proximity.

We should note that the **institutional setting** as well as the time of venture establishment and the **general environmental framework** was almost the same in 6 cases and it was a favorable one for the wood and furniture sector. Two cases (WCo10 and WCo8) have exploited the economic growth and the Greek market boom of 2000. Two cases (WCo1 and WCo3) were established in 2007 just before the crisis of the sector which started in 2008 together with the severe economic crisis of Greece. Although they survived the four first years in the middle of the crisis, their survival is still not secured.

Actually, the companies of the first group (the "big five" group) ***took advantage of the opportunities offered by the environment.*** More precisely:

- The entrepreneur of **WCo2** grasped the opportunity to buy a bankrupted plant in 2005. It was a time of buoyant economic activity and intense construction activity. MDF was only imported, while government would support the entrepreneur's developmental plans.
- **WCo10**'s vision seems to fit well the tendency towards ecology and exploits the economic growth of the 2000s in a fine way.
- **WCo9** took advantage of the global wood shortage and the relevant price increase as well as the growing trend towards ecologic products.
- **WCo8** is an exceptional case of a perfect time to enter the market. The entrepreneur himself confesses "I started at the beginning of a significant market boom. Maybe in normal times a company should need 30 years to reach what I have done in only 10 years". Activities stretch to banks and other national and private organizations constructions, and works for the Olympics 2004.
- **WCo6** with a significant past experience and know-how *read the signals of the market and realized the need to turn to global markets with top-quality products*. The company concentrated in what they knew to do best and excelled in it.

The firms of the second group ***did try to take advantage of the messages sent by the environment*** such as ecology and uniqueness (WCo1, WCo4), quality and building

activity (WCo3). Yet, they took into consideration only the regional and partly the national business environment while the imminent crisis had shown no signs by then (2007).
The firms of the third group had also identified important gaps in the market but both products were not easily accepted by the Greek market, since there were no favorable institutional settings at national level.

Revising the initial conditions of the ten W&F KIE cases, we could suggest that the development of dynamic entrepreneurial capabilities in this low-tech industry depends in major ways on both tangible (e.g. financial) and intangible (human, social, knowledge) capital, as well as the personal traits of the entrepreneurial team which form the new firm's informal culture since the very beginning. **Founders of new to the world KI low-tech firms develop more human-centric and less organized DECs than in cases of corporate venturing.** Among the start-ups, WCo8 presents an advanced development of DECs in relation to the other five new-to-the-world firms.

Before summing up the impact of DECs on certain collective parameters, we should mention that all cases have differentiated to a large extent than the average of the sector. The reader should bear in mind or read again the sectoral review; innovativeness and NPD are rare or refer to minor changes, new (imitative) design, conventional IT applications and similar actions. Furthermore, almost at a 100%, firms do not even think of exports or to develop DCs or other routines of strategic management. They are run by entrepreneurs who have finished elementary school at the best case and cannot even use PC. The cases were chosen among the ones that serve a minimum basis of knowledge –intensive tendencies and cultures.

Therefore, according to the findings of the ten W&F cases, the following observations can be stated:

a) Regarding KIE

Obs. 1: In traditional low-tech sectors and at least in the wood and furniture industry knowledge-intensive entrepreneurship is characterized by a balanced emphasis on different dimensions of innovation and relies mainly but not solely on external knowledge seeking.

Obs. 2: In traditional low-tech sectors and at least in the wood and furniture industry the focus on only the technical dimension of innovation relying on only external knowledge affects in negative ways new-to-the-world knowledge-intensive ventures.

Obs. 3: In traditional low-tech sectors and at least in the wood and furniture industry knowledge-intensive entrepreneurship favors corporate venturing and consequently the transformation of existing non knowledge-intensive firms to knowledge-intensive and innovative ones.

b) Regarding DECs

Obs. 4: In traditional low-tech sectors and at least in the wood and furniture industry agents need to develop the whole set of DECs, which are actually interacting among them, to start viable and successful ventures with strong initial competitive advantages regarding survival, growth and innovativeness.

4a: Moderate DECs (i.e. at least one *not* strong DEC) lead to weaknesses regarding survival, growth, or innovativeness of traditional low-tech sectors and at least in the wood and furniture industry.

4b: Moderate DECs do not hinder the development of knowledge-intensiveness of traditional low-tech sectors and at least in the wood and furniture industry.

The analysis also revealed further that **initial conditions** at personal / firm level affect the development of DECs and impact new venture's survival and performance. Therefore, the following observations can be stated:

Obs. 5: DECs presuppose certain levels of tangible and intangible resources. Financial, social and human capital affects DECs and their development and subsequently their impact on new venture performance. DECs seem to be tightly related to knowledge assets and knowledge exploitation. They presuppose certain levels of education and former entrepreneurial / managerial experience with high involvement in similar activities and a deep and overall knowledge of the entrepreneurial landscape by the entrepreneurial teams of knowledge-intensive wood and furniture new ventures.

In cases of corporate venturing local proximity increases the danger of core rigidities at least in the wood and furniture sector.

The analysis of the W&F case studies **confirmed the second hypothesis**, revealing significant differences among new ventures with strong and weak DECs. More precisely:

Confirmation of Hypothesis H2.1: DECs have a positive impact on new LT-KI ventures' competitive advantage, affecting the level of changes and challenges that these ventures bring to their business ecosystems

2.1a: Strong DECs produce strong initial competitive advantages which cause major changes in their business ecosystems

2.1b: Weak DECs produce weak initial competitive advantages which however cause some changes or challenges in their business ecosystems

2.1c: Among DECs, transcendental capabilities are mainly the ones to affect in major ways the initial competitive advantages and the changes they cause to new ventures' relative ecosystems.

Confirmation of Hypotheses 2.2 and 2.3: New knowledge-intensive low-tech ventures of the wood and furniture sector with DECs are more likely to grow

2.2-3a: Strong DECs have a positive impact on survival and growth

2.2-3b: Weak DECs have a negative impact on survival and growth

Confirmation of Hypothesis 2.4: New knowledge-intensive low-tech ventures of the wood and furniture sector with DECs are more likely to innovate.

Actually, DECs curve the innovative behavior of the new company.

2.4a: Strong DECs have a positive impact on innovative performance both at start-up stage as well as in curving its later course

2.4b: Weak DECs have a negative impact on innovative performance, especially after the initial innovation

II. DECs and new venture's performance: food and beverage sector

Knowledge-intensive enterprises were rather rare in the Greek food sector although there was always knowledge included regarding processes and technology especially in the few large firms. Most Greek companies involved in F&B sector are SMEs with a dynamic profile and various technological and R&D needs. However, they have not yet familiarised themselves with the idea of initiating, or simply participating in such activities. It is worth mentioning that the great majority of these companies have presented a rather cautious attitude towards the adoption of innovations that

prerequisite research for adaptation in their manufacturing procedures, as well as towards the participation in EU's R&D programmes that prerequisite co-operation with research organisations or other similar enterprises. A research by Caloghirou et al. (2004), provided empirical data from an extensive survey carried in 558 companies from Greece and other six European countries (Italy, Denmark, UK, France, Germany and the Netherlands). The results showed that the food sector (in comparison to the computer sector and other related industries) was less likely to innovate.

In all ten case studies **knowledge seeking activities** refer partly to R&D in-house and partly outside agents' potential (e.g. by manufacturers, suppliers, other industry, science etc.). It is worth mentioning that in contrast to W&F sector, food companies rely on in-house R&D, develop dedicated R&D departments and charge R&D expenditures. Yet, even in this industry, most innovative activities are combinations of various knowledge assets occupied by others along the value chain and regard formation of processes due to new knowledge produced.

More precisely, **three types of knowledge-intensive ventures** can be also traced with some differences compared to W&F sector.

- The **first type** emphasizes new-to-world innovation to enter business ecosystem; the cases of this type applied afterwards a more balanced emphasis on different dimensions of innovation[210] *combining external knowledge seeking to in-house research and knowledge development drawing from high quality human capital (both in terms of founders and workforce)***.** Views on scientific and technological advances accomplish innovation ambitions. **FCo1, FCo5, FCo6, FCo8, FCo9** and **FCo10** belong to this type.
- The **second type** emphasizes new-to-world innovation to enter business ecosystem but later applies a less balanced emphasis on different dimensions of innovation. They concentrate more on the technical dimension of innovation and combine both internal and external knowledge development but with no close co-operations FCo4 and **FCo7** belong in this category.

[210] **Note:** Actually it covers the three axes of a new venture: technology axis which is relevant to the technical development of a novel concept up to full scale production, Market axis which refers to the interaction with the market and the business axis which includes the business steps needed such as commercialization and business scheme selection, business and relative model development and IPR protection.

- The last type focuses on only the technical dimension of innovation relying on only external knowledge. It is rather interesting to see that this category consists of the two weak ventures, namely FCo2 and FCo3. *This last type is similar to the one of W&F sector and encloses equally the weak cases.*

The DEC analysis of the F&B cases also led to the formation of the following three categories

a) Cases with strong DECs: FCo1, FCo5, FCo6, FCo8, FCo9, FCo10
b) Cases with moderate DECs: FCo4, FCo7
c) Cases of weak DECs: FCo2 and FCo3 which lag behind regarding all dimensions of the DECs.

KIE and initial competitive advantage

Food and beverage cases target to differentiate **mainly with novel products** such as the cases of **FCo1, FCO4, FCO5** and **FCo9**. However, many cases target differentiation through functional parameters **in order to produce initial competitive advantage, such as:**

47**Table 7.15:** Mode of F&B cases' differentiation

Functional Parameters	**Cases**
Quality	**FCo6, FCo8**
Innovative production methods	**FCo2, FCo6, FCo7**
Exploitation of innovative production methods, elsewhere produced but adapted to local conditions	**FCo2, FCo3, FCo6, FCo7, FCO8, FCo10**
Unique novel business models and methods of promotion together with product innovation	**FCo10**

All ten new ventures managed to pose significant changes in their ecosystem. In contrast to W&F cases, changes refer to global relevant business ecosystems for companies with **strong DECs** and at national level for new ventures with **moderate** capabilities. All ten knowledge-intensive cases are regarded as successful cases. Most of them present annual sales increase without being seriously affected by crisis till the end of 2012. Five of them had a sales shock in 2008-2009 and one in 2010 which however did not affect the following years. Three of them were completely untouched by crisis. Yet, instability is evident in our two weak links: FCo3 presents a rather vulnerable sales picture and a significant sales drop in 2011, while FCo2 flits in and out of existence as it fluctuates with increases and decreases in annual sales. All ten companies, however, had developed DECs tightly related to knowledge assets and

knowledge exploitation in order to produce innovation and shape the initial competitive advantage to enter already saturated markets. All of them managed to develop DECs at different levels of course. In fact:

Six of them, **FCo1, FCo5, FCo6, FCo8, FCo9 and FCo10** ***have developed very strong DECs.*** They all present parallel increasing sales as well as high rates of innovation and NPD performance in their life-course till the day of the interview at least. Four of them are cases of corporate venturing; the two (FCo5 and FCo10) target radical internal renewal, one with a spin-off and one with a new innovative SBU. All of them present strong dynamic capabilities as well. The other two (FCo1 and FCo8) belong to the same category of new-to-the-world firm as WCo8 in the W&F sector. Although new, they sprang from relative family companies of the food sector, are well backed up and the entrepreneurs had exceptional academic and professional experience. **They all have changed the existing (by the time of venturing) business ecosystems at different levels and specifically:**

FCo5 introduces the notion of bio-functional food in Greece challenging the scientific world worldwide, while the company opens a totally novel section in wheat-based food for health-food products globally with relevant niche markets. The company focuses on quality products with high nutritional value in the peak of Research and Technology. In the gluten-free products there are other three companies in Europe and America with presence in the Greek market without a real competition to exist; the products produced by FCo5 are closer to the Greek tastes as well as the fact that the new venture's process method is the only -to date - to produce bread with a more natural texture which does not become stale within two hours. **There is no competitor till now for the innovative products** of the company which are worldwide patented and are suitable for special groups such as cancer patients and athletes. As innovator, the company had to *encounter serious problems with state institutions and markets.* Yet, after overcoming such problems the products are becoming more popular in Greece and abroad while research is further stimulated towards relevant directions.

FCo1 introduces a novel niche market at global level of products which the entrepreneur named *antipasti.* The *antipasti* name emerged due to bureaucracy; the novel products could not be categorized to any existing group. FCo1 opened a very wide and especially lucrative global market for Greek producers who saw a way to

add value to traditional products. All companies that followed the new direction adapted the name *antipasti* to sell their products abroad. Many new categories followed such as brand or private labelling, extreme high value products or extensions to fruit-filling etc. Today this is one of the most promising niche markets for Greek producers. It however needs knowledge to manage the various problems of food processing, present an ecology-friendly image and overcome health and institutional obstacles and legal limitations worldwide.

The number of competitors grows every year since many olive producers follow FCo1's paradigm. That's why the company's strategy is aggressive NPD and export oriented priorities. In 2014 the company prepares a new SBU with novel products.

From zero to top: FCo8, an exceptional case of a bankrupted company which became highly profitable, ***challenges quality*** as a first effort to differentiate and created **its unique position of high quality[211] based on innovation at the same time that the leading companies in Greece were creating the segment of functional milk.** The entrepreneurs posed the simple question *"Why should quality mean just following the set standards? Who makes specifications?"* So they targeted at milk of higher quality standards combining raw material, process technology and innovative package technology[212]. The fine-tuned bricolage and improvisation results led to a novel type of milk product which opened a new niche market at the same time as functional milks started creating new market segments. *The company encountered the same problems as the other two firms mentioned with terminology and legislation for innovative products.* FCo8 becomes soon one of the strongest milk producing companies in Greece. The once bankrupted company went on investing on knowledge and innovativeness focusing on relevant capital and through benchmarking[213], co-operations and R&D (in-house and joint projects) regarding mostly process, technology and packaging ones, as well as strong NPD to be today among the first and strongest four milk-based product producers in Greece. In 2012 it is the 10th among the Greek food companies with the highest sales and 33th among the 500 Greek companies with the highest sales (ICAP, 2012).

[211] http://pollymkt.blogspot.gr/2011_04_01_archive.html

[212] The company was the first in Greece and among the three on Europe to buy and use a novel packaging technology

[213] E.g. benchmarking quark production technology to produce a unique type of yogourt -3 major competitors did not manage to copy it yet

FCo9 creates a globally new niche market with gluten-free snack-type products which turn "medicine food" to pleasure and *are not limited* (due to texture and taste) to people of special dietary needs. The new venture encounters also the problems that follow an innovative product of a mature industry at least in Greece. *Is it a snack?* Greek super markets place it next to other snacks but they are much expensive and fail to be achieved. The company after this first –and short due to fast strategic response- failure turned to foreign markets and especially the English super markets which devote separate lines in health products and the innovative products named "cheese-ups" and not "snacks" find their way to 15 till now countries and win global prizes. There is again the transcendental thinking, "the flight beyond limits". One of the two entrepreneurs narrates *"Our slogan was:* ***Why not?*** *The more food specialists would persist that our vision was impossible, the more passionately we would work on our idea".*

A plethora of knowledge resources and assets was sought and collected though all possible ways developing a strong concentric-cycle networking to finally create a unique market of "snacks" and realize their vision: *"Make products that taste so great… you will not believe they are Gluten Free!"*

There are no direct competitors till now at global level according the sayings of the entrepreneurs. The sales took off when exports started with annual sales rates to be more than 50% even in the fiscal year 2012-2013.

We should note that the two almost neighboring ventures, FCo5 and FCo9 turned to gluten-free products about the same time (2004-2006) but they have shown no intention to cooperate until now.

"Innovation comes to "dress" the value of the concept" (Entrepreneur of FCo10). FCo10 **opened a new high-value niche market with innovative food distribution of branded Greek products** focusing on an initially contradictory concept of tradition and innovation. The company altered completely the relative national business ecosystem at global level; in most foreign markets Greek traditional products, when accepted, were in bulky packaging and usually regarded as "ethnic food" or sold as raw material. **FCo10 changed it to a certain extend upgrading quality and eco-standards as well as adding innovation next to the combination**

of quality and design (which are the focal points of relevant activities of Italian oil companies). The new niche market is named "Greek gourmet products" and today can be well noticed *(at least)* in Greek duty-free shops where other companies besides FCo10 are also today represented. Innovation stretches to technology, processes, marketing and promotion. All came in 2001 when the company had already created a niche of branded oil products (based as well on design and quality) in USA (in 1996). The new niche market is today flourishing with even extreme cases as the *λ oil* sold at a price of 82 Euros per kilo (Speiron Company, 2007). It was again a matter of a very simple question

> "It was there, during my postgraduate studies, that I met Marion Carthwright, a food gourmet, who expressed surprise that while Greece had so many authentic products you could never find them in English supermarkets. She said: 'That is what you should do.'"

Even then, when the company was created, the entrepreneur was innovative. He created a brand identity without product, promoting the "meze" concept (i.e. socialization of food) which was a marketing innovation! (*Note: HEPO SA followed with KERASMA).* Initially he focused on package design and marketing reassuring about the top and constant quality of oil to sell. In 1995, opening the niche market in USA was rather easy for the cosmopolitan entrepreneur since he was the first to do so.[214] After the rapid increase of similar companies differentiation would come through knowledge-intensive innovation. "*That's why we planned and realized a cutting-edge "technology diamond" (i.e. the plant). Our plant was ready for all our experimentations*" narrates the entrepreneur.

A diehard green, the businessman has continually pushed the boundaries of innovation collecting and exploiting human capital, technology, relevant institutes in Greece and abroad and other knowledge resources and assets. After long R&D programs the company has till now presented a series of innovations and has become a pioneer worldwide regarding ecological, packaging and energy saving issues. Promotion and marketing innovation followed too.

[214] Just for the history the first to trade traditional Greek products to USA was Kitrilakis who is a world-renowned authority on Greek food and a steadfast champion of the Slow Food movement. Affiliated with the Mt. Vikos Company, Mr. Kitrilakis also runs the not-for-profit agro-tourism organization, Zante-Feast. With a master in chemical engineering he started from NASA, founded Tecna to develop medical devices in the 70's and then turned to Greek traditional food to become a world famous food guru.

An impressive number of awards abroad and a constantly increasing sales volume follow FCo10 which in 2011 was awarded with the "Ruban D' Honeur" among 15.000 firms of 30 countries.

FCo10 resembles WCo10. They both share the innovative focus on environment and ecology including R&D, introduction of novel processes to transform them to products, human-centric perspectives and use of unorthodox methods in marketing, building in parallel unique business models worldwide. They both enjoy an impressive number of global awards and prizes. They both introduced a novel business model at strategic level in their industries; that is *''the totality of how a company selects its customers, defines and differentiates its offerings, defines the tasks it will perform itself and those it will outsource, configures its resources, goes to market, creates utility for customers and captures profits''* (Slywotzky, 1995). Both agents are true cosmopolitans, unconventional characters and they focused on reshaping an existing and framing a new market.

FCo6 did not actually change but certainly challenged and altered the business ecosystem at national level (and partly worldwide) by advancing quality standards as well as the whole level of the industry sub-sector. *For the new corporate venture, rice stopped being "just rice" and turned to a raw material of high potential for R&D and further advanced exploitation.* A desire to challenge the established perception of the traditional treatment of rice as well as a deeper feeling that the new generation can do better than the old led the new entrepreneurs **question** the "power" (translated into quality, taste and dominance) of the unique Uncle Ben's parboiled rice[215]. The first revolution would be the production of "European type" parboiled rice which would minimize the disadvantages of the existing production methods and would better suit the local types of rice and especially the white rice, the weak point of Uncle Ben's.

The innovative patented process method and technology is a breakthrough innovation at least at European level. It is actually patented for ten years and gives the firm the absolute leadership in Uncle Ben's weakest product; white parboiled rice. This attainment is the starting point of an increasing advance in research and innovation getting out of the strict limits of rice as food. The company changes from "*conventional rice packaging plant*" to "a knowledge-intensive organization". Intense R&D with a fine combination of in-house and joint projects results in high-value

[215] By then, besides the Uncle Ben's technology and a number of patents since 1987 which were not all commercialized, some companies in Italy had tried to change parboiled rice process but without success.

innovations. NPD is also aggressive since novel products are fast replicated (most of them as bad reproductions however) by local or international competitors. Yet, the company is the first in the world and owns relevant patents in a series of achievements. With the slogan "Nothing to be wasted", the entrepreneurs open wings to biotechnology, pharmaceutics and other sciences. Its latest success turns around innovative applications of γ-oryzanol. Who said that "rice is just rice?"

FCo6's competitors in the conventional products are two Greek companies, private labels and mainly Uncle Ben –mostly in yellow rice. The company is the leader in the Greek market (since '80s) with a share of more than 30% in rice products and about 20% in pulses today. In parboiled rice they are second in Europe (after Uncle Ben) and first in Greece. Still, they are the first in Europe to develop an innovative production method. The company is the only one in Europe with rice products which are certified to be cultivated based on the principles of Good Agricultural Practice.

Two of the cases, FCo7 (established) and FCo4 (new) do not present equally developed DECs and more specifically:

FCo7' "Achilles heel" seems to be the CCN dimension of the bricolage capability which seems to be related to the entrepreneur's weaknesses regarding PEA and the Transcendental Capability in general. Yet, the venture **challenges the business ecosystem** in multiple ways; it is the first to depart from the detrimental complacency of protected traditional feta. The entrepreneur questions the potential of innovating in an extremely traditional sector; almost a taboo for the Greek reality. Due to the small size of the company and its traditional style, first steps are quite slow and faltering. While he patented certain process methods, which were worldwide innovations, *this was not well communicated in order to even challenge markets. There were no aggressive investments or a parallel development of the business and the market axes.* The departing movement was the aggressiveness in NPD. Starting with reverse engineering and novel products which resembled existing products of large Italian and American companies, the company soon reached the point to create its own innovation. FCo7 presents a series of totally novel products every year (e.g. melityros in 2006 was enthusiastically accepted in Japan), wins prizes and increases sales. In 2010 a spin-off by the name of "R. I." was established. The company has not been affected by the severe crisis although it is not export oriented.

The company is not as famous as it could be and has not caused major changes at national level. Yet, it proves the central role of knowledge and innovation to the relevant sub-sector. There are no competitors till now for the innovative products. *Is it the fact that traditional feta is still very popular? Is this phenomenon due to the ignorance of the agents of the relevant sub-sector and their inability to follow knowledge-intensive concepts?*

FCo4 presents some weaknesses in almost all dimensions of DECs. However this is not surprising since DECs' sub-dimensions seem to depend on many parameters such as resources and human capital. The new-to-the-world venture **created a significant niche market in Greece** (national level) producing a "**quasi innovative" product**[216]. Idea was based on fructose biscuits and not chocolate. Being almost a monopoly, the micro company managed to survive with no significant problems in the market since no competitor was actually annoyed. The term "quasi pharmaceutical" solved further institutional problems regarding names and categorization. Strong NPD, technological and process advancement as well as package design assist the company's growth, which presented only a slight sales decline in 2009- when Greeks faced the shock of the severe crisis. Yet, it bounced back in 2010 and presented further sales increase in 2011 and 2012.

Limited knowledge (in relation always to KI cases) and limited financial resources are main reasons for moderate bricolage capabilities. Transcendental conditions are also moderately developed causing a domino effect in all DECs. **As a result of moderate DECs, the new venture has not expanded as it should have and has not caused major changes even at national level.** Yet, it presents a very good and promising growth picture, staying back from the "big ones" mostly in impact to relative environment, rate of market penetration and fame increase, as well as to R&D intensiveness regarding resources devoted.

The two above companies can be categorized as having developed ***moderate dynamic entrepreneurial capabilities***. We should remind once again that categorization is only among knowledge-intensive companies, pioneers in their sector or sub-sector. It is

[216] By then fructose chocolate bars were products of Teuscher Company in USA (origins from Switzerland), while Jacobs Suchard's R&D Dpt had prepared such chocolate for an experimental research work of Johnson et al in the end of the 80's (cross Internet information and interviewees' relevant data) .

considered self-evident that they are well above all other conventional companies of the sector. An important observation should be that this category presents much better performance in almost all parameters than the relevant cases of wood and furniture sector. This is also evident if we compare the case ratings regarding the changes they cause to the ecosystem and innovativeness (Tables B12.a and B12.b, Appendix B); from 1 to 10 the F&B cases present a rating from 1 to 5. This indicates that sectoral context matters and therefore, that the level of DECs' development has different impact on ventures in relation to the low-tech sector they belong to. Major differences are: F&B ventures of moderate DECs change their ecosystem to a certain extent and b) F&B ventures were not affected by the severe crisis while two out of 3 relevant W&F ventures did.

FCo2 and **FCo3**, both new-to-the-world firms, developed DECs but almost all dimensions ***were relatively weak*** and affected both start –up stage and later company course in a rather negative way. They are the only cases to face a setback in sales while 2011 was for both a very bad year. **FCo2** did not manage to break even after five years. It is ranked last in the scales of MARS and CAGR and next-to-last in sales. It also lags behind in innovativeness. **FCo3** is also last – together with FCo2 - regarding innovativeness. Besides the satisfactory MARS (rated sixth), the new venture suffered a serious decline in 2004-2005. It took two years to recover decline, but the disastrous sales of 2011 sounds the alarm for the company.

Both ventures had developed interesting and innovative knowledge-based concepts, being national pioneers in their new markets, a leadership which however did not manage to provide the lion's share. **FCo2,** the first high tech equipped hydroponics-based cucumber plant opened the way to about 2000000 sq. m in Greece with hydroponics but even in 2011-2012 there are no more than four to five relevant properly organized companies. **The company certainly changed the relative ecosystem, creating a new sub-sector in Greece and the relative niche market, but not for own benefit.**

FCo3 was also the first to reproduce pasteurized whole egg, yolk, egg albumin and relative products opening new perspectives to egg-consuming markets of a significant size (food, hospitality and gastronomy sub-branches) besides individual consumers. Although the idea was pioneering, weak DECs caused delays, non-integrated

solutions and many deficiencies in all three new venture development axes. Within the following two years two well-established companies of the egg-sector replicated the idea and presented increasing sales volumes quite soon after. Indicatively, sales volume of 2011 of the first company is 80 times, and of the second one 10 times above FCo3's sales volume.

Five out of ten cases have at least one patent; these companies belong to the groups of strong and moderate DECs. All companies have trademarks. FCo1 works only with private label products and that's why it does not develop trademarks. Besides the two weak cases, all other cases have received awards for their products.

The F&B cases **confirm the hypothesis 2.1** that *DECs have a positive impact on new LT-KI ventures' competitive advantage. Actually, it seems that the stronger the whole set of DECs, the stronger the initial competitive advantage.*

DECs, survival and growth

As in the case of W&F, it is rather difficult to set comparisons among the ten cases and their sales during the first years of life, since they address different markets regarding products and sizes and different economies (from local to global) although all ten cases belong to the same mature F&B industry. Based on the beauty of the case study research, we search again for deeper, non-statistically proven answers considering the case-specific data analysis. All ten ventures start with strong competitive advantages and satisfying initial sales. However, they do not all manage to take advantage of their pioneering and transcended business concepts.

Tables B6 and B7 and diagrams B4 to B6 (Appendix B) present financial data of the ten F&B cases. Taking the economic years of 2011 and 2012 as a major criterion for entrepreneurial crash tests due to the severe growth of the socioeconomic crisis in Greece, a first observation is that eight out of ten companies present increasing sales. In 2011, the only two companies which show a decline are the ones with ***weak dynamic capabilities***. **FCo3** presents a loss of 43% of sale revenues and **FCo2** a 12%. However, in 2012, FCo3 recovers the 43% while FCo2 suffers further losses. Furthermore, two other companies, FCo6 and FCo10 present losses around 8%.

FCo2 was further the company with the lowest mean annual sales rate and the lowest compound annual growth rate. Although established in 2002, it presented first sales

in 2005 due to a series of failures and mismatches. On the other hand, FCo3 presents a satisfactory financial picture ranking a little below the middle of the two indicators (sixth in MARS and seventh in CAGR). That can be attributed to the fact that the Greek relative market was a virgin one and the two competitors (situated in other places) covered at first local and regional market needs and then turned to the rest of Greece. A first "attack" of the other two players cost a significant decrease in sales in 2004-2005. The company devoted about two years to recover but the crisis combined with the weaknesses in further investment in innovation and technology led to the dramatic reduction of 2011. The two rivals of FCo3 were able to take the lion's share besides the pioneering idea of the entrepreneurs. 2013 socioeconomic developments will decide further for both companies, unless they change strategies and surprise their business ecosystems again.

There is a quite clear excellence of all ventures with strong DECs.

FCo8 is indisputably the clear leader among the cases. It presents the highest sales volume and holds the second best position in annual sales rate and CAGR. It is actually an exceptional case, since it was not simply a new SBU but a bankrupted company with a relatively bad history and a high debt. The company can be characterized a gazelle one[217] starting with a turnover of around 11 million Euros in 2000, increasing its revenues by more than 20% annually up to 2008 and presenting impressive annual growths such as 78% in 2001 and 57,6% in 2006. In the critical years of 2011 and 2012, the company presents a sales rate increase of 11% and 7% respectively.

Actually, all four corporate ventures occupy at least one of the fist positions regarding the three indicators chosen. **FCo5** is ahead in MASR, while the new venture holds the second place in the CAGR ranking together with FCo8. The relatively bad ranking in sales can be justified due to the fact that although regarded as an established firm, FCo5 is actually a new firm (fist establishment end of 2002). The entrance in a very mature market with well-established giants was quite difficult in the beginning offering extremely low shares. On the other hand, the acceptance of the innovative

[217] Gazelles are high-growth companies that are increasing their revenues by at least 20% annually for four years or more, starting from a revenue base of at least $1 million. This growth pace means that the company has effectively doubled its revenues over a four-year period. As gazelle companies are characterized by their rapid growth pace, rather than their absolute size

food products was initially met with enough hesitation and did not allow for high sales volumes in the beginning. FCo5 is also a gazelle company starting with a turnover of around 1 million Euros in 2003 and presenting impressive annual growths such as 182% in 2005, 62,1% in 2007 and 50.7 in 2008. In the critical years of 2011 and 2012, the sales rate increase continues to be significant reaching a 20,8% for 2011 and an impressive 47,5% for 2012.

The second case of corporate venturing regarding total company reformation is **FCo10**. The company presents the highest CAGR and holds the third best place regarding sales volume. Being a successful established company since 1996, MASR is relatively modest in comparison to the new-to-the-world cases and the other cases of corporate venturing which refer to either new SBUs or the special case of FCo5 (almost new). The company manages to keep its revenues with an increase of 3% in 2011 and a slight loss in 2012.

FCo6 on the other hand became a very strong group ranked sixth in the wider and very strong sub-sector[218], first among the 30 similar rice-firms (company's data) and 69th in the general sector of Food and agri-products for 2012 (http://www.inr.gr/?p=a65, accesses 20/5/2014). The mother company with the new venture managed to double sales volume after almost ten years. That can be attributed to the fact that innovation regarded process and not product. Consequently it was a matter of taking piece of the market "pie" and not creation of a new niche market. Even though MARS in the beginning and CAGR seem not satisfactory (related to the other companies'), knowledge intensive venture is well justified if we only consider the fact that 2011 closed with doubling profits for the company with 80% of sales to cover national demand.

FCo1 resembles WCo8 of the W&F sector. Due to strong DECs, the venture manages to have high sales (ranked forth), MARS (third) and CAGR (forth). The new venture opened a completely novel niche market at global level (starting from European countries however) and found fanatic followers very soon who created other creative alternatives as well. The exceptional in this case is that the company developed "innovation based on traditional products" (Matopoulos and Vlachopoulou, 2008) adding value to products which alone were sold in bulky ways and very low prices but without the power of marketing (as in the case of FCo10). The

[218] The 10.6 STACOD 2008 code also refers to cotton, tobacco, other cereals etc.

entrepreneurs developed significant DECs due to which a strong business concept was produced. Their unique initial competitive advantage was actually based on knowledge and innovativeness, and brought major changes to the national ecosystem regarding traditional products treatment as well as the global relative markets; in fact, the entrepreneurs created new niches which have further the distinct characteristics of local tastes (i.e. Greek products resembling each country's gastronomical preferences). The company **can be regarded a "gazelle"** since it almost tripled its revenues in four years. In the critical years of 2011 and 2012, the sales rate increase continues to be significant reaching a 10% for 2011 and an impressive 37% for 2012.
The second new-to-the-world venture with strong DECs is **FCo9.** Entrepreneurs' background and characteristics resemble the case of FCo1. Financial indicators cannot show the new venture's supremacy against the other four cases or the reasons why it is considered better than the others: MARS and CAGR range in the middle, while it comes seventh in sales volume. This is partly due to the fact that the first years the products were placed in the Greek supermarkets as it has been discussed above. Yet, the company is dynamically positioned in global markets since it presented itself with a totally innovative and world patented product (a kind of gluten free snack) and became export oriented. The financial results of the last three years (2010-2012) show a rapid increase of sales: 52, 4%, 131,6% and 59% respectively in a national unstable and negative business environment.

The second group which we have named group with ***moderate DECs*** contains a new-to-the world and a corporate venture and namely **FCo4** and **FCo7**.
They are two companies which were created by agents who share many commonalities in their DECs. In both cases limited resources were well exploited through bricolage and improvisational capabilities while transcendental capabilities were rather limited. Yet, they do not present similar growth performance. In fact the new-to-the-world company presents higher MARS and CAGR occupying the fifth place in our ranking, while FCo7 holds the eighth place for both indicators. We can easily explain these issues if we consider the fact that the corporate venture had already a satisfactory sales volume before reformation, while FCo4 is a brand new and small family company which tries to expand and make its brand popular. Priorities and initial sizes are different. The explanation of Carrizoza (2007) of new

"firms (which) have to reach a size that enables them to exist in the market" further justifies the issue. This is in line with literature since it is quite normal for small and new firms to have an above-average growth potential (Evans, 1987a, 1987b; Hall, 1987; Dunne et al., 1989).

On the other hand, while the major strategy of FCo4 was expansion and market acceptance, FCo7's initial strategy had a more "potential-research" direction. The entrepreneur purposefully did not wish to risk high investments in innovativeness in the beginning. However he did so in 2010 with the new spin-off "R. Innovation". Yet, in both cases of moderate DECs we observe relatively moderate growth and performance results. In contrast to the W&F cases, although both sectoral groups offer quite "luxury" products, F&B cases did not suffer the crisis effects. An important difference regards the fact that food products address ***directly the consumers*** while wood products address business customers. The two companies want to export but even today the main target is the national market.

Once again we observe that sectoral context matters since F&B industry presents much better performance regarding survival and growth than W&F industry. Major differences are the following:

a) F&B ventures of moderate DECs are not necessarily lagging behind ventures of strong DECs in economic indicators (as in the case of W&F industry)
b) Food ventures of moderate DECs were not affected by the severe crisis while two out of 3 relevant W&F ventures did.
c) Food ventures with weak DECs are less sensitive to the severe crisis than the relative W&F ones. They were affected mainly in 2011 and 2012 but "death" is not yet a threat. On the contrary, survival is questioned for W&F companies of weak DECs while a major impact of the crisis can be detected in almost all companies with moderate or weak DECs of W&F sector in 2011 and 2012.
d) In contrast to W&F sector, there is no supremacy of corporate knowledge-intensive venturing. A surprising symmetry can be observed regarding the two financial indicators of the ten cases. In both categories the first two places belong to corporate ventures with strong DECs: actually the first place is occupied by highly knowledge intensive and innovative companies (FCo5 and FCo10) while the second place in both indicators belongs to FCo8, a

completely different from mother company SBU. Forth (4th) to sixth (6th) position belongs to new-to-the-world ventures, 8th and 9th to corporate ventures (CVs) and the last place is occupied by a new one with weak DECs. The symmetry can be better observed in the figure below

Although the two first places belong to CVs, this is not enough to decide whether knowledge-intensive corporate venturing has more advantages in F&B sector.

Figure 7.6: MARS and CAGR symmetric allocation

MARS	CAGR
CV	CV
CV	CV
N	CV
N	N
N	N
N	N
CV	N
CV	CV
CV	CV
N	N

Therefore, **Hypotheses 2.2 and 2.3 seem to be confirmed** by the cases of F&B industry; *DECs have a positive impact on new LT-KI ventures' survival and growth.* Furthermore, the crisis test confirms our suggestion of the previous section that **the course of the sector has a significant impact on the survival and growth of knowledge-intensive low-tech ventures.**

Dynamic entrepreneurial capabilities and innovativeness

Knowledge-based introduction innovations of the ventures (Table 41.b) cover all four categories of the venture idea newness in relation to the innovation categories as they have been described in the relevant literature chapter and more precisely:

(1) *new to the world (products/processes/models)*: all cases except of FCo2 and FCo3. Many cases present also patents regarding products (e.g. FCo5 and FCo9) and technologies (FC6 and FCo7)

(2) *new to the market (national/international market)*: all cases

(3) *new to the firm*: all cases, and

(4) *a first mover or assigned to the most innovative companies in the market or product field*: all ten cases are first movers at least at national level.

Knowledge-intensive and innovative venture ideas of the ten cases have produced

(1) *products* : FCo1, FCo3, FCo4, FCo5, FCo7, FCo9

(2) *methods of production, processes and technologies* : all ten cases

(3) *methods of promotion* **:** FCo4, FCo10 and

(4) *business concept*: FCo10

Many of the initial innovations can typically be characterized as "radical departures" in their subsectors and some of them can even be categorized as breakthroughs since they advance science such as FCo5's effort against celiac disease and cancer, or open completely new niche markets such as FCo1, FCo9 and FCo10worldwide. All ten new ventures create new niche markets at least at national or European level and the ones with strongest DECs change or challenge their business ecosystems. Actually emerging markets are seen as the key driver of their future growth. Lack of competitors or a very limited number of them for a satisfactory time period is a further indication of innovativeness and consequently growth; among our cases the newest venture (established 2006) has till now no competitors.

Innovative products, innovative processes[219] **and the relevant technology** seem to be the core ways for knowledge-intensive food ventures to enter saturated markets with **strong initial competitive advantages** supported by further innovation along the value chain (as for package in most cases).

According to existing literature innovative trends in food and drinks industry turn around three categories: Health & Wellness, Indulgence and convenience (Hardy, 2009). Our ten case-studies fall mainly into the two first categories while some belong to both of them. More precisely:

- FCo2 and FCo5 belong to health & wellness category incorporating ecology issues as well.

[219] We remind that in food industry novel products are tightly connected to novel processes (e.g. Córcoles, Triguero-Cano and Cuerva, 2011)

- FCo10, FCo1 and FCo7 innovate presenting clearly premium / gourmet products, designating authenticity, novel flavour combinations, ethnic food repositioning and hyper premium tastes (Hardy, 2009).
- FCo4, FCo6, FCo8 and FCo9 bet on a mixture of health and indulgence, combining taste and specific health characteristics.
- FCo3 is the only one to fall into the third category of convenience[220].

There is also the exceptional case of FCo10 which can be characterized as a *novel business model* with innovative marketing and promotion around the concept of "food sharing", combined with a significant number of innovations regarding processes, package, retro-innovation and environmental sensitive novelties. The company has been a pioneer worldwide in most of the above mentioned areas (resembling WCo10 in W&F sector).

Most ventures target *ab initio* foreign markets: three as their main strategy, three as a major strategic direction and two as a vision to be reached in due time. Almost all of them face the paradox to "innovate based on traditional products" (Matopoulos and Vlachopoulou, 2008) in a more or less strict meaning of the term.

New start-ups develop novel niche markets at global level (FCo1 and FCo9) and national level (FCo2, FCo3 and FCo4) while all cases of corporate venturing target niche markets at both national and global level. Besides a wide use of sectoral knowledge, all ventures get more or less well out of sectoral limits engaging other sciences such as chemistry, biochemistry, biotechnology, environmental and energy engineering, health and wellness science, geoponics, pharmaceutics, etc. (in contrast to W&F sector where there is a more conservative attitude towards trans-sectoral knowledge seeking). Within our cases food meets even pharmaceuticals (FCo6) and biotechnology (FCo5), while packaging plays also a strong role in offering innovative benefits.

More precisely, ***strong DECs*** have led to strong initial novelties of all kinds and laid the foundations for strong innovativeness. Four out of the "big six" open totally new markets worldwide.

[220] **Convenience covers** On-the-go, Freshly prepared and Innovative packaging for flavor/nutrition preservation

FCo10 presents strong business and market promotion global innovations supported by technical innovation usually produced in some other "link" of the value chain such as package, carbon neutral oil and olives (both worldwide pioneering) in corporation with "My climate" NGO within "green" marketing strategy etc.

FCo8 produces mostly technological and process innovations, again at global level in cooperation with manufacturers, while it develops very strong NPD regarding both dairy and fruit juice products.

FCo5 has developed more a strong R&D image, innovating with patented products worldwide and applying research both in-house and in cooperation with relevant academic institutes. **The company devotes a significant amount of money to R&D. Indicatively in 2011 the R&D to sales ratio was 6,8% and in 2010 8,16/% resembling the indicators of high-tech industries.**[221]

In the same line of thought and strategy **FCo9** produces worldwide patented products mostly with in house R&D (14,6% in 2010 and 12,2% in 2009).

FCo6 challenged the properties and quality of a very common product worldwide, introducing process innovation. The innovative patented process method and technology is a breakthrough innovation at European at least level. It also endorsed the firm for extended research joint projects as well as strong NPD acting as a basis for the transformation of the conventional rice producing company to a highly R&D organization. FCo6 devotes respectively 1,4% and 3,5% for R&D in 2010 and 2011.

Actually, FCo5, FCo6, FCo9 and partly FCo10 have managed to achieve a fine **R&D-marketing coordination** which is vital for innovation success as Gupta, Raj and, Wilemon had already argued since 1986. These companies in contrast to FCo1and FCo8 have further created strong institutional networks with more emphasis on universities and agricultural boards. Yet, all six enhance networking by the evolution of marketing organization by means of "exchanging critical skills and information and involve reciprocal functions and obligations across firms" (Achrol, 1991)

All these companies are also aware of the power of package design and marketing.

FCo1 opened a new market worldwide by introducing innovative product families of gourmet (but private label) products combining traditional Greek food products in novel ways to add value. In this effort novel machinery and processes are also

[221] Indicatively for 2010 and 2011 respectively, R&D intensity for chemicals was 3.4 and 3,1, for technology hardware and equipment 8,7 and 7,8 while for overall food sector 1,4% and 1,7%. (EU R&D Scoreboard, 2010, 2011)

invented. The company goes on with aggressive NPD (about 10 to 15 novel products per year) which are developed in the company's laboratory with external assistance when needed.

A**ll six cases have developed strong innovation capabilities and have set bases for strong innovativeness** as proved by the innovation willingness, quality and speed (*Cozijnsen,* 1989*) which* they present all years since establishment. Actually, **they present novelties at a yearly basis** with more or less significant innovations at all levels. All six present in-house innovation upgrading technology, R&D, experimentation and strong NPD combined with novel processes, packaging innovation and design. In such efforts **they also form partnerships** (as in wood and furniture sector) with university technology centers, research associations, suppliers, and customers but in more research-focus ways. They develop formal but mostly unwritten routines of knowledge creation, articulation and utilization based on human capital development co-operations and research activities.
Thus, in contrast to the wood and furniture sector, all food-case ventures present a densification of innovative activity over the years, enriching their internal or external approaches to innovation and knowledge management. NPD is considered the best mechanism for gaining competitive advantage, since the-time-to market for new ideas is set to fall significantly. This is further used as the best appropriability method. This seems to be a major characteristic of ***knowledge-intensive*** low-tech sectors, since even the food and drinks industry appears resistant to external sources of innovation (Hardy, 2009).

Table B8 (Appendix B) presents innovation of the firms. It is quite notable that all companies are accomplished by technological novelties and introduce certain technological characteristics either in-house or through networking invented. Many of them are new to the world, in order to improve technological and process characteristics. All entrepreneurs or senior managers have also claimed that their initial knowledge management systems are constantly reworked and advanced, in order to capture a wider range of knowledge and opportunities not only all around the phenomenon of food technology, but they stretch as well to new territories of other sciences some of which are formally and typically characterized as high-tech (e.g.

biotechnology and pharmaceutics). All of them are also interested in novel ways to communicate the firms' messages all over the world by completely different methods however; private label or branded products built around novel cultures (FCo1 vs FCo10), concentrating on special groups with strictly health products or treating health products in ways to be consumed by all groups (FCo5 vs FCo9), treating traditional products in different ways (high-level R&D for FCo6 vs technological innovation and NPD for FCo8).

However a common characteristic of all these new ventures is the fact that through NPD and aggressive marketing, they are largely the actors of transforming plain agricultural products from regionally consumed undifferentiated products in the early 1990s and before, to highly differentiated markets which turn to be of the most dynamic segments of the food and beverage market by the early 2010s.

Another important point is the fact that all these ventures ***have developed rather mixed models of innovation.*** Although highly market oriented, they do not rest at market monitoring for NPD or R&D. They all believe in surprising consumers in multiple ways and such "surprises" cannot come from simply observing the market.

> "A market research can provide the same information to FAGE, DELTA and Olympos…. to everybody…. The important issue is to do something different not yet seen by the market." (FCo8's entrepreneur)

The same *motto* has been heard of other entrepreneurs too such as FCo4's, FCo7's and FCo1's. Consequently, the entrepreneurs create novel concepts relying on paradox imagination and creating links to universities and institutes to monitor scientific advances, regulatory developments and their implications. A major trait is that **they do not receive "*no*" as an answer.**

FCo4 and **FCo7** present quite the same performance regarding innovativeness and sustainability. They present parallel paths of image and product awareness increase, while their introduction to markets caused quite the same and rather moderate changes to existing eco-systems. Innovative attitude can be assigned to *the significant improvisation capabilities* the companies have developed due to the persistent tendency for learning and experimenting and the exceptional provocative competencies the agents own. Yet, moderate transcendental and bricolage capabilities

lead to moderate development of business and market axes, translated mostly into rapidness of rate of market penetration and fame increase, as well as to R&D intensiveness regarding resources devoted.

FCo7's cheese's activities started by process innovation but soon turned to be guided by its product orientation. The entrepreneur crafted a niche in a tough saturated market, focusing on special novel types of cheese. He actually places great emphasis on introducing new products that incorporate a high degree of innovation. The entrepreneur does not consider company to be market oriented; according to his opinion, consumers are not able to suggest truly innovative products. He also places great emphasis on the training of all people involved in training and franchisees.

FCo4's innovativeness is based upon strong NPD, process advancement as well as package design. Limited knowledge and financial resources are main reasons for moderate bricolage capabilities. Transcendental conditions are also moderately developed, causing a domino effect in all DECs and affecting the new venture's image. Like FCo7, the company needs further marketing competencies as complementary to NPD[222].

The two companies with **weak DECs** (FCo2 and FCo3) do not manage to produce further novelty, although **FCo3** tried hard to improve the initial innovative concept. **FCo2** presents a declining life course after reaching a sales peak in 2007, while FCo3 could not even get close to its competitors' sales volumes. Furthermore, the crisis of 2011 led to a severe decrease of sales. It appears as if due to weak DECs no real basis of efficient innovativeness was ever developed.

Contrary to the cases of the W&F sector where all innovations turn around the initial novel concept, **in the F&B sector there is a differentiation of follow-up innovations which seems to depend on the quality of DECs' development.** Accordingly, all six companies with strong DECs produce various types of innovation such as by-products of R&D exploitation, marketing innovation and even new niche markets. On the other hand, ventures with moderate or weak DECs stay again in innovation efforts around the initial novel concept.

[222] The entrepreneur has recognized this need and turned to the development of marketing capabilities in 2012. He further turned to exports starting with Europe and Australia.

It is also important to mention that although in W&F knowledge-intensive ventures there are not breakthrough innovation cases, in F&B industry one can observe certain cases of radical innovation such as the products of FCo5 and the innovative use of rice byproducts. These innovations are supported by significant R&D expenditures as well, which resemble the ones observed in high-tech sectors. Still, even the non-breakthrough innovations manage to **change or challenge the relative ecosystems at least at national level** and some manage to make the difference worldwide altering the "rules of the game". There are certain sub-niche markets created worldwide, such as in bio-functional and health food (FCo4, FCo5 and FCo9), world niche markets for tradition- based but innovative gourmet products (FCo1 and FCo10) and food top quality (FCo8) as well as innovations that introduced and opened novel entrepreneurial activities at national level creating totally new business value chains (FCo2 and FCo3) but failed to play a leading role in the relevant markets[223].

One should however mention that high degrees of innovation in all cases come primarily from "that most intangible of all assets, imagination/creativity" (Grunert and Traill, 1997) and thus this sub-dimension of transcendental synthesis which seems to be usually supported by high competence in R&D. In this sense, the innovative process appears to be directly affected by the level of expenditure and by the way R&D is carried out (for example, by means of internal or external structures in accordance to relevant literature; e.g. Acs & Audretsch, 2005; Molero & Buesa, 1996; Pavitt, 1984). Undoubtedly, firm size remains a major factor in determining the level of financial resources devoted to R&D and innovation activities in general. However, size constraints are not always the most important barriers as our cases indicate.

Another important observation is the issue of "hesitant" market penetration of the most innovative products, i.e. FCo5's innovative bio-functional wheat flour and FCo9's products. One reason may be related to so-called consumer inertia; that is to conservative consumer behaviour and aversion to new food products (in accordance with relevant literature; e.g. Galizzi & Venturini, 2008; Grunert et al., 1997). A second reason can also be the retardation due to strict regulation health claims and

[223] Pioneer firms are first-movers typically thought to gain advantages over rivals from being first. These first-mover advantages may include strong image and reputation, brand loyalty, technological leadership, and being in an advantageous position relative to the 'learning curve' involved in managing a specific product or process innovation

inability of bureaucrats to respond to novel approaches which causes confusion besides delays. It may also be a false marketing approach; FCo9 initially tried to place its novel products next to conventional snacks with much lower price while FCo5 turned immediately to the medical world. Both were later recognized as important marketing mistakes.

We should also mention that in the effort to rank the food cases using the 1-to-10 scale (Table B12.b, Appendix B), the author used point 5 as the minimum to denote the "worst" degree of the F&B cases regarding the parameters of initial competitive advantage, innovativeness and life course sustainability. In contrast, all points of the 10-point scale were used to capture the degrees of the three parameters in W&F sector and up to 9 for the T&C cases (Tables B12, Appendix B).

As in the W&F cases, all successful ventures of the sample develop the first type of knowledge-intensive entrepreneurship; i.e. they have a more balanced emphasis on different dimensions of innovation and rely mainly but not solely on external knowledge seeking, trying to produce simultaneously product, process and administrative innovation. This can be attributed to the quality of the transcendental capability. Its level of development however decides the degree of success. They also appear to develop a more intensive networking activity than the rest companies perhaps due to their strong bricolage capability. Indicatively, FCo5 and FCo9 with strong transcendental capabilities presents a wide range of initial and follow up innovations with a major impact on sales and growth.

The two cases of the third type (FCo2 and FCo3) prove again (and in line with the weak one of the W&F sector) that devotion to technical dimensions of innovation based on sole external knowledge cannot provide strong advantages, as well as that DECs when strong are multidimensional and multifaceted.

Thus, the new firms seem to innovate in order to sustain leadership even out of national borders and appear to achieve it in their majority. Business scope innovations refer to year to year investments in technology, R&D, experimentation and new product and market developments. Organizational innovations turn around processes and process improvements activities, business models and firm structure. In such efforts they do develop collaborations of different types. Therefore, there is a similar way of development to that of the W&F sector.

Therefore, it seems that the analysis of the F&B cases **confirms the hypothesis 2.4** that *DECs have a positive impact on new LT-KI ventures' innovativeness.*

In contrast to W&F sector, **patents and intellectual property protection seems to be rather important in F&B cases**. This seems to contradict the arguments referred in the relevant section for the W&F cases. However, it does not; Business concepts are again built around the agents' own transcendental thinking and realized by bricolage and improvisation capabilities. Products or technologies to be patented are *results* of such processes and not the *ground* for creating business. No-one "can really copy the whole package" according to some of the W&F entrepreneurs; but their innovative products regard mainly the Greek market (e.g. WCo1, WCo4, WCo5 and WCo7) while WCo2 uses an already patented technology. Thus, it seems that the interest for appropriability is related to certain characteristics of the innovation such as the type, the level or the combinations made. It also appears to regard mainly innovative products and then processes while no one seems interested in patenting marketing methods and models. This can further explain the reason that low-tech companies lag behind in the number of patents.

Initial conditions

Entrepreneurial profile: In food and beverage sector, three categories of ventures were again recognised regarding origins of entrepreneurs before venturing:

- established firms which applied corporate venturing (5 cases),
- new-to the world firms established by entrepreneurs grown up in a relevant entrepreneurial milieu and extended educational and professional background (4 cases) and
- new-to the world firms established by entrepreneurs with no family backup or former direct relation to the sector (1 case).

In accordance with Protogerou and Karagouni (2012), new-to-world product innovation, IPR protection, and knowledge creation stem from highly educated founders and human capital. It is interesting to note that the firms of this group create more in-house knowledge than the rest, supported by knowledge from external sources. **Human capital is a very important factor of knowledge intensiveness** referring to entrepreneurs' and initial team's education, former experience and variety

of different sciences represented. It is worth mentioning that all entrepreneurs were quite different in attitude and knowledge, and above the average entrepreneur of the sector.

All case-study firms are established by agents over 30 years old (Table 4.1b) which strengthens the assumption of the significance of prior experience and knowledge in order to build a higher entrepreneurial status and to have cultivated the transcendental capability. Actually, the ages range from 31 to 41 (34 to 42 for W&F sector). The two cases where the entrepreneurs are older than 41 (49 and 52) years old refer to entrepreneurs engaged in another sector before (FCo4) and another subsector (FCo5) respectively. There are two parallel cases in the W&F sector where entrepreneurs are around 50 but there are cases of corporate venturing. The only case of entrepreneurs below 30 is FCo9 (the entrepreneurs are 25 and 27 years old), where though there was a strong family company as a sectoral background, important knowledge background and a sense of worldview on economic and other specific knowledge (both master holders and prior members of large organizations). A parallel case is WCo8.

Differences detected between W&F and F&B sectors regard the educational level, the size of family companies and the markets they served. Eight out of the ten agents own a higher education degree (at least University degree). Accidentally the percentage is exactly the same with the one of W&F sector where however we referred mainly at a TEI degree. **There are two cases with a degree of secondary education**. The one case refers to **FCo8**'s entrepreneurs who were already owners of another non-KI but relevant company. As in the W&F relative case of WCo2, they also used well educated staff (both engineers and economists and especially chemical engineers) for the KI venturing. *"We have 10 chemical engineers…..Knowledge is expensive. We bought knowledge by seeking partners.* The entrepreneurs have literally invested on knowledge at all levels.

> "We have such personnel – mechanical, electrical and electronic engineers from the Polytechnic School and the TEI – this is a case of our innovation; i.e. all our production lines are run by TEI graduates – mechanics, electricians – whatever this means regarding knowledge. It is quite different if the operator has the knowledge needed. We have applied this policy the last six years and we have felt the improvement in production. Yes, this can be called innovation. We may have to pay them more, but what are you going to say if you have another cheaper operator and the lines stops around ten times the shift?"

We should mention that their first venturing goes back to '80s (1985) and although conventional and not knowledge-intensive enclosed clever pioneering ideas. Still it was not their first company since it was the evolution of a traditional family cheese dairy. The second case of **FCo4** shapes the profile of an entrepreneur who has no University degree but has a great passion for pastry making and when the family company (a weaving mill) closes, he enters a pastry school to follow his dream.

Regarding the second case of moderate DECs, **FCo7**, it is worth mentioning that the academic studies of the entrepreneur are rather irrelevant with the sectoral entrepreneurial direction; *he studied Greek literature.* Still he has been deeply involved in family business since childhood and he also claims that *his studies made him develop alternative and creative ways of thinking broadening horizons and perspectives.* It was further the turning point for his decision to transform a heavily traditional business into a knowledge-intensive one.

Regarding the two cases with weak DECs, **FCo3's** entrepreneurs are University-diploma holders but they come from rather irrelevant academic sectors and have no prior experience of the sector or any family business. A primary school teacher and a PC engineer turn to food production. Still, they also claim that their background supported their effort to attempt innovative business concepts which would need knowledge to be implemented. They further lay the ability to be easily introduced into the KI world of egg pasteurization on their higher education. In the case of **FCo2**, the venture started with an excellent combination of an entrepreneur with master on finance and a long professional experience gained in high level management function and a 4th generation farmer with a cosmopolitan view. Yet, there was no real and high-level education on the agri-food sector and about one year after the establishment the first entrepreneur withdrew.

All cases of strong DECs (with the exception of the FCo8 case) are related to the existence of Master and a University Degree. It is worth concentrating on the specific characteristics of this issue as well and more precisely:

- Five out of six have a university or master degree in economics

- FCo9 and FCo10, the two ones with export –oriented strategy in the building of their initial competitive advantage, have a further academic specialization on international trade and management
- FCo5 which is the most R&D intensive case is the only one where an entrepreneur holds a relative master diploma (chemistry and food technology), while the other entrepreneurs is again engaged in economics.
- All cases "buy" knowledge (*Note: the term is borrowed by the entrepreneur of FCo8)* investing in highly and relatively educated personnel: For example **FCo9** engaged 2 PhD holders, 5 master and 5 University or TEI diploma holders from the very beginning. The venture started with 18 people and that means that 67% of the human capital was of higher education. The same goes with **FCo10** with experts in the food and gourmet products area who also become shareholders of the company. **FCo1**'s entrepreneurs with an academic specialization on economics and food marketing fulfill the gap with two chemists with specialization in food technology – one engaged and one as an external partner. Finally, **FCo6** engages a strong team of engineers with a chemical engineer, a PhD holder to be the soul of the R&D Department. She becomes almost a member of the family since she started there as a graduate, went on with her master in London and her closely related to the firm's activities PhD. She is the "mother" of many innovations of the company.

In the W&F sector we can also observe a trend towards economics: two entrepreneurs (WCo6 and WCo8) have a relevant University diploma, another one has a TEI diploma and in the case of WCo9 the "soul" of the venture is an economist and marketer. On the contrary we can notice that 4 out of ten academic degrees are in irrelevant sectors and specifically: Moderate DECs are related to irrelevant academic education but high sector experience. In the two weak cases there is neither any relevant experience of the sector, nor a relevant educational background.

The cases with strong DECs "buy" knowledge as well and more precisely WCo2 resembles FCo8 in this aspect. WCo8's entrepreneurs who presents the strongest DECs among new-to-the world companies, is a PhD holder with a further academic specialization on industrial design and a long engagement in the relative family company. Five of the company's initial 30 employees are diploma holders.

The impact of the academic and professional background of the entrepreneurs in low-tech knowledge-intensive entrepreneurship ***deserves further qualitative and quantitative research.*** Again we cannot claim that an irrelevant diploma is an obstacle to successful DECs or to the venture's success regarding survival, growth or innovativeness. In food sector most entrepreneurs hold an irrelevant to food industry diploma and yet they raise successful firms. Therefore, more ***research is needed since education seems to play a significant role but it is not the same with specialization.*** This appears also to be a significant difference with the high-tech KIE where entrepreneurs are in their majority specialized in the industry they choose to enter.

All entrepreneurs combine some **specific traits** that remain context specific. More precisely, in F&B sector most of them are characterised by an innovative spirit, proactiveness and entrepreneurial alertness. However, these traits seem to be leveraged by the fact that most entrepreneurs have grown up in a similar entrepreneurial milieu with experience in the food (or other) industry and sometimes with already existing relations with suppliers. It is not a surprise that weaknesses regarding such traits appear only in the cases with weak DECs (FCo2 and FCo3); the entrepreneurs do occupy the above characteristics but lack the background. FCo10's entrepreneur did not come from a purely entrepreneurial family but still it was a cosmopolitan family environment which enabled him to develop a high level of PEA and provided him with strong social ties. He further had his own experience in the business world and the ability to choose the more suitable partners. FCo6 is perhaps the most extreme case, since all five stakeholders have been raised in an entrepreneurial environment demonstrating over than 50 years of innovative performance and pioneering in the Greek food industry. They were educated to take over the company and move forward.

All ten cases have a relatively significant number of educated staff which strengthens their characterization as knowledge-intensive. Personnel qualifications affect strongly and positively innovativeness and performance as it is well stated in literature. The research by Caloghirou et al. (2004) showed that there is a strong positive relationship between the extent of innovation of the firms and their R&D intensity and **personnel qualifications.**

All F&B cases are connected to some kind of **knowledge producing organization** which can be a University, a research institute or even private experts and consultants. Most cases with strong DECs present an increasing trend towards such co-operations; only FCo1 seems to rest on its co-operation with a food technology expert and machine manufacturers. The cases with moderate or weak DECs lag behind in such co-operations either due to the inability to find common interests (e.g. FCo4) or due to their own unwillingness for such projects (e.g. FCo7) regarding mainly research projects and external R&D.

Resource availability (both tangible as financial capital and intangible as social and human capital) appears to be a major determinant for the development of all DECs. Notable is again the supremacy of corporate venturing where all resources are richer and abundant, networking and contacts are easier and transcendental conditions are superior. Even in the two cases of new-to-the-world firms of FCo1 and FCo9 the strong family business can support financial and organizational demands as well as easier access to stakeholders all along the value chain (e.g. manufacturers, suppliers and markets).
On the other hand, FCo2, FCo3 and FCo4 with limited resources encountered major difficulties in DECs development and further business concept implementation including waste of valuable time and money in order to find solutions, relative contacts and/or face arising and non-expected problems.

Still, in the F&B sector there is no tendency for transformation from existing non-knowledge-intensive to knowledge–intensive firms as observed in the W&F industry. We remind that most cases of corporate venturing regarding exactly such transformations, while even new-to-the-world cases with entrepreneurs, raised in a relevant milieu established the knowledge-intensive version of the family company (e.g. WCo1, WCo4, WC8). This does not appear to be so in food and beverages industry, where it seems that there is more a will to establish novel, dynamic and export oriented companies. FCo5 and FCo10 own a knowledge-intensive culture since their first establishment. FCo8 is a brand new SBU which extends products and markets while mother-company follows its own course. However, such transformation (as described in the W&F sector) can be detected in the cases of FCo6

and FCo7. The same can be also stated for the new-to-the-world ventures with strong family business backgrounds. While for example, in the case of WCo8, the new venture was a pure transformation of family kitchen manufacturing to a similar but knowledge-intensive company, these two F&B cases develop completely different products: the world innovative cheese ups and crackers (within the bakery sector where the family company was) and the antipasti using local olive and fruit products (within the canned fruit and vegetable industry where the family company still is).

Once again the fact that new-to-the world ventures are less likely to have the needed resources is in accordance with literature (e.g. Ireland et al., 2001) as well as common sense. Yet, "alone, financial capital is relatively less important than social and human capital for achieving and especially for sustaining a competitive advantage" (Ireland et. al, 2012). The obvious difference between the resources of new-to-the-world founders with a limited private capital background and setting up KIE with practically rich resource availability is reflected on sizes, time and scale of expansion. Unlike the W&F sector, all ten new ventures apply and get subsidized irrespectively of size or former status. Whereas the majority of W&F established firms try to finance their founding innovating and knowledge-based activities internally, all F&D relative firms apply for subsidies besides the use of private capital.
Knowledge resources are collected through contacts and networks including almost all stakeholders of business ecosystems and regard **scientific, manufacturing, practical etc. types of knowledge**. **Accumulated knowledge** on food technology from previous experience is evident not only in cases of corporate venturing but also in new-to-the-world ones, since entrepreneurs often come from relevant family companies.

Location of new ventures *does affect* the start-up performance for F&B ventures, weather new or corporate and this is another difference with W&F sector. This is due to the traditional dependence on raw material as well as proximity to transport media and accessibility in general. It is also quite interesting that while in 7 of ten cases in W&F sector entrepreneurs come from the place where they establish the venture, in F&B sector it is precisely the opposite; only 3 entrepreneurs have established the new venture in the place of their origins. Besides raw material and accessibility, some

other reasons that have been traced are cheaper land, existing installations (e.g. mills) and subsidy reasons. Of course the choice affects access to social and human capital too. Local players find support at bureaucracy matters, easiness in recruiting the desired human capital and contacting suppliers.
No company referred to problems to create markets due to being away of big urban centers. In W&F industry instead, all five new firms have stated that they encountered difficulties to promote their products due to their location. Yet, there were certain complaints that firms away from Athens do not attract public interest regarding support in R&D, funding projects and dissemination of innovative results.
Such cases are again in line with various studies which have shown that regional proximity of various players is only important for some entrepreneurial activities among which successful co-operations and significant delays.

We should note that the **institutional setting** as well as ***the time of venture establishment*** was almost the same in 9 cases and it was a favorable one for the food and beverages sector. During the decade 1995-2005 the sector is growing more rapidly than the total Greek manufacturing sector (20.6% vs 11,7%). Prosperity in the sector went on till 2008 although in a more fragile national environment, while the relative sector in Europe had already shown signs of decline (IOBE, 2008). FCo9 is the only company to be established in 2006.
Times of buoyant economic activity and intense construction activity, global wood shortage and the growing trend towards ecology were quite clear signals for the W&F entrepreneurs. Interestingly, in accordance to W&F sector where the entrepreneurs (especially "the strong five") took advantage of such existing signals and grasped opportunities, it is quite the same in F&B sector. All ten companies actually *created opportunities* in order to find their way and place in the business ecosystem taking advantage of arising trends towards health and wellness, a shift to more gourmet products, the benefits of globalization and the new ways of life.

The companies of the first group **create** strong opportunities which are dynamically translated to integrated businesses with equal development of all three axes **(***technical development of a knowledge-based innovative concept up to full scale production,*

high-level interaction with the market, innovative business scheme selection). More precisely:

FCo1, FCo5, FCo9 and **FCo10** take advantage of multifaceted knowledge (scientific, marketing, business model building etc.), abundance of raw material of high quality and global market knowledge and innovate by offering either patented unique products (FCo5 and FCo9) or highly differentiated products with unique characteristics (FCo1, FCo10). Globalization and easier access to knowledge were maybe *their* "opportunities". All products had not been imagined before, create new markets and avoid getting trapped within national borders. FCo10's vision further fits well the tendency towards ecology and translates in a fine way the economic growth.

FCo6 and **FCo8,** both with a significant past experience and know-how *read the signals of the markets and realized the need to turn to national (and global) markets with top-quality products*. They actually questioned quality and challenged established perceptions. The new ventures flourished and developed R&D and knowledge-based innovation.

All six companies have taken advantage of the motto "Think locally and act globally". They presented creative challenges to invent sources of entrepreneurial wealth.

The firms of the second group **did try to create** strong opportunities which however did not manage to be dynamically translated to integrated businesses with equal development of all three axes**.** They also invested on knowledge but are rather weak in the "act globally" direction. Yet, both entrepreneurs recognize weaknesses developing export orientation.

The firms of the third group *had* not actually *created* opportunities but they had identified important gaps in the market and emerging trends. These are cases of grasping opportunities which were not adequately developed regarding the three axes mentioned above. Their products opened new business areas and niche markets at national level but they did not manage to demonstrate their real value in the market.

Actually, it seems that the easier access to knowledge, globalization and to funding affected strongly the creation of the knowledge-intensive F&B ventures. No specific opportunities gave rise to plans and business concepts. All novel ideas were product

of relevant queries on innovative ways to enter or alter business ecosystems (FCo1, FCo3, FCo4, FCo7 and FCo9) or outcomes of similar discussions (FCo5 and FCo10). FCo6 and FCo8 are corporate venture cases where the excellent knowledge of the sectoral and broader entrepreneurial landscape could easily locate general weaknesses not yet globally questioned (e.g. milk quality) or areas not further questioned after a successful patent (e.g. no one had tried to question Uncle Ben's patent before). FCo2 is a unique case which came out due to an accidental visit to a similar but amateur cultivation that thrilled the entrepreneur.

Still, the **domestic market-specific beliefs** affect the advantage built by the low-tech agents depending mainly on the markets the new ventures address. Actually this impact is more significant in this sector than in W&F industry. This is due to the fact that consumers are rather more sensitive in using unknown products even "at the shape of the familiar" or they get confused at least at national level.

Some of the above business concepts were well accepted by the relevant markets from the very beginning: these were the products of FCo10 and FCo1 (abroad), as well as FCo6, FCo7 and FCo8, at national level, resulting in high sales.

Some had a neutral acceptance of the Greek market: FCo2's cucumbers and FCo4's chocolates were accepted without hesitation but without much excitement either.

The most innovative products (radical innovation) were the ones of FCo5 and FCo9. They both encountered certain problems due to hesitation and confusion they caused at least at national level. They both turned to specific markets; special "selves" for FCo9 abroad, special target groups in Greece and abroad for FCo5. They both succeeded abroad and then became acceptable by Greeks. Of course the market problems caused delays, frustration and extra money to both companies. Entrepreneurs had to rethink and redesign the placing of their products in the markets and ways or channels of promotion. Although it took almost four years to be accepted within the borders, both companies manage to have increasing sales volume and create dynamic conditions for expanding to new markets.

The only case of negative effect of hesitant acceptance was the case of FCo3. The entrepreneurs encountered many difficulties to both persuade and train customers. Although it was not global innovation, the product was not familiar for most users (individuals and especially housewives are still not buying such eggs in Greece anyway). Time was valuable since two strong competitors appeared within the

following two years which had further the advantage of owing raw material (eggs) and having already established contacts with customers.

Before summing up the impact of DECs on certain corporate parameters, we should mention that all cases again have differentiated to a large extent than the average of the sector. The reader should bear in mind or read again the sector description[224]; innovativeness and NPD are rare, although there is a growing interest towards novel products. The majority of Greek food companies own a more conservative business mentality that is related to their size and several managerial inefficiencies, while the sector presents low levels of clustering (SEVT, 2006; CIAA, 2007). Food product development is considered a highly risky venture. The cases were chosen among the ones that serve a minimum basis of knowledge –intensive tendencies and cultures.

> "But for something innovative, there is no point to add another conventional food company. You can bet that it won't survive, unless you can offer something not only different but exceptional as well. It's a matter of knowledge then…" *(FCo4's entrepreneur)*

Therefore, according to the findings of the ten F&B cases, the following observations can be stated:

a) Regarding KIE

Obs. 1: In traditional low-tech sectors and at least in the F&B industry, knowledge-intensive entrepreneurship is characterized by a balanced emphasis on different dimensions of innovation combining harmonically external knowledge seeking to in-house R&D

Obs. 2: In traditional low-tech sectors and at least in the Food and Beverage industry the focus on only the technical dimension of innovation relying on only external knowledge affects in negative ways new-to-the-world knowledge-intensive ventures.

b) Regarding DECs

Obs. 3: In traditional low-tech sectors and at least in the food and beverage industry agents need to develop the whole set of DECs, which are actually interacting among

[224] In the Greek Food and Drink enterprises, the restrictive factors for the development of innovation are the traditional forms of administration that are not familiar with innovation and its needs and the small margin of profit of enterprises. Actually there is limited will of the smaller companies to develop and apply innovations, since there are also limited resources (human and financial) for its application. Innovation and relative funding programmes are considered to be the privilege of large companies of the sector such as Vivartia, Giotis, Elais – Unilever etc.

them, to start viable and successful ventures with strong initial competitive advantages regarding survival, growth and innovativeness.

3a: Moderate DECs (i.e. at least one *not* strong DEC) lead to weaknesses regarding survival, growth, or innovativeness of traditional low-tech sectors and at least in the food and beverage industry.

3b: Moderate DECs do not hinder the development of knowledge-intensiveness of traditional low-tech sectors and at least in the food and beverage industry.

The analysis also revealed further that **initial conditions** at personal / firm level affect the development of DECs and impact new venture's survival and performance. Therefore, the following observations can be stated:

Obs. 4: DECs presuppose certain levels of tangible and intangible resources. Financial, social and human capital affects DECs and their development and subsequently their impact on new venture performance. DECs seem to be tightly related to knowledge assets and knowledge exploitation. They presuppose certain high levels of education and former entrepreneurial / managerial experience with high involvement in similar activities and a deep and overall knowledge of the entrepreneurial landscape by the entrepreneurial teams of knowledge-intensive food and beverage new ventures.

In cases of corporate venturing local proximity increases the danger of core rigidities at least in the wood and furniture sector. .

Strong DECs presuppose at least a higher education degree and/or former experience with high involvement in similar activities and a deep and overall knowledge of the entrepreneurial landscape

The analysis of the F&B case studies **confirmed the second hypothesis**, revealing significant differences among new ventures with strong and weak DECs. More precisely:

Confirmation of Hypothesis H2.1 for the F&B cases: DECs have a positive impact on new LT-KI ventures' competitive advantage, affecting the level of changes and challenges that these ventures bring to their business ecosystems

2.1a: Strong DECs produce strong initial competitive advantages which cause major changes in their business ecosystems

2.1b: Weak DECs produce weak initial competitive advantages which however cause some changes or challenges in their business ecosystems

2.1c: Among DECs, transcendental capabilities are mainly the ones to affect in major ways the initial competitive advantages and the changes they cause to new ventures' relative ecosystems.

Confirmation of Hypotheses 2.2 and 2.3: New knowledge-intensive low-tech ventures of the food and beverage sector with DECs are more likely to grow

2.2-3a: Strong DECs have a positive impact on survival and growth

2.2-3b: Weak DECs have a negative impact on survival and growth

Confirmation of Hypothesis 2.4: Proposition 2: New knowledge-intensive low-tech ventures of the food and beverage sector with DECs are more likely to innovate. Actually, DECs curve the innovative behavior of the new company.

2.4a: Strong DECs have a positive impact on innovative performance both at start-up stage as well as later

2.4b: Weak DECs have a negative impact on innovative performance, especially after the initial innovation.

III. DECs and new venture's performance: textiles and clothing sector

As explained in the sectoral review most textile producers are big and well established **knowledge-intensive** organizations, while the rest sub-sectors are composed of micro and small companies with a few exceptions. Due to tough global competition especially from countries in South-East Asia, innovation has taken place in all parts of the value chain of the T&C sector (Aslesen, 2008). Clothing, on the other hand, is rather **fashion dominated** with almost no knowledge-intensive companies and with a limited number of Greek firms which produce their own design connecting knowledge with creativity. Moreover there are very few new companies established after 2000.

The level of Knowledge intensiveness seems to be a distinctive difference *among companies that stayed trapped in the rather easy model of automatization and low price policies (e.g. transferring production to third countries such as Balkans) and the ones which sought differentiation based on knowledge.* A consequence of the

different strategies was the annoyingly high percentage of shutdowns and downsizings in all sub-sectors[225]. Yet, even though companies that have invested in knowledge-intensive differentiation may survive, it is only a few that manage to prosper. Reasons will be identified later in this unit but the issue deserves a deeper investigation in the future.

In contrast to the other two sectors, in this sample of ten cases there are two broad categories of knowledge seeking activities:

The first category resembles the relevant activities observed in the other two industries; that is, it refers to strong combinations of intramural R&D and knowledge creation with external knowledge seeking (e.g. by manufacturers, suppliers, other industry, other science etc.). Most innovative activities are combinations of various knowledge assets occupied by others along the value chain and formation of processes due to new knowledge produced (TCo1, TCo2, TCo3, TCo4, TCo6, and TCo9). Business scope (e.g. technology, new product and market developments), is the core way to produce ***strong initial competitive advantage*** with knowledge and learning ability to be the main way to combine and transform all information and knowledge into transcendental thinking. External approach is mainly integrated through networking in a concentric- cycle way. These cases resembling the F&B sector, rely on in-house R&D, develop dedicated R&D departments and some charge R&D expenditures. They are called ***"technology oriented".***

The second category applies mainly for organizational and structural innovations tightly linked to design competence and creative business concepts (TCo5, TCo7, TCo8 and TCo10). Although all ten cases care for fashion and certain activities address design, the cases of this second category rely and collect mainly design oriented knowledge combined with capabilities of developing highly demanded *brands* associated with fashion content and strong image building through a combination of technology, promotion and marketing. These are the ***"fashion dominated"*** companies. Yet, once again, most innovative activities are combinations of various knowledge assets and formation of processes due to new knowledge produced (best explained in detailed reference to cases).

These two categories suit further to the categories developed by Boeheim (2008) for the T&C sector regarding innovativeness. Companies are characterized as:

[225] E.g. the number of firms in the clothing sector has fallen from 12.744 in 2006 to less than 5000 in 2010, according to SEPEE information.

***Strategic innovators**:* firms which introduce product or process innovations (at least one product that is new to their market), developed at least partly in-house, perform R&D on a continuous basis, and they are active in national or international markets. These innovative products and processes are adopted by other firms throughout their domestic economy and internationally. In this groups fall the cases of TCo1, TCo2, TCo3, TCo4, TCo6, TCo9 and thus the first category group.

***Intermittent innovators**:* they develop innovations at least in part in-house and have introduced new-to-market innovations not diffused to other firms. The second category can be assigned to this group considering unique design as innovation combined with technical novelties

In contrast to W&F and F&D sectors,[226] observation of T&C ventures and their evolvement over the years reveals a tendency to change their internal or external approaches to innovation and knowledge management trying to find novel ways to survive. Thus, in-house innovation turns from investment in technology to more focused R&D, new approaches and business models, novel marketing and promotion methods. In such efforts they form partnerships mainly with suppliers and customers contrasting to the other two sectors where co-operations with university technology centers and research associations are more common. They develop formal but mostly unwritten routines of knowledge creation, articulation and utilization based on human capital development activities. **Three types of knowledge-intensive ventures** can be traced in this group as well.

- The **first type** shows a more balanced emphasis on different dimensions of innovation[227] combining external knowledge seeking to in-house research and knowledge development, drawing from high quality human capital both in terms of founders and workforce. **TCo1, TCo2, TCo3, TCo5, TCo6, TCo7, TCo8 and TCo9** belong to this type.

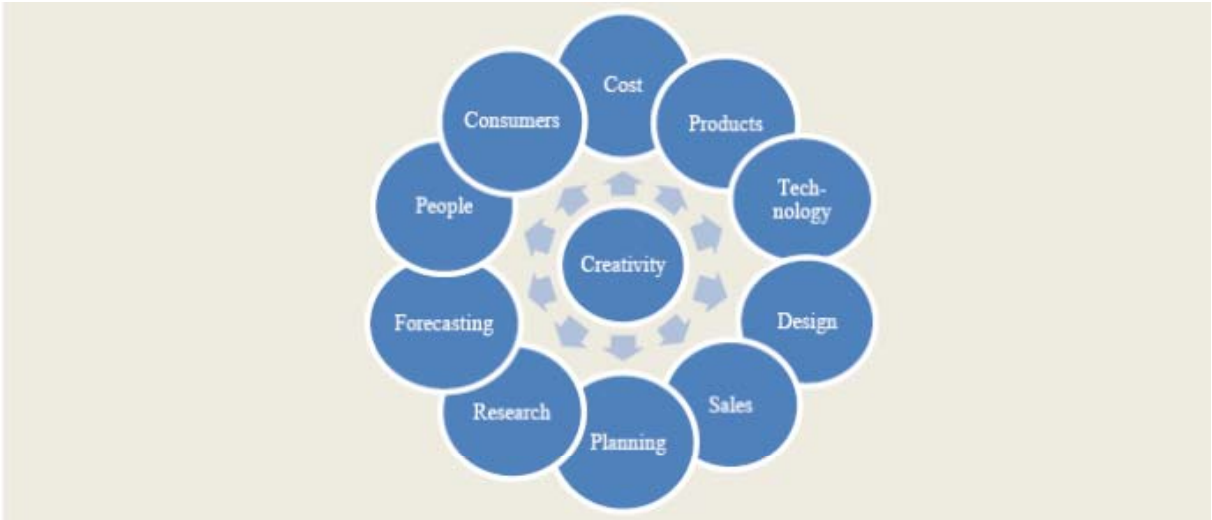
[226] W&F : external approaches to innovation and knowledge management, F&D: strong orientation towards R&D and sciences, co-operations with academia and scientific research

[227] **Note:** Actually it covers the three axes of a new venture: technology axis which is relevant to the technical development of a novel concept up to full scale production, Market axis which refers to the interaction with the market and the business axis which includes the business steps needed such as commercialization and business scheme selection, business and relative model development and IPR protection.

- The **second type** develops only the technical dimension of innovation combining both internal and external knowledge development with **TCo4** as the only case.
- The **third type** is represented by **TCo10**, and partly by **TCo7** and **TCo8** and indicates that ***creative design*** is a strong knowledge basis that can produce strong initial advantage and yet it is a combination of different knowledge assets.

The third type represents a quite different approach of knowledge intensiveness which enters the field of creative industries. "The creative design process and the creation of fashion design are for many veiled in glamour and magic, but in reality it is hard work" (Hansen, 2009). Knowledge is generally found and acquired on a global industry level. Fashion houses must walk a fine line between creativity and commerce, clothing and process technologies, business models and marketing novelties. According to Hines et al., (2007) "this 'hybrid fashion network' creates a permanent flow of rapidly changing information and knowledge that makes it necessary for fashion houses to constantly interact with the surroundings in order to avoid being 'future surprised' about emerging trends and styles". In eurocult.ogr the creative sector is described as knowledge-and work-intensive. **TCo5, TCo7 and TCo8** belong to this group as well. The design-group was considered important to be formed since TCo10 cannot enter the first group due to the lack of the technology side including the strict meaning of R&D.

Figure 7.7 : The influence of creativity.



Source: Knox (1989) in Hines et al., (2007)

In contrast to both the other two sectors there are no cases of T&C KIE to rely on *only* the technical dimension of innovation and *only* external knowledge. This can be attributed to the fact that the specific industry had experienced this model a decade ago and the majority had already rejected its efficiency by the beginning of the new millennium.

The analysis of the T&C cases led to the formation of three categories and namely

d) Cases with strong DECs: TCo1, TCo2, TCo7
e) Cases with moderate DECs: TCo4, TCo5, TCo6, TCo8, TCo9 and TCo10
f) Cases with weak DECs: TCo3

KIE and initial competitive advantage

The T&C sector is significantly dependent on developments in other fields such as machinery, ICT, chemistry and material sciences. In contrast to the other two sectors, all new ventures *targeted rather survival* by creating new needs and advanced differentiation though complex combinations of NPD, technologies, flexibility, design and customization. In their past, they were pioneers at national level and among the leaders at global level. Half of them were among the strongest Greek companies such as TCo9 (3rd position in Europe's textile industry in 2001, a strategic partner of global denim leaders such as Levi Strauss and Diesel). Thus, KIE in T&C sector was related mainly with differentiation in functional parameters and processes **in order to produce initial competitive advantage, such as:**

48**Table 7.16:** Mode of T&C cases' differentiation

Functional parameters	**Cases**
Innovative products/services	**TCo1, TCo2, TCo3, TCo4, TCo6, TCo7, TCo8, TCo9**
Quality	**-**
Exploitation of innovations elsewhere produced but adapted to local conditions and extended	**TCo1, TCo2, TCo3, TCo4, TCo6, TCo7, TCo8, TCo9**
Unique novel business models and methods of promotion together with product innovation	**TCo5, TCo9**
Fashion	**TCo5, TCo7, TCo8 and TCo10**

In this sense, all ten cases managed to pose major or minor changes in their ecosystem at national and European level. Relationships have been found among DECs and the level of these changes. More precisely:

All ten knowledge-intensive cases are generally regarded as successful cases within the relevant industry. Many of them presented significant annual sales increase till 2007 which was however much lower compared to those of food and (to a smaller percentage) wood cases. All of them are seriously affected by crisis up to now (i.e. 2014). All ten cases, however, had developed DECs tightly related to knowledge assets and knowledge exploitation in order to produce innovation and shape initial competitive advantages in order to compete with the new rules of the game[228]. Thus, all of the agents had foreseen these changes and tried to create "new rules" before their competitors. All of them managed to develop the three entrepreneurial dynamic capabilities at different levels however. In fact:

Three of them, TCo1, TCo2 and TCo7 have developed strong DECs. They managed to get out of the strict national and sectoral limits and create novelty all along the three axes (technology-market-business model). They present increasing sales at least till 2006, as well as high rates of innovation and NPD performance. They are all cases of corporate venturing; two targeting radical internal renewal and one spin-off and all targeting new markets. **They have caused changes to the existing (by the time of venturing) business ecosystems at different levels and specifically:**

TCo1 is a spinoff of a linen producer with export activity. The innovative idea that led to its establishment was the **provision of state-of the art innovative products /services** for virtually all requirements on innovative fabrics and demands of end users with mother company being the first and more demanding customer. It includes novel technology and process method, it is mainly market-driven as well as a response to the need of verticalization and **moving up the value chain**. "*Finishing as the last step in textile processing becomes more and more important and offers indeed greater prospects for product differentiation" (Chemical Engineer of the company).*There are **no direct competitors in Greece or Europe.** Competitions come mainly from Turkey and other countries of Asia (substitutes and not direct competitive products). Similar dyeing and finishing plants in USA are not in the same market share.

TCo2 is the first and only, till today, company in Greece to engage in high tech clothing innovation. It produces personal security products such as fire rescue

[228] i.e. the dramatic changes in the T&C industry geography

garments, using special high performance fabrics[229]. Based on its developing capability on NPD, the technology gradually obtained after 1993 and its core design capability, the company decided to become a constant innovator (at least for the Greek market) developing innovative products for very small niche markets. The idea is innovative by itself, as well as its process, since the company has developed a method on personal r*equirement selection and consultation on specific individual problems*[230] *which are turned into innovative products by the company itself, or by cooperation with supplier companies (Du Pont) or with technical consultants (Israel).* **Solutions in individual customers' needs are possible due to vertical manufacture capabilities**. This is unique in this specific sub-sector at global level as far as we were told. The company translating the negative messages for the sector shifted from a conventional linen producer to a high value technology product manufacturer with R&D, design and NPD as core business activities. Its main strategy became the creation of new niche markets, improving the market position (Hirsch-Kreinsen, 2008). The company was characterized as sectoral innovation leader by Leheyda et al (2008) and by Innova project (2006-2008). Its exports have increased from 30% in 2010 to 68% in 2011 (Defense net, 2011).

TCo7 is the first Greek jeans manufacturer to develop a Greek jeans brand **building a unique culture around its jeans and promoting** a whole lifestyle out of them (Staff Jeans website, 2010)**.** The entrepreneur invested on the triptych design-branding-technology to add value in Greek products against the giants of Levis and Diesel**.** Today there are **three other Greek significant apparel companies** which however do not produce only jeans. Yet, TCo7 was rated 3rd regarding turnover in 2012. The company exports about 60% mainly in Italy and Germany[231]. The core idea was the fact that denim was a "new material" with a huge research and treatment potential even in the beginning of the new millennium. The entrepreneur **was the pioneer in combining single-piece dyeing and special treatment in Europe** offering high quality innovative and cutting edge design[232]. He is considered an innovator in denim

[229] The company is among 174 in Europe and 239 worldwide regarding only industrial protective clothing

[230] This is supported by the Jim Rohn who claims that a well serviced client can be of a greater value than a publicity of 10.000 dollars (Rohn, 1994)

[231] Germany, Switzerland, Belgium, the Netherlands, Italy, Serbia, Cyprus and Russia in 2010

[232] The dyeing of a fabric or a particular garment is a complicated and delicate business. Shading, special effects, combinations and variations of colour, flash lights, make the composition and calibration of colour a real art in its own right. Technology has become the indispensible right arm of

distressing techniques and washing, since he developed his own techniques for denim treatment. The company started with 20 employees to reach 280 in 2008. Turning to KIE TCo7 meets success. In the middle of the severe crisis the company owns a distribution of over 500 stores throughout Europe, with 15 mono-brand flagship stores in Greece. In 2014, it's one of the fastest growing candidates on the Italian market[233].

TCo3 ***is the only case of weak DECs.*** It sprang from the cooperation of two strong entrepreneurs within the clothing sector but different sub-sectors (namely white linen manufacturing and branded jeans). It is a new-to-the-world company established on a combination of technology, fashion and ecology, as well as the experience and fine networks of its entrepreneurs. The company's activities are pioneering in Greece and the entrepreneurs claim that it is also in Europe[234]. The new company used innovative biodiesel technology to provide energy to modified dyeing machinery for piece dyeing. Even since the very first year of production, the company had gained the 11% of the Greek relevant market. Single-piece dyeing provides fashion treatment (avoiding "straight") and providing "vintage" looking. This is too expensive if done by using conventional dyeing technology per piece. The concept is Italian but individual know-how belongs to the new company. Technology and process modifications were defined after try-and error efforts. **TCo3 created a new sub-market, at least in Europe** as far as we were told. Today there are 6 other single-piece dyeing plants in Greece and 12 conventional dyeing plants with biodiesel. TCo3 did not manage to get the lion's share in Europe or do well after 2006.

Six cases have developed moderate DECs. A common weakness of all these cases regards the existence of moderate transcendental capabilities. However, they present significant rates of innovation and NPD performance. Five of them are cases of corporate venturing. The other one (TCo10) is a new-to-the-world firm established due to the inspiration of a fashion designer and fashion critic to become an entrepreneur. **They all have caused minor changes to the existing (by the time of**

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the stylist's creativity. Denim became massively popular during the 1950s and in the mid 1980's manufacturers began to use techniques to 'distress' the denim in order to make them look worn. By the 1990's, pre worn-out jeans had became popular throughout the Western world.

[233] http://www.waitfashion.com/en/fashion/brini-vs-wait-recap-staff-jeans.html (accessed 6 May 2014)

[234] A search in the Internet however did neither confirm nor reject it.

venturing) business ecosystems at national level and challenged it globally at sectoral level (without however provoking vital changes). More specifically:

TCo10 is a quite different case of new venture which however deserves being included as a representative case of alternative KIE in the T&C sector. Fashion Entrepreneurship is organized around a designer, evolving a complex net of knowledge assets (such as design, raw materials, manufacturing and business) and focusing on the production of high design clothing and accessories. The entrepreneur managed to enter the high-fashion and demi-couture world, create and build his own empire developing his new symbolic language –a distinctive and consistent style characterized as "Old Athens" (elegance, nostalgia and womanly looking). Today he is considered among the emerging global designers.

Gaining some market share means taking customers of other competitors, since the fashion sector is a saturated and volatile market (Jones, 2005). Furthermore, **only a few fashion designers become entrepreneurs** while a very small percentage of them are capable of making it through the first years and many do not succeed in reaching a stage of retention (Kurz, 2010). As Renzo Rosso, creator of Diesel, stated: "Fashion is inspiration, creativity and intuition. But it is also organization, strategy and management. These two apparently contrasting sets of elements have to come together to ensure the success of a business idea." (In Saviolo and Testa, 2002). Leadbeater et al (2005) further pointed out that many want to stay small, because they want to maintain their independence and the focus on creativity. KIE in fashion industry is quite different since it is more connected with creativity and a complex communication network. Innovation comes through creativity and constant change.

TCo5 is a kid fashion company which invested on differentiation even since mid-90s, proving multiple times its ability to change and thus having long before cultivated DECs. Being one of the many apparel industries that were established in late 70s (the golden age for the sector), its entrepreneur soon realized that he had to build on a distinctive brand and organize a sales network in order to gain awareness. In 1997 he reorganized the company drastically with distinct departments, processes and procedures and a strong design department. In 2002 the brand reaches 90% awareness. Yet, the entrepreneur has also sensed the changes in the global landscape; threats of the confusion of target groups where imports of expensive kid fashion

(Lapen House, Allouette, Mayoran[235]) are combined with easy-to-wear cheap cloths such as Zahra and H&M, and mass and very cheap clothes sold in all kinds of shops or in open markets. On the other hand there was a clear shrinking of the sector. Big and well established companies disappeared or changed to purely mercantile.

In 2006 he recognized the need to revitalize sales operations and build new capabilities in order to create value for shareholders. The company uses corporate venturing (in line with Narayanan, Jang and Zahra, 2009) applying once again KIE and creating a novel corporate identity.

The company was the first (and the only one to our knowledge in Greece) to develop a novel method of partnership which is called "*Consignment*"[236] in order to solve problems created by franchise and company owned shops. The system is built around commission business, placing any material in the hand of another, but retaining ownership until the goods are sold. The system was developed in co-operation with the Department of Management and Technology, Bocconi University. The system reformation of the whole value chain (from design to final consumer with a special emphasis on inventory management) and its principles were according to the entrepreneur "a combination of theories which contradicted the existing literature".

The firm developed an innovative distribution system; however we do not know if it had any imitators in Greece. According to the entrepreneur

> "Subsidies and investments were only in the productive and technological part of the sector. We did not know to make brands and channels. We did not know how to sell. Then the multinationals found us unprepared. With the first blow we dropped dead!"

This case is a representative one of the creation of innovation and competitive advantage other than technology which was (and still is) the core of relevant policies for the sector and sets significant questions on the effectiveness of such policies under the existing conditions of the industry.

The company survives the crisis with higher percentage of losses in 2010 and 2012. Today it exports to Cyprus, Skopje, S. Arabia, Bulgaria, Romania and Slovenia using the same system.

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[235] Mayoran applies a very aggressive policy since it is backed up by Spanish promotion benefits

[236] An arrangement whereby goods are left in the possession of another party to sell. Typically, the consignor receives a percentage of the sale (sometimes a very large percentage). Consignment deals are made on a variety of products - from artwork, to clothing, to books. In recent years, consignment shops have become rather trendy, especially those offering specialty products, infant wear and high-end fashion items.

The rest of the cases, TCo4, TCo6, TCo8 and TCo9 are all big, well established organizations which present also moderate DECs. They were put in this sub-group because they present some common weaknesses not traced in the above four cases and more precisely:

- a reluctance to widen the concentric networking cycle and a rather reactive attitude preferring problem-solving than rather creating **(bricolage** capability)
- Weaknesses in provocative competencies such as presence of routines and procedural memory due to strong path dependency which encourage rigidities within structures (improvisational capability)
- Core organizational rigidities due to the persistence on established routines. This seems to be also the source of all the above weaknesses. A major feature of all four companies is that they are big, well-established organizations with distinct departments and formal rules. They had followed routines for years, had built procedural memory and had developed a precise culture around the importance of technology and automation which was tightly connected to high performances. However, this attitude is rather harmful for improvisation (Moorman and Miner, 1995; Brown & Eisenhardt, 1995); organizations need to consciously build the necessary will to develop improvisation (Clegg, 2002). Indeed, a major criterion for the development of the DECs has been stated to be the conscious efforts of the entrepreneurs to depart from former ways of thinking and acting. This danger was not that evident in the W&F corporate cases because none of them had enjoyed the sizes and success of these four cases at global level.
- Core rigidities due to spatial and cultural proximity of the new venture. This is in accordance with the cases of weak DECs in the other two sectors (e.g. WCo6 and WCo9 *vs* WCo2 and WCo10). These four companies attempt corporate venturing but "within their yards". New plants are close to old ones but the most important is that new cultures are similar to old ones. It seems that *the closer the new to old strategy, the weaker the DECs developed for corporate venturing.*

More precisely:

TCo6 has been long one of the leading Greek textile companies with strong export activity. Being a conventional cotton spinning mill till 1998, the two entrepreneurs (brother and sister) decide on a new SBU to develop the capabilities of producing innovative products. They actually thought of **creating competitive advantage on**

the triptych ecology-technology-R&D. The innovative products would be of very specialized specifications and of high-value, customized for high-end European markets. The two entrepreneurs had foreseen the need for innovation as well as the growing trend towards ecology in order to create new markets. They have further invested in eco-cotton and energy efficiency. **Today there are very few relevant firms in Austria and Italy, and other two in Greece.** According to the entrepreneur *"they are the few that promote research, innovation and quality"*. **The company was characterized as sectoral innovation leader by Leheyda et. al (2008) and by Innova project (2006-2008).**

TCo9 is also one of the leading Greek companies and among the global leaders of denim production, selling to the upper segment of the market. It is the only totally verticalized organization of denim production in Europe. The company was a former joint venture with a Dutch textiles company. In 1999 the family acquired Royal Ten Cate NV share and formed a new strategy in order to restructure the company. The new messages of the industry worldwide (common to entrepreneurs of all ten cases as seen above) posed a need for change. The family focused on denim branded fashion for two reasons: a) Denim started to become female fashion with the new millennium (this was also exploited by TCo7); and b) Fashion required a huge number of product codes and fast changes.

This decision indicated the way for competitive advantage development and called for **a total restructuring of the company** which was by then highly automated for *mass production*. Actually, the whole idea **was a response to market needs and threats.** The company was among the pioneers worldwide of the sub-sector to introduce **mass customization,** a method first defined theoretically by Stan Davis in Future Perfect (1987). It was the major supplier for Levis till 2005 while other customers were Diesel, Armani and TCo7. TCo9's vision soon produced exciting results as well as a plethora of novel products some of which were patented (royal denim and perflex) at first at national level and now at European level. **Today there are similar firms in Italy (3 companies) and Turkey (5 companies). There is no competition from China or other Asia countries[237].**

[237] The main problems that TCo9 faces today are mainly due to excessive borrowing in order to face competition from Turkey, the increase of cotton price and the 7 million Euros on tax returns. In the end of 2012 TCo9 became the first Greek company to take distress funds (**http://www.tovima.gr/finance/article/?aid=443140**)

Figure 7.8: Denim product line *(from TCo9's archives)*

TCo8 was till 1997 a leading underwear manufacturer in Greece. Market messages turned company to seek **differentiation.** At that time global trends and strategies of leading companies indicated **fashion** as the only solution **combined with innovative raw material.** That meant a total reformation of the company. TCo8 was a highly automatized company with a few product codes of white underwear of fine quality. It needed to turn to a fashion producer targeting younger ages (where the meaning of underwear is completely different). The story reminds the one of TCo9. The difference lies that in the case of TCo9 there were some big business customers who were just asking for more, while R&D started with their support (according to the TCo9's entrepreneur, Levis was a great supporter in the first steps of advanced R&D). In the case of TCo8, the company had to

- Invest in fashion exploiting creative design, new materials and global trends information for new and fast changing product mix.
- Change its production lines
- Change sales and promotion procedures and processes
- Change its image
- Capture new target groups

The **complete restructuring** of TCo8's business model was further an answer to multinationals[238]. Still it required much knowledge and investment on human, social

[238] We remind that corporate venturing can refer to the development of a new corporate activity that may or may not include the creation of organizational bodies or to the strategic renewal i.e. changes in

and physical resources. "*It is a very expensive story which still goes on…".* The firm developed a strong design department with intense NPD[239], sought knowledge on innovative material and relevant technology, developed R&D (devoting about 1% in it), entered new sub-markets (e.g. lingerie and youth underwear) and invested heavily on training.

In 2005 the company enjoys the fruits of its efforts ranking third with a slight difference from the first two. In 2010 the company maintains its position in Greece following the international Triumph. However, in 2012 it falls to the 15th position. It is worth mentioning that during the 2000-2010 decade many relevant firms lost the race of competition and shut down.

TCo8 is a pioneer in fashion underwear design in Greece, the first to establish a design department combined with R&D, an ERP system and use "green daisy" label for infantile clothes.

TCo4[240] was a conventional fabrics manufacturer for Greek and foreign customers till 1997. The plant engaged highly automated equipment and was well organized achieving consistently high quality, strict delivery times, realization of specially designed fabrics, and high percentages of global leading companies' satisfaction. In 1997, a fire destroyed the factory completely. The entrepreneurs saw it as an opportunity to change the company's strategy towards more value-adding products. Sensing the global trends the two entrepreneurs (brother and sister) decided **to invest in innovation and knowledge, and produce highly differentiated products**. They chose to invest heavily on technology to make *a cutting edge technology fabric plant which would act as a basis to fulfill requirements of highly specialized knowledge.* In 1999 they entered the stock market and contracted Werner[241] to reform their business idea. The entrepreneurs being conscious of their lack of relevant knowledge, invested on their suppliers' knowledge (both of machinery and raw material) which by the time were also highly involved in innovation. Unique and extremely expensive equipment was combined with high automation, a strong R&D Department with chemical

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strategy and/or in the structure of the organization, (Sharma and Chrisman 1999) and a firm transformation by revitalizing its operations and reordering its core capabilities (Ruiz-Navarro 1998).

[239] In 2003 the design department occupied 13 employees: designers, technical specifications specialists and specialized cutter-tailors

[240] By then TCo4 was a single company, today it is a group

[241] Werner International's extensive team of highly qualified textile and apparel manufacturing experts was by then the best and most expensive consultants worldwide

engineers and textile specialists, a design department and a Quality Control Department. The plant was ready in end 2002 and ever since the beginning of 2003 three global leaders were attracted by the company's capabilities and became significant customers. Since then and for the next three years TCo4 developed high levels of innovativeness which resulted in two patents at European level and many innovative products, such as tailor-made products and solutions using new treatments and processes on fiber and color.

In 2006 the company loses its strongest customer. Since then the innovative manufacturing activities gradually declined, leaving expensive machinery useless and turning back to more conventional activities.

> *"The only positive outcome was the acquisition of rammers (note: type of equipment), which still offers some value to our products". (CEO of TCo4)*

Therefore, it seems that DECs were oriented towards technology and more precisely towards the wishes of the strongest customer. The company failed to develop a new and flexible business model to follow technology and strategy reformation or towards new markets. The general director of the company confesses

> *"We may have not found the right path to reach customers. It is not easy. You know, we are rather weak in promoting our innovative products"*

Today, besides the significant losses in sales, the company still works on highly innovated products[242] ; for example it presented a highly technical product that interacts with the body by stimulating blood microcirculation and thermoregulation at the Munich Fabric Start fair in September 2012. TCo4 continues to export its products to Europe, Israel, South America and Hong Kong[243].

All cases, but for the one with weak DECs, have trademarks while TCo6, TCo7, TCo8 and TCo9 have received awards. TCo2, TCo4 and TCo9 have further at least one patent.

The T&C cases confirm the hypothesis 2.1 that *DECs have a positive impact on new LT-KI ventures' competitive advantage. Actually, it seems that the stronger the whole set of DECs, the stronger the initial competitive advantage.*

[242] The company today has reduced the number of chemical engineers to 7 and of designers to 3

[243] In 2002 a subsidy for the new installation was approved. The money was never granted to the company. Actually in 2009 the state denied to give the money because the company had less employees than in 2002

DECs, survival and growth

As in the other two sectors, it is rather difficult to set comparisons among the ten cases and their sales during the first years of life, since they address different sub sectors, customers and markets regarding products and sizes and different economies (from local to global) although all ten cases belong to the same mature T&C industry.

A major characteristic of the T&C cases is the fact that even since 2000 and especially after 2004 the sector was confronting a crisis at global level as we have seen above in the sectoral review. While most Greek T&C companies remained introvert, our case studies were among the ones to react by developing KIE. Out of ten cases, seven ventured around 2000 (TCo1, TCo4, TCo6, TCo7, TCo8, TCo9 and TCo10). That indicates that they were reacting to the global crisis in the T&C sector, while no-one really expected the severe Greek crisis.

The first shock came in 2006 for most of the Greek KIE companies. Big global customers abandon high-value textiles or fabrics for the sake of cheaper substitutes in China and other Asian countries. Innovation and value-added products do not seem to win the battle at global level. TCo4, TCo6, TCo9 and TCo1 develop policies such as extreme flexible orders with very short delivery times and *fast fashion*[244] to recover. The Greek crisis found almost all T&C firms exhausted. Instability, unfair competition, the liquidity-starved market, mistrust of foreign stakeholders, denial of bank loans and a significant decline in domestic demand (as a result of the economic crisis) worsened all perspectives. Furthermore, state-owned money reached several millions of Euros either by subsidies or by value-added tax owed by the state to businesses in the sector with high export activity. Thus, the last three years (Table B10, Appendix B) can act as a major criterion for entrepreneurial crash tests. Diagrams B7, B8 and B9, and Tables B9 and B10 present financial data of the T&C cases.

TCo3 appears that it cannot survive the crisis. It is not irrelevant the fact that it is the only one with weak DECs. The new-to-the-world venture manages to have high CAGR (first for the first 4 years and 3rd for the last ones) but besides the first two years of high sales rates its growth is stable and declining.

On the other hand, ***the three cases of strong DECs*** present the highest sales rates and CAGR for the first four years (Table B9, Appendix B). In contrast to the other two

[244] E.g. a leading company in clothing produces 26 collections per year with a 14 day duration for each

sectors it is quite clear that corporate venturing is a reaction to sectoral crisis. All cases were quite successful and wish to remain so. Venturing pushed up turnover at a rate of 150% for **TCo2** and around 23% of TCo7 with a steady sales growth for the following years. It can also be assumed that it created the conditions to survive the crisis. However, TCo2's growth presents a rather erratic picture. This is due to the nature of the specific innovative products, as well as due to the fact that main orders depend of national public bodies in Greece and abroad.

Among the ones with moderate DECs, four of them returned to the same sales volume as just after the venture, while TCo5 and TCo8 presented a decline in 2010-2011. Both companies' decrease of sales volume may be due to the fact that both serve mainly the domestic market which was in very deep recession these two years. Three cases (TCo8, TCo9 and TCo10) present growth (mean annual sales rate for the first four years), as well as high CAGR rates.

TCo5 is the one of the first group that occupies the last position regarding performance of first four years. Yet, the interview analysis indicates that the strategic reason of corporate venturing was not sales and profits increase but the creation of more stable systems to confront multinational and the new face of competition. The performance results of the last four years justify the decision besides the decrease in sales. TCo5 takes the 4th position on both CAGR and MASR of the last four years.

If one observes the sales curve of **TCo6** ever since the corporate venturing, one can see that there was a declining trend even from the very beginning. However, this cannot be counted as a failure, since the company managed to maintain a place among the strong ones (ranked 8th position for 2010).

TCo4 presents an erratic unstable growth course. This is mainly due to its dependence on few big customers at the first years and before the global shock of 2006. However, the company is strong and well-organized with strong DCs and thus manages to create significant competitive advantages and survive. According to our opinion, TCo4 could have been more effective if the entrepreneurs had really considered a radical restructuring of it and therefore had developed strong DECs.

TCo10 is the new-to-the-world venture with moderate DECs**.** Limited information on financial indicators does not allow any comparison of the new venture's performance against the other cases. Based on the sayings of the entrepreneur the new venture prospers even in the middle of crisis mainly due to haute couture specific niches.

Both **TCo8** and **TCo9** present satisfactory growth rates for the first four years. The two companies share common characteristics, presented similar DECs (as seen above) and, as expected, present a parallel development in growth. A strong difference among the two cases regards the fact that TCo8 remains mainly within Greek boarders while TCo9 is mainly an export oriented company.

Largest companies seem to have the highest losses. A rather interesting observation is that **2010-2011** turnovers of all companies with moderate DECs returned to the level of 1999-2000 sales, that is the levels before the venturing but within favorable - both national and global - business and institutional settings. Furthermore, these companies are even in 2010 among the first 10 companies ranked by total assets; TCo9 occupies the first position, TCo7 the 3rd, TCo8 the 4th, TCo6 the 8th and TCo4 the 9th (Greek Financial Directory, 2012). Therefore the results of KIE can be characterized as positive[245] even in cases of moderate DECs.

Regarding the three cases of strong capabilities, **TCo7**'s turnover during the last three years appears to be three times bigger than the one of 1999-2000. **TCo1'**s turnover has doubled, while the unstable course of **TCo2**'s case does not allow for any comment. However, the company stays about the same amounts of turnover instead of the severe crisis while it presents a steady increasing rate in innovativeness as we will see in the following section. On the other hand, **TCo3** presents a declining course with 2012's turnover to be the half of 2011.

It is quite important that only the companies of high DECs present occasionally revenue rates higher than 20%. More precisely: **TCo1** starts of around 1 million Euros and presents annual change rates of around 236% and 137% for the next two years. **TCo2** achieves various rates above 20% until 2008 reaching 140% in 2004 (due to the Olympics 2004 in Greece) and a 63% in 2008. However there are significant fluctuations in the annual change rates of the company**. TCo3** presents a 24% the first year of sales of the corporate venturing and then a percentage around 50% for two years in a row. However, none of the cases allow for the characterization as a "gazelle". **TCo9** has also surpassed the 20% ceiling twice.

[245] During this decade major T&C companies (among which more that 1000 big established textile groups) have shut down or moved to Balkans (see sectoral report above)

T&C cases support strongly and confirm the assumption that **sectoral context matters**. It is quite evident that T&C industry offers fewer chances for survival and growth at both national and global level. History and path dependencies of the sector are also affecting KIE development and results on performance. Within the same national context, F&B industry presents extremely better performance regarding survival and growth while W&F industry offers more opportunities. Major differences among T&C sector and the other two are:

a) All T&C cases were affected by the severe crisis with not a single one to avoid turnover decrease.
b) Economic indicators in T&C cases appeared unable to provide clear signs of performance to compare cases of strong DECs to the ones with moderate DECs due to the rather peculiar condition of the industry. This was easier to the other two sectors
c) There are no cases of brand new ventures besides TCo10[246] and none with an entrepreneur not relevant to the industry. That can be attributed to the fact that according to our knowledge there were hardly any (really) new ventures established after 2000 and according to experts' sayings and our personal research none knowledge-intensive.

However, **Hypotheses 2.2 and 2.3 seem to be confirmed** also by the cases of T&C industry; *DECs have a positive impact on new LT-KI ventures' survival and growth.* Furthermore, the crisis test confirms our suggestion of the previous section that **the course of the sector has a significant impact on the survival and growth of knowledge-intensive low-tech ventures.**

DECs and innovativeness

Regarding innovativeness, T&C industry resembles the wood and furniture sector[247] although the two sectors are not identical; therefore we can trace

[246] Even TCo3 can be considered a spin-off joint venture of TCo1's parent company and TCo7. However it is a new venture.
[247] In W&F sector there are two categories regarding innovativeness: cases with no further innovations (WCo3 and the two weak cases) and cases with a regular or intense innovative activity

- a group of cases with no further innovation as in the W&F group *but* with creative fashion design (which is not observed in our W&F cases although they could, since it is also a creative industry) and
- a group with a regular innovative activity which sometimes results in patents. Innovations regard products, processes, marketing and organizational processes.

In their innovative efforts **the companies form formal partnerships** (in contrast to W&F and F&D sectors where informal form is more common) mainly with suppliers, and customers. A partial interaction with university and technology centers is related to secondary research interests such as energy or the development of individual technology (in contrast again to W&F and F&D sectors). They develop formal but unwritten routines of knowledge creation, articulation and utilization based on human capital development co-operations and research activities.

Knowledge-based introduction innovations of the ventures cover all four categories of the venture idea newness:
(1) ***new to the world***: TCo1, TCo3, TCo4 (innovative technology), TCo2, TCo6, TCo7 and TCo9 (innovative products), TCo7, TCo8 and TCo10 (design), TCo7 and TCo10 (trends), TCo3, TCo4, TCo5 and TCo9 (innovative organization methods and processes, production processes)
(2) ***new to the market*** (national or international market): all cases
(3) ***new to the firm:*** all cases, and
(4) ***a first mover*** or assigned to the most innovative companies in the market or product field: all ten cases are first movers at least at national level.

Knowledge-intensive and innovative venture ideas of the ten cases have produced
(1) *products* : TCo2, TCo6, TCo7 and TCo9
(2) *methods of production, processes and technologies* : TCo1, TCo3, TCo4 TCo5, TCo8 and TCo9
(3) *methods of promotion* **:** TCo7
(4) *business models* : TCo5, TCo7
Adding in this sector
(5) *design and fashion trends:* TCo7, TCo8 and TCo10

Actually, there are no T&C cases which could be characterized "breakthroughs" or "radical departures", since they more often constitute combinations of existing patents and innovations in general. In spite the fact that they offer significant competitive advantages, they neither change dramatically the ecosystems, nor create new ones. This is in accordance with relevant studies. Textile firms innovate by means of buying external knowledge, advanced machinery and equipment (65%) and performing intramural R&D (46%) while of the various methods of non-technological change, the aesthetic appearance or design in at least one product and implementing new organizational structures are used most often (Boehaim, 2008).

One fact that deserves to be mentioned is the **proactiveness** of the interviewed Greek textile manufacturers regarding innovation according the relevant subsequent literature and sectoral reports. Interestingly enough, the ten cases studied within the present research fulfilled much earlier (i.e. 2001 to 2004) many of the recommendations proposed by specialists and policy makers[248] in late 2008 and 2011 for the industry survival. More precisely, among the cases of the study regarding innovative products, firms tried to:

- cast outcomes of new research fields in the areas of material science to turn their technological advantage into growth and pave the ground for the next generation of textile use such as moving from commodity fibers, filaments & fabrics, towards specialty high value-added products from flexible high-tech processes such as synthetic, products of biotechnology and nanotechnology, non-woven materials etc. (TCo1, TCo2, TCo3, TCo4, TCo6, TCo8 and TCo9)
- find the functional roles in the value chain that represent knowledge-intensive activities in order to make these areas competitive advantage by, for example, by strengthening the links to fashion and the design industry (moving down the value chain) (TCo7, TCo8 and TCo9).
- promote partnership between T&C industry and the fashion and design industry, and to promote design-based entrepreneurship (TCo7, TCo8 and TCo10)

[248] ZEW, SPRU,MERIT, LABEIN, INNOVA Watch, ITMA are some of the projects with relevant proposed policies and recommendations

- invest on ecological issues such as eco-friendly materials and treatments, energy efficiency etc. (TCo1, TCo3, TCo8 and TCo6) by exploiting important technology areas such as Engineering, Research and Design.

On the other hand, almost all of them did not stop investing on process (production) technologies, automation and flexible high-tech processes while they also tried to produce innovation by:

- offering tailor-made solutions investing on intelligent production, logistics and distribution (mass customization such as TCo8 and TCo9).
- reforming production technologies to the requirements of new textiles and composite materials both with regard to new machinery, processing methods and processing activities (almost all cases),
- implementing ICT (almost all cases)

Two significant areas still untouched were (and are)

- the use of brand new research findings in biochemistry (such as biopolymers) and nanotechnology and
- the creation of "bridges" to other manufacturing sectors besides clothing such as expansion of textiles as the raw material of choice in other industrial sectors and new application fields[249].

According to the interviewees they did not invest in these areas because of the small size combined with the indifference of the domestic market, the lack of relevant research or academic institutions in Greece (distance can be an important obstacle according to the entrepreneur of TCo6), the difficulties of addressing other sectors, the high potential of the T&C industry globally, the specific demands of the foreign customers.

Therefore, it is evident that in most cases new ventures provide advanced alternatives of products and processes at national, European or global level and the ones that invest on design count on fashion differentiation. A common feature of the T&C cases was the fact that they went on with corporate venturing because of need (with the

[249] There is only one company in Greece belonging to another sector that produced among others technical textiles for other uses (in Thrace).

exception of TCo10) using in most of the cases technology as the main (but not only) media for change. The threats for the sector at global level were evident ever since mid-nineties. The entrepreneurs of all ten cases had felt the urgency of restructuring or moving ahead. Regular innovation was not enough.

> "We had to restructure the whole product model to resist multinationals. Market messages were very clear. Differentiation was the only solution. Although we had invested heavily on automation and production systems of mass production, we had to change. That started in 1997, since we had received the messages. Our eyes and ears were open. Whatever the knowledge and the experience you have, it is not enough when you enter a completely new area. You have to come out of your shell and start searching… If we did not change, we would not exist today…" (TCo8)

> "The company started in 1992 as one among the others, working under contract. Soon it was evident that this would come to an end. We saw design and branding as the only solution". (TCo7)

> "Our new ideas started around 1998. It was evident that the company had to change." (TCo9)

TCo2, TCo6 and the entrepreneur of TCo1 have narrated quite same stories. Interestingly, while the global industry crisis was evident to almost all entrepreneurs before it really happened, they all confess that the Greek severe crisis could not be predicted by no-one. Many troubles of today are not due to some wrong entrepreneurial decision but due to obscurity, lack of entrepreneurial landscape, extreme instability, the unreliable attitude of the Greek political world etc. Many of the entrepreneurs have never collected subsidy money, ever since 2000 (while the amounts are really very high)[250].

Knowledge-based innovation through venturing offers in all ten cases advantage asserting ***their temporary precedence as leaders*** in the relevant markets at national and European level. Lack of competitors or a very limited number of them is a further indication of innovativeness. The findings also confirm Heidenreich (2009) who claims that LMT industries are more in need of other forms of innovations such as special designs, higher quality and flexibility and other organizational and process innovations composing according to Boeheim (2006a) a rather complex structure of knowledge bases.

[250] The case of TCo6 is indicative: a subsidy of 14 million Euros was proven for the new investment of 1999-2000. The money had not been given to the company at least till the end of 2011, although the EU had granted it since 2002.

Strong dynamic entrepreneurial capabilities have led to strong initial novelties of all kinds and laid the foundations for strong innovativeness. The main characteristic of this group is that **novelties do not constitute answers to needs as in the cases of the moderate and weak capabilities.** Instead, they are new ways to gain space and share mainly in existing European markets and the virgin (for their products) Greek market.

TCo2 develops a new for the Greek manufacturing sector niche market quite successfully adjusting novelties to surpass globally related products. It has developed a strong R&D image, innovating with patented products and applying research both in-house and in cooperation with other parties. The entrepreneurs try to differentiate in all three axes; they develop novel products, engage innovative promotion methods and engage novelty in their business models e.g. with the provision of flexibility down to one-piece order. The new venture focuses on R&D and technological collaborations running relevant projects and participating to European ones. The company is the **only one** in Greece to turn from a conventional weaving mill producing fabrics and garments to a highly technology-oriented firm producing technical innovative and special use fabrics, ballistic products and protective garments. Today the company's products are sold all over the world**.**

TCo7 presents strong business and market promotion innovative ways and significant creative design combined with technological innovations. The company manages to become the unique branded jeans company of Greece. It has a significant evolution regarding innovation. Indicatively it is one of the four companies that have applied RFID (together with Gerry Weber, Levi Strauss and America Apparel) since the product cost can bear the additional cost of RFID application (Ruile and Wunderlin, 2011).

TCo1 produces mostly technological and process innovations in cooperation with manufacturers, while they develop strong NPD regarding both design and techniques. The innovative idea that led to its establishment was the provision of state-of the art innovative products for virtually all requirements on innovative fabrics and demands of end users with mother company being the first and more demanding customer. The entrepreneurs decided to invest in exploitation of cutting edge technology (some parts of which were developed by their own ideas). This constituted the basis of working with innovative yarns, fabrics and innovative dyeing – finishing and treating

elements. The newly established plant started by using a process for finishing and treating textiles with skin-care oils and emulsifiers, patented a year before which could not be applied in conventional plants. While erecting the new unit, TCo1's engineers developed the technology referring to the color and chemicals preparation for automatic mixture and feed. This combination constituted the strong competitive advantage for the new venture, since all relevant companies refer to it for special high demand orders.

TCo1 remains highly innovative. It continues investing in collaborations with raw materials' suppliers to build innovation as well as the pilot use of novel production technologies such (local and European) (such as the pilot use of a Clariant's anti-smell process invented by Greek Kyriazis). A series of innovations followed (mean frequency: one per year, Table B11, Appendix, B).

The companies of the first group with strong DECs present strong similarities although they do not belong to the same sub-sector. All three are accomplished by technological novelties and development of relevant innovation capabilities. Moreover, they all have set significant bases for innovativeness. According to narations and Table B11 (Appendix, B), they present novelties and more or less significant innovations at all levels almost at a yearly basis. Novel technological characteristics are mainly products of collaborations while networking (starting from bricolage) is deemed as very important. *"Everything is networks"* states the entrepreneur of TCo7, while the entrepreneur of TCo2 boasts on the company's high-tech partners. Still, all three cases have developed their own R&D and NPD activities, presenting active involvement and strong interactions with their partners. Initial knowledge management systems are constantly reworked and advanced, in order to capture a wider range of knowledge and opportunities all around the phenomenon of high-fashion jeans (TCo7), the concept of advanced and high-tech special garments and clothing (TCo2) and innovative fabric dyeing (TCo1); thus getting out of sectoral and national borders. They are also interested in novel ways to communicate the firms' messages all over the world by completely different methods however.

The company with **weak DECs** (TCo3) started with a significant innovative concept combining a unique process idea (one-piece dyeing) to an ecologic view with the

parallel production and use of biodiesel. The company opened **a completely novel niche market** at least at national and European level and found significant applications in both high and fast fashion. Innovation was based "on traditional processes" as the company's CEO stated. However, TCo3 did not manage to produce further novelty. This can be attributed to the fact that TCo3 was the result of strong transcendental capabilities of two entrepreneurs who were leaders in their subsectors. However, they did not pursuit the new business idea developing the other DECs as well; bricolage and especially improvisational capabilities are very weak. Teleology can be here detected as well as the fact that the new business idea's implementation and future was left in the hands of a third person who did not share the capabilities of the two entrepreneurs. Therefore, personal involvement seems to be a significant issue. TCo3 presents a declining life course and survives mainly due to orders placed by the two entrepreneurs' main activities.

The second group of cases with ***moderate DECs (TCo4, TCo6, TCo8 and TCo9)*** presents quite the same performance regarding innovativeness and sustainability. All four companies are highly innovative and R&D intensive, devoting significant amounts to research[251]. They actually start corporate venturing relying on their strong dynamic capabilities (such as networking, NPD, collaborations, sensing and reconfiguration). However, it is highly questionable if the strong reliance on DCs hinders the development of DECs and therefore hinders the performance of venturing. Innovations turn again around application of high technology, use of value added innovative raw material, production of innovative products (TCo4 and TCo6) or on creative design combined to innovative material and high technology (TCo8 and TCo9) resulting even to patented products (TCo4 and TCo9).

Regarding the strict meaning of innovation, these cases seem to be more innovative than the ones of the first group. Still, they do not manage to overcome the rigidities of the industry worldwide, perhaps due to weaknesses in the other two axes and namely business and mainly market axe. They apply to the same customers offering wider and advanced ranges of products. Moreover, their reformation was not followed by major changes to existing eco-systems, but they were rather "adaption" to demand. **This is precisely the major characteristic of this second group; their novelties are**

[251] Which however do not reach the amounts presented in the F&D sector.

answers to already –more or less – formed needs of existing markets. Although innovative, they do not create *a priori* knowledge. As seen in the other two industries as well, T&C industry confirms the issue that devotion to technical dimensions of innovation cannot provide satisfactory competitive advantages. Furthermore, DECs have to be multidimensional and multifaceted to be really strong.

The same applies for the other two cases of **moderate DECs**; they apply to existing markets and the same groups. **TCo10** is a special case where innovation coincides with creativity and constant change. As Burke (2008) stated to the point "The constant in fashion is "change" underlining the fact that the fashion industry has rather complex aesthetic, cultural but economic dimensions as well". **TCo10** invests on creative distinctive design in order to combine art and production.

TCo5 is a case which creates a problem to solve it; the entrepreneur has positioned the company against the various types of international and multinational direct or indirect competitors and tries to create competitive advantage. Thus, while on former efforts the company was twice reformed to suit better a creative than manufacturing company it now seeks ways to create competitive advantage regarding sales and customer contact. The innovative model entails further innovation in inventory systems as well as innovative machinery. However, **TCo5**'s innovative business model has a minor impact on final consumers while it could maybe be the springboard to further differentiation.

A**ll six cases have developed strong innovation capabilities and have set bases for strong innovativeness** as proved by the innovation willingness, quality and speed they present all years after venturing. If we look again at each case we can see that **they present novelties** and more or less significant innovations at all levels **on a yearly basis.** All six present strong NPD based on design and innovation and combined with novel processes. NPD is considered the best mechanism for gaining competitive advantage, since the-time-to market for new ideas is set to fall significantly (e.g. fast fashion). This can be attributed to the fact that besides the development of moderate DECs when venturing, the companies (except TCo10) were and continued to be well-established organizations with well-developed DCs (before and after venturing). TCo10 follows since its main strategy is creativity.

It is quite notable that

- **All** companies (except TCo10) **are accomplished by technological novelties and introduce certain technological characteristics** developed either in-house or through networking, as in the other two sectors.
- **All** companies present novelties in a yearly basis. Many of them are even new to the world, in order to improve technological and process characteristics.
- **All** these ventures ***have developed rather mixed models of innovation with a focus on fashion and creative design.*** Yet, there is no real cooperation among them and universities or relevant institutes. Instead, they co-operate mainly with suppliers of raw material and machine manufacturers.

Contrary to the cases of wood and furniture sector where all innovations turn around the initial novel concept and in line with the F&D sector there is also in T&C sector a differentiation of follow-up innovations. Therefore, companies with strong DECs tend to develop various types of innovation such as R&D on by-products' exploitation, marketing innovation and organizational innovation. On the other hand, ventures with moderate or weak DECs stay trapped in innovation efforts around the initial novel concept regarding mainly technologies and processes[252] (which is in line with the literature for low-tech and more specifically textiles industry).

As in the F&D sector and in contrast to W&F, T&C knowledge-intensive ventures present some breakthrough innovation cases, such as the patented products of TCo6 and TCo9 which are supported by significant R&D expenditures as well. Yet, contrary to the F&D sector these innovations cannot alter the relative business ecologies since they just add special projects in existing markets with many other innovative ones. **TCo2** and **TCo3** are the only ones to have created a new business area at national level while simultaneously challenging at least the European relative Industry and altering the "rules of the game".

One should however mention that high degrees of innovation in all cases come primarily from "*that most intangible of all assets,* imagination/creativity" (Grunert and Traill, 1997) which is supported either by high competence in R&D (mostly in the second group of moderate DECs) or the creative design competence.

[252] Indicatively, TCo9 invested about 60.000.000 Euros on novel technologies and new machinery.

Undoubtedly, firm size remains again a major factor in determining the level of financial resources devoted to R&D and innovation activities in general.

Appropriability is considered important for the T&C sector. Secrecy (even by relevant contract in the case of TCo9), use of trademarks and lead-time advantage on competitors are most used especially by the textile industry. Three cases own patents while all cases use complexity of design. In contrast to W&F sector, the agents of T&C second group turn to rather technical innovation, flexibility and top quality than the fruits of "transcendental synthesis" as strong basis for competitive advantage. This regards mainly the four cases of established organizations with moderate DECs and can be partly attributed to their core rigidities in achieving a complete change of thinking while developing DECs. As discussed in the relevant section, the entrepreneurs are in all cases (but for the weak one) personally involved, own deepened conviction (which becomes even teleology in some cases) and develop high-level PEA; however, spaciousness remains caged in their industries covering though all the value chain which is not common for T&C sector. Transcendental synthesis is mainly reproductive[253] while bricolage and improvisational capabilities cannot escape the parent organization's path dependencies. The entrepreneurs of TCo2 and TCo7 resemble the ones of W&F sector; they believe in the strength of what we have called "transcendental synthesis": "No one can really copy the whole package". There is also a tendency not to use appropriability for machinery co-developed with manufacturers. TCo1, for example, does not benefit from the launch of the "innovative automatic settings' adjustments and variable loading features" for the automatic mixture and feed at ITMA by the machine manufacturers.

As in the cases of the other two groups, all successful ventures of the sample develop the first type of knowledge-intensive entrepreneurship; i.e. they have a more balanced emphasis on different dimensions of innovation and rely mainly but not solely on external knowledge seeking, trying to produce simultaneously product/service, process and administrative innovation. However, one can here observe the significance of design for clothing companies (TCo5, TCo7, TCo8 and TCo10)

[253] One should be conscious here. The result may be novel innovative products and even patented; but the idea synthesis is based on existing concepts by bringing back empirical intuitive business ideas (*exhibitio derivata*)

contrasting the textiles and fabric producers or the dyeing cases. Of course this is quite normal and expected due to the specific context of the T&C industry.
The weak case (TCo3) confirms the findings of the other two groups; i.e. that devotion to technical dimensions of innovation based on sole external knowledge cannot provide strong advantages, as well as that DECs when strong have to be multidimensional and multifaceted.

Thus, business scope innovations refer again to year to year investments in technology, R&D, experimentation and new product and market developments. Organizational innovations turn around processes and process improvements activities, business models and firm structure. In such efforts they do develop collaborations of different types. Therefore, there is a similar way of development to that of the other two sectors.
Therefore, it seems that the analysis of the T&C cases confirms the hypothesis 2.4 that *DECs have a positive impact on new LT-KI ventures' innovativeness.*

Initial conditions
Entrepreneurial profile: In textiles and clothing sector, there are also three categories of ventures regarding origins of entrepreneurs before venturing; the two are quite similar and the third is a type not observed among the cases of the other two groups. More precisely: established firms which applied corporate venturing (8 cases), new-to the world firms established by entrepreneurs with no family backup or former direct relation to the sector (1 case) and as joint efforts of established entrepreneurs (1 case). However, in all cases the role of the entrepreneurs seems to be significant, while the established parent firms have already a strong background and most of them are knowledge-based. This contrasts significantly the picture of the parent firms of corporate venturing in the wood and furniture sector.
It is interesting to note that most firms of this group create in-house knowledge supported by knowledge from external sources. **Human capital** is then, again, a very important factor of knowledge intensiveness including also the entrepreneurs' education and former experience as well as the quality of the teams they use in corporate venturing. It is worth mentioning that all entrepreneurs were quite different in attitude and knowledge, and above the average entrepreneur of the sector.

All case-study firms are established by agents over 30 years old with a mean of 44.1 years. Actually, most entrepreneurs are over 40 with the exception of TCo9's, who is 37. This is mainly due to the fact that the cases regard mainly corporate KIE and the fact that T&C sectors did not seem attractive for newcomers after 2000[254]. Actually, the ages range from 37 to 57 (contrasting 31 to 41 of the F&B sector and 34 to 42 for the W&F sector).

Nine out of the ten agents own a higher education degree (at least University degree) in accordance with the other two sectoral groups and confirming the fact that KIE is related to the existence of some form of higher education degree. However, there is also in this group a case of an entrepreneur **with a degree of secondary education; TCo7**'s entrepreneur who had owned the non-KI company for more than ten years before turning it to a knowledge-intensive one. We remind that similar cases were FCo8, FCo4 and WCo2.

From a rather strict point of view the entrepreneurs of **TCo2, TCo5, TCo6, TCo8** and **TCo10** own a relevant to the sector higher education degree. **TCo1's** entrepreneurs are a mechanical engineer and a marketer; both had a long experience in the subsector as CEO of an export company the first and a businessman the second.

TCo9's KI entrepreneur is the second generation, has studied economics in Greece and a master in George Washington USA where he combined the master with several courses on textiles technology. **TCo4's** entrepreneur had a University degree on Physics but had been the creator and the leader of a globally successful company for more than thirty years. **TCo3** (the weak case) is a quite peculiar one. The two entrepreneurs created the initial business idea but the actual venture creation was left at the hands of an economist, a family member with no prior experience in the sector.

Therefore, it seems that the academic and professional background of the entrepreneurs plays a significant role in all KIE cases as confirmed further by the T&C cases. Again we cannot claim that an irrelevant diploma is an obstacle to successful DECs or to the venture's success regarding survival, growth or innovativeness. Thus, according to our opinion, their impact in low-tech knowledge-intensive entrepreneurship ***deserves further qualitative and quantitative research at sectoral level and in general.***

[254] Indicatively, during the decade 2000-2010 the clothing industry presented a significant contraction with the Industrial Production Index to present an accumulated loss of -68,4% (IOBE, 2011)

A common characteristic among the cases of T&C and F&B and a number of W&F cases is that they "buy" knowledge investing in highly and relatively educated personnel: Established companies have invested in employees with a higher education diploma. Ten out of 65 employees of **TCo1** were engineers, while **TCo4** started as KIE with more than 15 engineers (seven of them were chemical engineers).

The entrepreneurs present equal **traits** as in the F&B sector such as an innovative spirit, proactiveness and entrepreneurial alertness when compared to conventional T&C entrepreneurs. In the cases of TCo2 and TCo9 they are even educated to take over the company and move forward.
A quite significant difference with mainly the F&B sector and partly the W&F one is the fact that there is no tendency of cooperation with Academia for KIE. The entrepreneurs prefer to co-operate mainly with machine and raw material suppliers or at least with research institutes, private experts and consultants.

Resource availability (both tangible as financial capital and intangible as social and human capital) appears to support the development of DECs. With eight out of ten cases to regard corporate venturing T&C cases enabled some further analysis of the role of resources. Actually the cases indicate that when resources are quite abundant, networking and contacts are easier and transcendental conditions are superior. However, the bigger and more established the companies it seems the more difficult to escape core rigidities and transcend boarders and routines. Thus, the danger mentioned at the W&F corporate cases appears to play a more significant role here; especially TCo4 presented weak improvisational and transcendental capabilities due to its commitment to established routines and a high level of teleology. On the other hand, the new venture could not escape the initial network pool and develop satisfactory bricolage capabilities. The above mentioned weaknesses appear in the other cases of moderate DECs too, at different levels. These observations confirm further Ireland et al.'s (2012) argument that "alone, financial capital is relatively less important than social and human capital for achieving and especially for sustaining a competitive advantage".
Regarding subsidies, T&C sectors studies in the middle; while the W&F entrepreneurs avoid them and all ten F&B apply and get subsidized irrespectively of

size or former status, five T&C cases apply for subsidy money. However, two of the five companies have never taken the money of the subsidy (which reached the amount of 14 million Euros) although they realized the investment. As the following years were actually crisis years for the sector, this liquidity problem led to several other financial problems for the companies. Internally, all F&B relative firms apply for subsidies besides the use of private capital.

Knowledge resources are collected through contacts and networks including almost all stakeholders of business ecosystems and regard **manufacturing, practical etc. types of knowledge**. Accumulated knowledge on textiles, weaving and knitting technology from previous experience is quite evident.

T&C sector stands again in the middle regarding the role of location of the new ventures. Actually, it seems to be important for TCo2, TCo4, TCo6 and TCo9 for different reasons. More precisely, TCo6 and TCo9's plants need to be in places with water abundance due to the nature of the processes. For TCo2's entrepreneur

> "Unfortunately, for our products Athens is Greece but we did not to place the new plant in Attica, since there are many legal and institutional difficulties and limitations. On the other hand, we should be close in order to be both close to suppliers and service providers and to our big customers as well. Furthermore, this place facilitated immediacy and better communication for the make-to-order cases which constitute a vital part of our production… And foreigners find it easy to visit us here".

Legal, institutional and subsidy reasons led TCo4 to establish the plant in a different place too. Although it was not mentioned, the author thinks that Athens was perhaps the only place for the case of TCo10 case since it can offer a significant market and it is the place where all fashion stakeholders are gathered.

However, in all cases there were several complaints on the fact that most important suppliers of both machinery and innovative raw material are abroad.

As in the cases of W&F, in 7 of ten cases in T&C sector entrepreneurs come from the place where they establish the venture. Of course the choice affects access to social and human capital too. Local players find support at bureaucracy matters, easiness in recruiting the desired human capital and contacting suppliers. This has been mainly reported in the cases of TCo1, TCo3 and TCo7.

With the exception of TCo2, no other company referred to problems to create markets due to being away of big urban centers. The author believes that this is also significant for TCo10 and at least TCo5 and TCo7. However, such problems were not mentioned may be due to the fact that these cases are situated in big Greek urban places.
Yet, in all three groups, there were certain complaints that firms away from Athens do not attract public interest regarding support in R&D, funding projects and dissemination of innovative results.

We should note that the **institutional setting** as well as ***the time of venture establishment*** was almost the same for seven cases and it was around 2000, a crucial year for T&C industry[255] survival at global level (regarding developed countries). Two cases were established in 2005-2006. **TCo3** was actually an "offspring" of two successful entrepreneurs at the time of their prospering. It would add further value to the products of their individual companies and let them enter the green energy industry. **TCo5** was actually a case of complete restructuring in order to confront costs and reform a non-defensive strategy against the negative course of the clothing sector. **TCo10** was established in 2002; it was still the time of prosperity with high fashion to pay back all costs in the domestic market and a time of opportunities for openings to the fashion capitals (i.e. most prominently New York, Milan, Paris and London).
The ten T&C cases tried to create opportunities in a saturated industry in order to resist the low-price competition by offering high-value and novel products / services difficult to be supplied by the third-world countries or secure competition against global giants such as TCo7 and TCo8.
The companies of the first group **create** strong opportunities which are dynamically translated to integrated businesses with equal development of all three axes **(***technical development of a knowledge-based innovative concept up to full scale production, high-level interaction with the market and innovative business scheme selection)*.
More precisely:
TCo1, TCo2 and **TCo7** take advantage of multifaceted knowledge (scientific, marketing, business model building etc.), former experience and global market

[255] For the reasons please refer to the sectoral review. Also indicatively http://www.tovima.gr/finance/article/?aid=159411

knowledge and innovate by offering either patented unique products (TCo2) and services (TC1) or highly differentiated products with unique characteristics (all three). Globalization and easier access to knowledge were maybe *their* "opportunities". They all create new markets at national level but avoid getting trapped within national borders with exports, while they try their products to be at least comparable to relevant ones and have specific value adding differences. Thus, the three companies have taken advantage of the motto "Think locally and act globally" and thought of creative challenges to invent sources of entrepreneurial wealth.

The firms of the second group **did try to create** strong opportunities investing in knowledge which however did not manage to be dynamically translated to integrated businesses with equal development of all three axes**.** It seems as if they did not manage to escape their past and transcend borders. They all created novelties but they did not search for new markets following their former strong customers. They manage to keep a high-value niche market at global level, survive and maintain a good ranking on sectoral and industry, in general, financial indicators.

The firm of the third group *did not manage to create* market opportunities besides the novelties that introduced and the emerging trends. It seems that the idea was not adequately developed regarding the three axes mentioned above. The company's services opened new business areas and niche markets but they did not manage to gain their real value in the market.

In all cases, the excellent knowledge of the sectoral and broader entrepreneurial landscape as well as dynamic capabilities implementation could easily locate general weaknesses which were not yet globally questioned (e.g. new properties for yarns or more concern on ecology).

Revising the initial conditions of the ten T&C knowledge-intensive cases, we could suggest that the DEC development in this low-tech industry depends in major ways on both tangible (e.g. financial) and intangible (human, social, knowledge) capital, as well as the personal traits of the entrepreneurial team which form the new firm's informal culture since the very beginning. Confirming further the findings of the W&F cases it is quite obvious that in case of corporate venturing DECs are better

organized and less human-centric and they seem to be affected by the existence of dynamic capabilities**.** Therefore, **it seems that KIE development through the development of DECs should be handled with care in cases of corporate venturing while it seems to be easier in cases of nascent KIE.**

Before summing up the impact of DECs on certain corporate parameters, we should mention that all cases again have differentiated to a large extent than the average of the sector. The reader should bear in mind or read again the sector description; although T&C sector was highly developed, firms used to be passive receivers of technology while innovativeness and NPD were quite rare. Textile industries reacted to changes in the late '90s with investment in equipment and automatization in order to cut down costs, while clothing industries failed to react creatively; there was only a mass transfer of the productive units to neighbor countries for cheaper labor[256]. However, a significant number of companies closed down (e.g. around 5.500 firms in the time period 1995 to 2008).

According to the findings of the ten T&C cases, the following observations can be stated:

a) Regarding KIE

Obs. 1: In traditional low-tech sectors and at least in the T&C industry, knowledge-intensive entrepreneurship is characterized by a balanced emphasis on different dimensions of innovation combining harmonically external knowledge seeking to in-house R&D

Obs. 2: In traditional low-tech sectors and at least in the Textiles and Clothing industry the focus on only the technical dimension of innovation relying on only external knowledge affects in negative ways new-to-the-world knowledge-intensive ventures.

b) Regarding DECs

[256] This labor force, however, was not specialized for the demanding work. In 2012 many companies return in Greece both due to the bad quality produced in Balkan countries and due to the fact that cheap labor can be also found in Greece (indicative daily wage for 10-hour work around 12 Euros).

Obs. 3: In traditional low-tech sectors and at least in the T&C industry agents need to develop the whole set of DECs, which are actually interacting among them, to start viable and successful ventures with strong initial competitive advantages regarding survival, growth and innovativeness.

3a: Moderate DECs (i.e. at least one *not* strong DEC) lead to weaknesses regarding survival, growth, or innovativeness of traditional low-tech sectors and at least in the T&C industry.

3b: Moderate DECs do not hinder the development of knowledge-intensiveness of traditional low-tech sectors and at least in the textiles and clothing industry.

The analysis also revealed further that **initial conditions** at personal / firm level affect the development of DECs and impact new venture's survival and performance. Therefore, the following observations can be stated:

Obs. 4: DECs presuppose certain levels of tangible and intangible resources. Financial, social and human capital affects DECs and their development and subsequently their impact on new venture performance. DECs seem to be tightly related to knowledge assets and knowledge exploitation. They presuppose certain high levels of education and former entrepreneurial / managerial experience with high involvement in similar activities and a deep and overall knowledge of the entrepreneurial landscape by the entrepreneurial teams.

In cases of corporate venturing, however, the development of DECs should be handled with care avoiding the danger of core rigidities and teleology.

In general, strong DECs presuppose at least a higher education degree, former experience, high involvement in similar activities and a deep and overall knowledge of the entrepreneurial landscape

The analysis of the T&C case studies **confirmed the second hypothesis**. More precisely:

Confirmation of Hypothesis H2.1 for T&C cases: DECs have a positive impact on new LT-KI ventures' competitive advantage, affecting the level of changes and challenges that these ventures bring to their business ecosystems

2.1a: Strong DECs produce strong initial competitive advantages which cause major changes in their business ecosystems

2.1b: Weak DECs produce weak initial competitive advantages which however cause some changes or challenges in their business ecosystems

2.1c: Among DECs, transcendental capabilities are mainly the ones to affect in major ways the initial competitive advantages and the changes they cause to new ventures' relative ecosystems.

Confirmation of Hypotheses 2.2 and 2.3: New knowledge-intensive low-tech ventures of the T&C sector with DECs are more likely to grow

2.2-3a: Strong DECs have a positive impact on survival and growth

2.2-3b: Weak DECs have a negative impact on survival and growth

Confirmation of Hypothesis 2.4: New knowledge-intensive low-tech ventures of the T&C sector with DECs are more likely to innovate. Actually, DECs curve the innovative behavior of the new company.

2.4a: Strong DECs have a positive impact on innovative performance both at start-up stage as well as later

2.4b: Weak DECs have a negative impact on innovative performance, especially after the initial innovation

7.5 Sub-section 4:

Hypothesis 3: DCs exist in new LT-KI firms and DECs constitute their entrepreneurial side

7.5. a) Introduction

How can new LT-KI ventures overcome resource base weaknesses and evolve?

Within the present research, data analysis revealed significant indications of the existence of dynamic capabilities in the investigated newly-established firms and corporate cases, as evidenced by the frequency of references to various DC elements discussing the life-course of the firm, **despite the fact that only one question asked in the interview probed this area in a direct way.** The consequent analysis of the thirty cases under the new DEC framework and in combination with the observed DCs -at least at the time of the interview - served then as a basis to investigate potential links among DECs and DCs. More precisely, at this stage the analysis focused on:

I. the detection of key activities linked to the three micro-foundations of DCs as described in relevant literature. Although there were not specific questions on the issue, the narrations of the interviewees were quite rich and allowed for this investigation regarding the life course of the firms till the day of the interview.
II. the exploration of potential relations among the dimensions and sub-dimensions of the dynamic entrepreneurial capabilities and the dynamic capabilities.

Although the study is not a longitudinal one, the long narrations of the interviewees for the new ventures course since establishment and till the day of the interview allows for a first approach of the DC existence and creation issue regarding low-tech but knowledge-intensive firms.

The analysis is further based on two assumptions:

1) The capabilities that stand out as the most relevant in the very early stage of firm development belong to entrepreneurs or entrepreneurial teams and therefore the described Dynamic Entrepreneurial Capabilities
2) Knowledge *is* a main strategic resource. The ways that firms search or scan for knowledge, and the ways of use, combination or new knowledge creation and

its implementation in practice are related to dynamic capabilities and the achievement of a competitive advantage.

We also assume that the decision to develop DCs is again human-centric. In this sense, to develop DCs, first, **environment must be changing, and then, actors must perceive the necessity for adaptation processes** (e.g. Eisenhardt and Martin, 2000; Helfat et al., 2007). This is obvious or expected as our cases have indicated; not all entrepreneurs had the necessary skills to scan the competitive environment, or even perceive environmental conditions in the correct way, resulting in inadequate strategic decisions for adaptation (for example the cases of WCo7 or TCo4) and therefore with significant impact on the development of DCs.

Our work so far indicates that DECs can provide the knowledge-based resource foundations for the initial competitive advantage of a new venture. On the other hand, DCs reflect 'the capacity of an organization to purposefully and systematically create, extend or modify its resource base' (Helfat et al., 2007, p.4) and can "explain the sources of enterprise-level competitive advantage over time" (Teece, 2007, p. 1320). A firm's resource base includes tangible, intangible and human assets such as labor, capital, technology, knowledge, property rights, and also the structures, routines and processes needed to support its productive activities. Thus, while the creation of resources regards the very first need of turning a business concept to a new venture within DECs, 'creating' a resource reflects DCs which include obtaining new resources through acquisitions and alliances as well as through innovation and entrepreneurial activity. In addition, while DECs support the set-up within a certain context, it seems that the extension of a firm's resource base is quite necessary even since the early years of company life to promote growth in an ongoing business. In the same vein, the ability to 'modify' the resource base covers any reaction to change, e.g. a response to external environment shifts, and may entail certain levels of the improvisational capability.

A number of iterations of the KI-LT case studies analysis revealed **links between DECs and DCs** and more precisely links among the dimensions of bricolage, improvisational and transcendental capabilities and the micro-foundations of sensing, seizing and reconfiguration. This indicates than DECs may then be embedded in certain DC dimensions or otherwise DECs provide entrepreneurial "rules" which turn

to managerial dynamic "routines" following Casson (2000) who tries to connect the entrepreneurial behavior to the managerial implementation. Within a knowledge-intensive context, DECs seem to lay the foundations and interfere with some of DCs' dimensions; they also seem to play a role in the subsequent development of (i.e. strong or weak) DCs. As there is no consensus so far on a model to explain the process of DC generation, we adopt a combination of the two broad views on capability development and suggest that dynamic capabilities' development is emergent and gradual (Helfat and Raubitschek, 2000; Galunic and Eisenhardt, 2001); they are actually built up from repeated interactions over time (Ethiraj et al., 2005) but also developed deliberately and strategically (Winter, 2003) building on prior capabilities and skills and therefore, according to our suggestion, on DECs.

Consequently, we assume that DECs can be the media to transform human-centric skills, entrepreneurial features and entrepreneurial capabilities to firm-based processes which will constitute the core of the new firm's dynamic capabilities. Following the quote of Casson[257] (2000), DECs provide the "rules" (and are therefore "entrepreneurial") while DCs provide their implementation (and are therefore dynamic "routines"). Under these circumstances, DCs do not essentially transform the firm's resource base, but mainly support its adaptive change.

We should however mention once again that the findings regard only low-tech but knowledge-intensive cases.

7.5 b) Some theoretical aspects

In order to capture firms' activities linked to the dynamic capabilities, Teece's (2007) framework was engaged and more precisely the capabilities (1) to sense and shape opportunities and threats, (2) to seize opportunities and (3) to maintain competitiveness through transferring and reconfiguring the business enterprise's intangible and tangible assets. More precisely, DC dimensions adopted (Table 7.17), followed relevant work of Protogerou, Caloghirou and Liukas (2005, 2008), Protogerou et al. (2012), Teece (2007, 2011) and Helfat and Peteraf (2009). Therefore, sensing capability is described by:

[257] Casson (2000), "rule making is entrepreneurial, but rule implementation is routine".

Market and technology sensing: it reflects the firm's ability in "noticing and monitoring changes in operating environments, identifying new market and technological opportunities, probing markets and listening to customers" (Teece, 2007). It regards mainly sensing of markets and technologies. More precisely, market-sensing involves understanding and responding to market intelligence (Pavlou and El Sawy, 2011). Technology sensing entails processes of learning and understanding technology developments in the business environment in order to respond to technological changes in its environment.

New product development capability regards the capability to offer novel products, adapt products to the specific needs of different customers and market niches, and to actively promote and market the developed products/services. It can be R&D-driven or market driven or even a combination of the two in order to enter new market segments and stimulate customer demand (von Tunzelmann and Acha, 2005). It is been closely associated with dynamic capabilities (e.g. Eisenhardt and Martin, 2000) and a key source of sustainable competitive advantage (Teece, 2007). NPD can be assigned to both sensing and seizing capabilities; according to Teece (2007), it can be thought as a form of "search" for new products and processes, while it is also a way to address opportunities sensed.

Networking capability refers to the formation of mutually beneficial personal or business relationships in order to expand and accelerate the exchange of information and knowledge, discover and control of opportunities, or even for financial and institutional support (Caloghirou, Protogerou and Karagouni, 2014). Networking may be related to distribution channels and marketing, exports or market research on market shifts and customer needs, and the establishment of best practice techniques in advertising and promotion. On the other hand, networking may regard technology collaborative agreements and more precisely common R&D and development of new products/services, machine and new production technology co-development and even operations management. Collaborations can be also developed on the basis of product promotion, cost minimization and market segment expansion. "R&D and technical cooperation agreements in particular have become a strategically important part of business decision-making in many industries in recent years in both high- and low-tech sectors. They include any agreed-upon cooperative R&D or technology arrangements between firms, such as joint ventures, technology partnerships and

informal networking arrangements" (Caloghirou, Protogerou and Karagouni, 2014, p. 147).

Seizing capabilities regard mainly investment in the opportunities sensed by improving technological and marketing competencies and by expanding their resource bases. Besides "investing heavily in particular technologies and designs" (Teece, 2007) *seizing* includes also "designing business models to satisfy customers and capture value, secure access to capital and the necessary human resources. Companies that successfully build and orchestrate assets within their ecosystems stand to profit handsomely" (Teece, 2011).

Reconfiguration capability reflects the firm's ability in achieving evolutionary fitness through the recombination of assets and the change of organizational structures as the company grows, and markets and technologies evolve (Teece, 2007). Knowledge management constitutes a core micro-foundation of Teece's (2007) reconfiguration capability including learning, knowledge transfer and integration as well as property protection. Transforming capabilities are needed when radical new opportunities are to be addressed or even periodically to soften the rigidities that develop over time (Teece, 2011).

49**Table 7.17: Nature of DC dimensions and activities linked to DCs**

DC dimensions	Nature	Key firm's activities linked to DC
Sensing (shaping) opportunities and threats	Organizational ability to scan, filter, monitor, assess, create, learn, interpret, figure out and calibrate opportunities and threats	Probing and re-probing the information • Market sensing (customer feedback, processes of market-shift recognition) • Technology sensing • NPD - Investment in research activity (R&D) • Networking/ participation in collaborations
Seizing Opportunities	Organizational ability to address potential opportunities through new products, processes or services	• Selection of the physical technology • Design of the business model • Recruitment of suitable human capital • Access to capital
Reconfiguration	Reconfiguration of assets and organizational structures as the environment changes	• Business model redesign • Asset realigning • Routines and processes redesign • Knowledge management

Sources: Teece (2007, 2011), Protogerou et al (2008, 2011), Helfat and Peteraf (2009)

As discussed in the relevant chapter (2.2.4.1 d), there is an on-going debate on the existence and importance of DCs for the creation and evolution of new ventures. Indicatively, Teece (2010) called for studying 'entrepreneurial management' to understand how sensing and seizing opportunities arise. According to our view, dynamic entrepreneurial capabilities seem to be rooted in entrepreneurial human capital, social capital and knowledge. Entrepreneurial human capital refers to entrepreneurs' skills based on education, training, and expertise and social capital to social relationships that entrepreneurs maintain, including internal and external networks. On the other hand, knowledge includes both areas of scientific, practical, technical and other types of sectoral or intersectional knowledge assets as well as the entrepreneurial cognition which regards beliefs and mental models that serve as a basis for decision making (Adner and Helfat, 2003). Moreover, DECs seem to create (in cases of nascent LT-KIE) or completely alter and restructure (in cases of corporate LT-KIE) the resource base and appear to become ultimately repeatable both during the whole process and all stages of venturing (from first hint of the new venture, up to the first production and first sales) as well as when KIE comes up again (corporate cases). **This fact may allow us to qualify them as dynamic**, according to the relevant suggestions of Helfat and Peteraf (2003).

Among DCs both sensing and seizing seem to be closely related to DECs. Even by definition sensing involves the identification and conceptualization of opportunities both within and beyond prevailing technological paradigms (Teece, 2008) and is regarded an entrepreneurial activity (Teece, 2010, Chap. 16, p. 695). *Sensing* opportunities involves scanning, interpretation, and learning across technologies and markets, both "local" and "distant" (March and Simon, 1958; Nelson and Winter, 1982). While sensing regards mainly "exploration", *seizing* refers to "exploitation"; opportunities require investments in development via further creative and/or combinatorial activities (Teece, 2007). The process of *reconfiguration* addresses the opportunity-sensing and refers to the transformation and recombination of assets, routines and resources, since "over time the firm still needs to periodically consider (and reconsider) its own "fit" to the opportunities it plans to exploit" (Teece, 2010). It also involves the generation of new combinations of existing knowledge (Grant, 1996).

Generally, in DC literature, knowledge utilization is an essential DC process; DCs connote renewal, while new or enhanced knowledge is regarded as a crucial element (Eriksson, 2013; Macher & Mowery, 2009). According to Pandza et al. (2003, p. 1028), ‘‘the process of how a firm acquires its capabilities cannot be separated from how it acquires its knowledge.’’ Thus knowledge appears to be a significant link between LT-KIE and DCs, since a focal issue in LT-KIE regards the creation and adaptation of the new venture's resource base (Protogerou and Karagouni, 2011) with knowledge assets to be a core part of them. Therefore, according to our hypotheses, an important role of DECs is to enable the collection and combination of diverse distributed knowledge bases in accordance with relevant literature (Bender, 2004; Hirsch-Kreinsen and Schwinge, 2011; Robertson and Smith, 2008; Smith, 2002).

Low-tech but knowledge-intensive entrepreneurs of the examined cases were found indeed keen to set specific problems, question existing knowledge and seek different and complementary information and knowledge within other sectors (both high and low-tech ones). This was mainly done due to the developed **bricolage capabilities** and more precisely, the

- *Repertoire building* which entailed the dimensions of problem-making, ‘resourcefulness’, creative resource recombination and interactive learning
- *Concentric cycle networking* which entailed the dimensions of networking (based on an initial network pool) and participation in collaborations

As many times repeated, the role of *resources* and their combinations is quite critical in DC theory. Alexander McKelvie, and Per Davidsson (2009) argue that resource endowments are critically important for new firms and that the development of dynamic capabilities is a likely mechanism for their performance effect. Literature has also dealt with resources impact on dynamic capabilities (cf. Sirmon et al., 2007; Kor and Mahoney, 2005; Teece, Pisano, and Shuen, 1990). Teece (2010) further argues on the effective coordination and alignment of assets, resources and competences.

In addition, it has been suggested that the integration of diverse knowledge bases happens primarily through *problem-solving* activities (Iansiti & Clark, 1994) which constitutes problem solving a key aspect of DCs (Eriksson, 2013). Lately, Helfat and Peterson (2014) have included problem solving in their Managerial Cognitive Capabilities and micro-foundations of DCs" as a capability that provides foundation

for *seizing* since it underpins business model design as well as the capacity for making sound strategic investments.

Learning has been also widely considered the foundation for DC creation and development (e.g. Ambrosini et al., 2009; Grant, 1996; Nielsen, 2006; Zollo and Winter, 2002). This is due to the fact that learning mechanisms are able to modify existing knowledge to adapt organizations to their competitive environments (Chen et al., 2010; Li and Tsai, 2009). Learning has been considered as a dynamic capability itself, rather than an antecedent of it; it has actually been identified as "a process by which repetition and experimentation enable tasks to be performed better and quicker" (Teece *et al*., 1997, p. 520). It has been also regarded as one of the four main processes that comprise DCs: reconfiguration, leveraging, learning and integration (Bowman and Ambrosini, 2003 based on Teece *et al*., 1997). Learning assists in the reconfiguration of 'resources at hand' (Miner et al., 2001). Bricolage capabilities together with improvisation and trial and error learning enable new ventures to overcome specific problems as well as to create or respond to new opportunities. As LT-KI ventures grow, they are more likely to develop substantive R&D facilities and engage in formal experimentation (Baker et al, 2003).

On the other hand, *networking and participation in collaborations* are known as significant dynamic capabilities as it has been discussed in detail in literature review. CCN secures that the actors concerned (i.e. the entrepreneurs and the center of the network cycle) have some knowledge of each other (if not personal, then at least through others), which implies trust (e.g. Gulati, 1998); this according to Paine (1963) matters even for a successful enactment of the role as entrepreneur.

In general, **bricolage has been connected to DCs in several ways.** It has been even considered an essential dynamic capability in new technology-based firms by O Jones, Macpherson and Jayawarna (2011) who suggested bricolage as a core process for the acquisition, reconfiguration, integration and exploitation of resources to establish NTBF growth. Boccardelli and Magnusson's (2006) study also showed that new ventures used bricolage in resource acquisition and deployment which were not described by existing models of dynamic capabilities. The concept of bricolage as a purposeful activity for new resource combinations has been also received with a Penrosian view of idiosyncratic solution creation in order to lead to growth.

Therefore, the articulation of bricolage in order to assist firms both explore and exploit new opportunities (Baker and Nelson, 2005; Miner et al, 2001) resonates with the DCs literature and we expected to find:

strong links among bricolage and dynamic capabilities, with a number of dimensions to be embedded in relevant routines.

Furthermore, elements of the improvisational capability have been also found to be related to the concept and micro-foundations of DCs in literature. According to our hypotheses the dimensions of the **improvisational capability** are the following:

- *Information Flowing* which refers to the ability of real-time information and communication, flexibility and experimental culture
- *Provocative organizational competencies* which regard the absence of adequate routines, low procedural memory and minimal structures

Improvisational capabilities have their origins in individuals, as discussed in the relevant chapter and as considered in relevant literature. However, they are also found in groups and organizations (e.g. Eisenhardt and Tabrizi 1995; Kamoche et al. 2003; Pavlou and Sawy, 2009). As Weick (1998) explains, improvisation is "a patterned, conscious, and deliberate activity that is repeated in response to novel situations and can be enhanced with practice". Ciborra (1996) regards improvisation as a significant ability to generate new combinations of resources to address turbulent environments. Moorman and Miner (2001) explain in the context of NPD that improvisation can turn into a capability.

Among the above mentioned dimensions, real-time information and communication enable knowledge sharing; this dimension is then found embedded in the relevant sensing processes and therefore can be regarded a prerequisite of DCs in accordance with literature (e.g. Bergman et al., 2004; Kale and Singh, 2007). Flexibility has been also regarded as a capability for organizational change and has been suggested as a prerequisite of all DCs in firms of all sizes (e.g. Eriksson, 2013; Judge, Naoumova, & Douglas, 2009). On the other hand experimental culture has been often related to NPD (e.g. Crossan, Cuhna and Vera, 2005; Moorman and Miner, 1998).

Therefore, the literature has confronted improvisation as a deliberately developed capability for accomplishing reconfiguration and change, (e.g., Crossan et al. 2005). According to Pavlou and Sawy (2009), improvisational capabilities are consistent in

spirit with the competitive dynamics and hyper-competition literatures. The authors make a clear distinction between improvisational and dynamic capabilities; they claim that while dynamic capabilities regard "the ability to learn, adapt, change and renew over time", improvisational capabilities are first-order capabilities which refer to the ability to "recognize the intrinsic value of other resources or to develop novel strategies before competitors." They characteristically claim that *dynamic capabilities are suitable for "waves" and improvisational capabilities for "storms".*

In the same vein, following Teece's (1997, 2007) definition, DCs involve also managerial processes which at the founding stage are mainly entrepreneurial ones according to Boccardeli and Magnusson (2006) before being replaced by organizing principles. This is in accordance with our suggestion that improvisational capabilities are dynamic entrepreneurial capabilities which have an emergent and loosely structured nature to act upon emerging opportunities with spontaneity and intuition. They are more likely to occur in the early stages of the new venture, when routines and resource configurations are yet to be institutionalized.

On the other hand, dynamic capabilities are of a more structured, stable, and disciplined nature, relying on formal planning by stressing "disciplined flexibility" (Pavlou and Sawy, 2009). According to Eisenhardt and Martin (2000), only in high-velocity markets, they take on a different character becoming "simple (not complicated), experiential (not analytic), and iterative (not linear) processes. The authors call them then "improvisational processes" (Eisenhardt and Martin, 2000, p. 1113). Therefore, it seems that there are certain relations among DCs and improvisational capabilities and more precisely, we expect that: ***certain dimensions will be found embedded in processes while others will be transformed or become idle until the next KI-venture.***

The second case is expected to be found in LT-KI corporate venturing and regards all DECs; "dormant" capabilities are expected to emerge again when venturing is undertaken. For example, real-time information and communication seems to be embedded in sensing, while flexibility and experimental culture are important at least in NPD and technology adaptation. On the other hand, the ability to unitize *anew* knowledge-intensive entrepreneurial efforts achieving low procedural memory and minimal structures or escaping existing routines are capabilities that seem to stay idle

until they are needed[258]; this can be a case of a new venture or even an R&D project or another type of company or department restructuring.

According to Moorman and Miner (2001), organizations engage in improvisational actions reflecting a repeated capability to engage in effective improvisational actions with valuable outcomes. Furthermore, several scholars argue on the significant role of bricolage and improvisation on sustaining the renewal and reconfiguration of the resource base of an organization (e.g. Baker et al., 2003; Jones, Macpherson and Jayawarna, 2011). Baker and Nelson (2005) emphasized firms, in comparison to entrepreneurs, as agents of entrepreneurial bricolage. These creative processes provide potential solutions for environmental changes and/ or specific opportunities identified by management (Miner et al, 2001, Katila and Shane, 2005).

Therefore, existing literature seems to justify a transition from entrepreneurial and loosely-structured to more planned and formal processes. Furthermore, in all LT-KIE cases, DECs regard mainly knowledge together with the other kinds of resources. Thus, the capacity to absorb and make use of new knowledge is contingent on what individuals, entrepreneurial teams or organizations know and can do (Cohen & Levinthal, 1990). This seems to turn out as rigidities in terms of routines, procedures, and processes (Brown & Duguid, 2002; Cohen & Levinthal 1990). Since organizations tend towards formalization (Duymedjian and Rüling, 2010), we would argue that embeddedness of certain DECs' dimensions in DCs was rather expected. On the other hand, retention of DECs may be useful in order to identify individual's knowledge and experience, and sometimes ensure organizational legitimacy and visibility, or even create opportunities for learning from trial and error. DECs –idle or not – may constitute an interesting alternative to the rigidities and other dangers due to formalization.

As evident in the above section, sensing and seizing in LT-KIE involves cognition and therefore processes to acquire knowledge about, and understand technology, science and market developments in specific business environments. The research revealed that new ventures originated from the cognitive capacity of individuals while spin-offs and SBUs were results of the organization's strategy and culture although

[258] This is due to the fact that "commitment to existing processes, assets, and problem definitions makes this (i.e. change) extremely hard to do, especially in a firm that is currently performing satisfactorily" (Teece, 2010, Ch 16.) as we have discussed above.

driven by certain individuals' decisions. It seems that **individuals who start ventures are themselves sources of the dynamic entrepreneurial capabilities** which in turn are precursors of the dynamic capabilities to better fit into shifting environmental conditions. DCs then are developed as market changes, business ecosystem changes and the competitive positioning of other companies evolve, threatening the firm's existing position.

In a nutshell bricolage and improvisational capabilities help actors (individuals or firms) both explore and exploit new opportunities that might otherwise be too expensive to investigate by more traditional means (Baker and Nelson, 2005; Miner et al, 2001; Newey and Zahra, 2009). However, opportunities are created and directed according to our theory by the transcendental capability (TC). The birth of new conceptual artifacts and structures in the intersection of knowledge and transcendentalism is not novel in literature (e.g. Jantsch, 1980; Nonaka and Toyama, 2003). Todd et al. (2013) argue that firms serve as vehicles for entrepreneurs to materialize their imaginative mental acts in order to "disrupt markets and drive them away from equilibrium". According to our suggestions, **the transcendental capability is a purely dynamic entrepreneurial capability of strategic nature which drives and directs the other two DECs.** A main question then was whether it was embedded in DCs or otherwise, the identification of dimensions of the transcendental capability within DC micro-foundations and more precisely the role of elements regarding

- Panoramic ecosystem awareness (PEA) and sense of spaciousness *(transcendental conditions)*
- Receptivity, spontaneity and judgment *(transcendental synthesis)*

As a strategic DEC, TC is responsible for strategic decisions; therefore differences in DECs lead to differences in entrepreneurial decisions.[259] According to our framework, PEA regards mainly the level of entrepreneurial cognition of the inter-sectoral business ecosystem view (starting with the specific industry and expanding to areas defined by the actors) and the level of perception of changes. Therefore,

[259] We remind the bipolar cases of ventures with the same types of raw material and product but completely different entrepreneurial directions.

entrepreneurial decision-making seems to be connected to entrepreneurial cognition, beliefs and mental models. This is in accordance with early research on the cognitive basis for decisions (e.g. March and Simon, 1958; Cyert and March, 1963) and the later development of the dynamic managerial capabilities by Adner and Helfat (2003). Studying the U.S. petroleum industry from 1977 through 1997 the authors introduce the concept of dynamic managerial capabilities to underpin the finding of heterogeneity in managerial decisions and firm performance within changing external conditions. The authors claim that "Strategic decisions at the top of an organization do not emerge from a disembodied decision- making process—managers make these decisions". In accordance to this view, we suggest that ***PEA provides the basis*** for creating a broad field of vision, "selective perceptions and interpretations" (Huff, 1990) and therefore ***PEA is a prerequisite for sensing dynamic capability:*** Developing PEA, entrepreneurs of deepened conviction purposefully collect and translate information, finding connections among different input from a broad field transcending sectoral limits; in the same vein, sensing capability regards the ability to constantly scan, filter, monitor, assess, create, learn, interpret, figure out and calibrate opportunities and threats. This is in line with literature; according to Leybourne and Sadler-Smith (2006), high self-confidence of leaders is related to the ability to require sufficient information pertaining to the firm's external environment and internal organization as well as the ability to effectively process that information. Thus, PEA requires feedback loops regarding information and knowledge collection and process which start from individual iterative processes to end up in structured routines of sensing. While PEA is a matter of the entrepreneur, it is unstructured but purposeful and depends heavily on the individual, sensing is then structured and planned and by the time it becomes quite undependable from the individual entrepreneurs.

The same goes for spaciousness as well; it has been described as a precondition of possibility for entrepreneurs to become aware of the existence of empty "spaces". This is however the role of sensing: the identification and assessment of opportunities and thus "empty spaces". Therefore, it seems that ***spaciousness can be considered a prerequisite of sensing.*** In cases of limited spaciousness sensing may be limited too; according to Augier and Teece (2009) managers may lack full information about future events. Spaciousness may be considered the ability to "prepare the ground" of

the new venture. For example, investigating dynamic capabilities through the conduction of strategic firm's activities in a turbulent foreign market, Cao (2011) specifies that foreign companies invest heavily in market sensing before entering Chinese markets while after entrance they go on with relevant processes.

On the other hand, receptivity and spontaneity denote the "capacity for receiving and elaborating data". In other words they regard the ways and processes used of sensing, retrieving and storing data and information, their mechanisms to process them and combine them with relevant resources in order to produce specific concepts. Their functions indicate that ***receptivity and spontaneity may form the initial basis of sensing dimensions.***

In the context of the dynamic capabilities, the ability to integrate and combine knowledge is a core skill (Kogut and Zander, 1992; Grant, 1996 in Teece, 2007). *Transcendental synthesis* as a simultaneously bottom-up and top-down information processing capacity may encourage the formation of embedded systems of knowledge, open innovation and cospecialization management through coherently organized multifaceted information-processes. For example, it appears that it is transcendental synthesis that underlies the ability to identify needs and opportunities to invest in cospecialization assets, a fundamental ability to dynamic capabilities according to Teece (2007). Transcendental synthesis can supply combinations that fuse or mediate between the two fundamentally different and original domains of opportunity information.

According to the developed framework, transcendental synthesis is comprised of both individual capacities and analytical systems (formed later in the company's lifespan) to sense and learn, filter and shape opportunities. It is also a fundamental driving force of the continuous alignment of tangible and intangible assets and knowledge management which constitutes the heart of the reconfiguration capability within knowledge intensive frameworks.

Especially regarding its second sub-dimension, i.e. judgment, according to our framework, we suggest that ***it is a prerequisite of seizing capabilities*** since it regards the "coordination of scarce resources" (Casson, 1982). Exploring the psychological foundations of DCs and building on relevant insights from literature (e.g. Dane and Pratt, 2007; Gavetti, 2005; Lieberman, 2000), Hodgkinson and Healey (2011) argue that **judgment** *does* constitute a *necessary* component of dynamic capabilities.

Therefore, we suggest that **DECs are the antecedents of DCs**; some of their dimensions may be embedded in DCs, some may be major prerequisites, ***while others will be transformed or become idle until the next KI-venture.***

Once the organization tries a new venture again, all DECs appear to become more autonomous and able to deviate from processes and mechanisms. They enact dynamic processes in which both individual transcendental thinking and group coordination challenges are at a constant interaction within the broader context of an uncertain business environment. In this framework, dynamic capabilities spring and evolve in a non-sequential order, avoiding proclivities imposed by described processes which may cause delays and obstacles or high uncertainty on decision making. New corporate venturing may be a result of, and a decision based on reconfiguration (as seen in many of the T&C cases) and may create even new "turbulent environments" although in low-tech sectors. Quoting a relevant example from literature we could refer to the unprecedented success of dry beer which created a "turbulent environment" (Turpin et al., 2002, p. 13) for beer makers; they began to look forward to the "after-dry" era—each with a different vision of the kind of product future consumers were likely to favor (Turpin et al., 2002, p. 13). This leads to the assumption that DECs support the fact that every opportunity has an object and -in turn- can become the object of another opportunity starting anew the sensing process.

Since DECs are present in LT-KI venturing, their dimensions are expected to be found mainly within sensing and seizing capabilities. Some of them can be even be the two sides of the same coin. After all, as Augier and Teece (2009) state "the role of the entrepreneur and the manager overlap to a considerable extent". It may be that the sensitivity of new ventures in external environments needs to be developed by entrepreneurs, who obtain knowledge and resources through networks or the enterprise information system, and further spread the knowledge and resources within their new venture in order to realize the positive effects of an opportunity - sensing capability (Patzelt, 2010).

7.5 c) Sectoral approach

7.5c1) Wood and furniture sector

The main and common feature of the **W&F firms** is their focus on the domestic market which seems to affect DCs development as well. Actually, the case firms' dynamic-capability profiles appear to be related to the level of DECs' development. And more precisely:

All new firms of the **"big five" group with strong DECs** revealed the presence of strong Dynamic Capabilities as well:

The nascent company **WCo8** which had developed strong DECs, presents diverse strong DCs at the time of the research (10 years after establishment) which, according to the interviewee, are deliberately and consciously developed (DECs and DCs are presented in Tables A13-A15, Appendix A). *Sensing* is the strongest one, followed by *seizing*. *Market sensing* is exercised by developing processes of customer feedback and market-shift recognition. Statistics provided by ICAP are combined with other sectoral studies and sectoral journals monitoring European trends and regular visits to international trade shows, benchmarking and best practices adapted by three leading Italian kitchen manufacturers. There is a well-organized "Creative Department" where processes focus mainly on novel and creative design. *Technology sensing* regards searching for, and probing innovative elements (such as kitchen mechanisms and materials), as well as novel technology details to enhance value. Occasionally, there was some joint research on process technology but cannot be regarded as a regular process of the company.

> "We invest heavily in new products, innovative raw material, mechanisms, and the innovative combinations in general. We go more deeply into creative design. I am personally involved in it. This is the policy that shapes the culture of our company and the attitude of our members: we have to be always in front of the others regarding innovative design"

Networking regards contacts mainly with raw and supplementary material suppliers and B2B customers such as architects and decorators. Collaborations extend from appliances manufacturers to decoration journals. The company gets well out of the conventional value chain of Greek kitchen manufacturing, at least, with extreme design (e.g. kitchen furniture completely out of recycled aluminum with a quite exceptional modern style) and use of innovative material (e.g. first to use the Corian innovative material and train installers and Egger melamine). The entrepreneur is a

member of many associations. He is the Greek consul in Lithuania and the youngest member of the Federation of Industries of Northern Greece (FING). *"Of course I have used my contacts, my knowledge and my skills to promote my company so far"*

We remind that in the case of **WCo8**, the entrepreneur had developed dynamic CCN starting from a strong initial pool; this seems to be gradually evolving in high-level networking.

Seizing comes with the selection and investment in physical technology to correspond to the novel material or the added value; e.g. the novel dyeing installation or the Corian use entailed equipment and new personnel hiring and training. The entrepreneur chose to start with the segment of high-upper kitchen market in Northern Greece and extended to the rest of Greece later. Still, it was his own decision not to export, being loyal to his motive "think globally, act locally" from the very beginning. He invested in building and keeping a strong brand image following the policy of the venture creation. No transformation processes were mentioned. The size and partly the age of the case (since foundation) may explain why *reconfiguration* is not evident.

The four parent companies of the corporate ventures (of the big five group) provide some further observation on the revitalization of DECs, since they all owned DCs before the venturing[260]. Actually, we can distinguish two categories of cases in corporate venturing:

In the cases of WCo2 and WCo10, DECs were developed without being dominated by the organization's initial DCs. They are free from routines while constant improvisation and transcendentalism are evident. The entrepreneur of WCo2 states it quite clear:

> "I believe in constant development. Every new piece (explanatory note: new venture or SBU) is unique for me. It is quite wrong to mix the habits of your mother company with the new one. This is why I choose new, "fresh" members for the new companies. These people have a different attitude; they are not boxed in the everyday routine of the mother company"

Yet, the new ventures' dynamic capabilities (as they appear in Tables A13-A15, Appendix A) follow different paths in these two cases:

[260] Information derived by discussions with sectoral experts and contacts with the four cases.

- ***In the case of WCo2***, DCs become "micrography" of the organization's relevant capabilities; e.g. there is no separate R&D or market identification administrative team, while processes especially for seizing are directed by the mother company.
- ***In the case of WCo10***, Dynamic Capabilities became stronger with a wider range of application. The company renewed and expanded the content of almost all micro-foundations avoiding the danger mentioned by Winter (2003) and Eisenhardt and Martin (2000) of DCs to "become increasingly routinized and codified, loosing dynamism and leading to the decay of the competitive advantages". Instead it managed to broaden scope and after some years it started exports and became global under a strong ecological image.

The other two parent companies of the strong-DECs group owned strong DCs before venturing. Both cases (WCo6 and WCo9) did not manage to totally escape routines, or develop and apply DECs in the degree they should, although WCo9 put great emphasis in separating the venturing from the rest activities of the organization[261]. It appeared to us as if the two cases developed "DC-addicted" DECs - if we are allowed the expression - in order to establish the new knowledge-intensive ventures and then integrated them in the same culture and management of the parent company.

This appears to be a major danger and problem in cases of KI-LT corporate venturing. If we contrast the two sub-groups above (i.e. WCo2 and WCo10 *versus* WCo6 and WCo9), we can find a fruitful area for research on how DECs can come up again in an established organization in order to produce positive results and avoid pitfalls. The present research reveals this tendency but cannot thoroughly explain it. The entrepreneurs' strong personality, unconventionality and personal involvement seem to play a very important role in the first two cases. In the second subgroup the entrepreneurs although interested, do not share the above characteristics to the same extent and are not personally engaged to the extent of the first ones.

Indicatively, in the cases of **WCo6** and **WCo9** it appears that strong DCs of parent companies revealed the need to stretch to the new venturing shifting from non-KIE to KIE. However, they both regarded the already existing network of contacts as satisfactory, providing a rather negative return to ***bricolage with CCN and repertoire building*** to expand in already known areas. On the other hand, **WCo2** invests mainly

[261] WCo9's entrepreneur had recognized this danger and organized a completely new team underlining the importance of working out of mother company's routines.

in technological knowledge to intervene in innovative ways to known processes increasing productivity, incorporate ecological aspects, achieve energy savings, and recycling while patenting innovative processes.
Both cases also approach problem creation by a different angle; their initial aim is not to differentiate or open a new niche market, but to use knowledge for the shake of product and process quality solving in parallel certain production problems. Therefore bricolage seems even by problem definition to lag behind. We have further noticed that improvisational capabilities are hindered by the inability to surpass the tendency to routinized processes. More weaknesses of improvisational and transcendental capabilities have been explained in the relevant section. Therefore, all four established organizations had already owned DCs, which in the two cases seem to hinder the performance of their DECs. Actually, it seems that *the more organized (by means of following rules and routines) the company, the more difficult to apply effective DECs.*

One should also note that in both the cases of WCo2 and WCo10, the new ventures were located well away from the main organization, while the entrepreneurs avoid getting involved at works of the operational level. WCo10's entrepreneur had mentioned "*My brother does the everyday work, the routine*" and WCo2's entrepreneur had added "*I am here to have ideas*". On the contrary, the entrepreneurs of the second sub-group develop and apply corporate venturing "in their yard" indicating that such **local proximity increases the danger of core rigidities.** Furthermore, the entrepreneur of WCo6 gets personally involved in the every-day operations of the company. Path dependences and habits were stronger and did not allow for a proper development and exploitation of the autotelic capabilities.

Despite the above differences, **all four cases present significant DCs**. They have well-developed processes of customer-feedback selection and elaboration, while they appear to acquire market knowledge though multiple external sources such as technological institutes, sectoral experts, journals, conferences, seminar, industry workshops and international and national trade shows. They have developed technical departments with NPD teams and they devote certain amounts of their annual budgets for R&D. They have regular processes for new designs and products and they mostly use try and error processes. They develop regular co-operations with the WFDT

Department (TEI of Thessaly) on process and product improvements adding new characteristics and family products or working on new concepts to add value. All of them have invested in quality improvement and the use of innovative materials.

They have all developed processes for regular meetings to discuss market shifts, technology advances or the adaptation of best practices. WCo9's strategy is based on designing methods to capture value. WCo2's departments follow the rule of gathering both bottom-up and up-down information which is diffused in regular meetings. The R& Development Office of WCo10 has the responsibility of evaluating information relative to new technologies and stakeholders' innovative ideas. All the above information are recorded and analyzed by the statistics office of the company and taken into account in order to plan the company's strategy. WCo6 has established a routine of visiting big customers four times a year to collect ideas, suggestions and market tendencies.

Co-operations with Technological Institutes are quite regular to collect information and develop innovation; WCo2 has a regular co-operation with WFDT Department; WCo6 and WCo9 have several research projects with relevant Institutes. WCo10 has even co-operated with a team of John Hopkins University on the "sleep phenomenon" (holistic health program, 2011). Projects can be at formal or non-informal level. New technologies are also a focal point for the companies. Their contribution relates to their resolution that they use technology to reduce harmful effects to the environment, improve work conditions and reduce waste of energy and of raw materials.

Training is deemed as very important. There are regular programs at different levels for all personnel while executive members visit international trade shows and attend seminars on technology, management and sectoral innovation. Knowledge and information diffusion meetings are held especially on innovation and new technology issues. For example, **WCo10** underlines the significance of its employees; they are the biggest investment for the company and receive a number of benefits such as continuous training, recognition and reward of personal achievements (in the form of salary bonuses, promotions and gifts). The head of the Human Resources Office makes different educational plans for each department according to its needs. She keeps a file containing personnel training charts for each department and a Personnel Training Record. WCo10 is considered by employees as a learning institution. The company's policy is to communicate "best practices" outside the organization through

its co-operation with social and educational institutions and the exchange of knowledge and experiences on a theoretical and practical basis (from WCo10's records). **WCo2** wants to take it one step further; the entrepreneur dreams of a sort of internal learning school "to train people on wood engineering but on an empirical basis. I mean to focus on technology knowledge and operation-level knowledge."[262]

WCo9's *value framework* focuses on people: "Our interest on our people is the main source of inspiration and the main planning direction of our actions". The company plans the constant training and development of the employees and encourages experimentations and innovation (from company's records). In 2009, they developed a project on distance learning for the personnel. All four companies have trained their personnel on EFQM. All four companies target leadership in Greece and Balkans at least.

All five companies establish combinations of internal and external approaches towards development; i.e. in-house innovation capabilities by year to year investment in technology, firm structure and process improvements activities and knowledge. They also develop partnerships mainly by direct approach of customers and suppliers, as well as joint research with universities (mainly WCo2 and WCo10) and equipment providers (WCo6, WCo8 and WCo9). Thus, they also invest in human and structural capital, building technological capabilities (as it will be further discussed in the section of production technologies).

In the case of the big five, we can conclude that ***strong dynamic entrepreneurial capabilities*** enable aggressive market penetration, intense NPD, building of strong brand images as part of the new strategy and export orientation of a moderate level. More precisely, **strong DECs seem to be related to high level *sensing and seizing* which appear from the very first steps of the new venture.** Comparing DECs to DCs seems to reflect Teece's (2012) thoughts on how the entrepreneurial management function is embedded in dynamic capabilities; DECs (i.e. bricolage, improvisational and transcendental capabilities) allow agents to figure out "big opportunities or challenges and address them" (Teece, 2012, p. 1398)[263] shaping at the same time the quality and level of DCs. One can detect for example, certain

[262] This is something very usual in large manufacturing organizations at least in Germany according to the author's knowledge. People trained to be employed are called "Lehrlingen" (industrial trainees)

[263] However, Teece makes it clear that he does not refer to new enterprises.

characteristics that are then transferred in more organized ways and routines in dynamic capabilities such as processes to identify target market segments, changing customer needs, and customer innovation for sensing capability or investments in novel technology and new market exploration for seizing processes.

However, in all five cases "the big challenges" can be defied to the existence of the transcendental capability which seems to be responsible for the positioning of the new venture within the existing or the newly created business ecosystem. The transcendental capability as the ability to cognize the nature of what is going to offer competitive advantage may even be the DEC that lays the foundations for the reconfiguration capability or otherwise the ability "needed most obviously when radical new opportunities are to be addressed" (Teece, 2011) in regard to the specificities of low-tech KIE.

PEA has offered agents the ability of a strong sensation of global (or national for some cases) facts and business ecosystems and thus it can be considered an antecedent of sensing. Furthermore, its unstructured and individual-based processes seem to be a potential base for the development of structured sensing processes. *Visa-versa*, we can assume that the four cases of corporate venturing own part of their high-level PEA to the dynamic capabilities of the parent company. Sensing, seizing and reconfiguration in combination with prior knowledge and previous experiences and successes, existing strong networks or a strong starting knowledge pool appear to assist PEA's development triggering recognition of the value of every piece of new information. Then, PEA seems to emerge regarding mainly the level of acknowledgment of the inter-sectoral business ecosystem view (starting with the specific industry and expanding to areas defined by the actors) as well as the level of perception of changes, which are purely entrepreneurial elements. This purely entrepreneurial side of PEA in corporate cases may also explain the different kinds of PEA among the four cases and namely the *"cosmopolitans"* such as the agents of WCo2, and WCo10 and the *"industry masters"* such as the agents of WCo6 and WCo9. The same goes for spaciousness as well; it seems that sensing before venturing provides the conditions for spaciousness and in parallel spaciousness may direct sensing and seizing as well.

In sum, these four successful LT-KI corporate cases indicate that the dimension of transcendental conditions has a significant impact on core choices and, thus, seizing

processes and they may direct sensing processes. On the other hand, they also indicate the co-existence of DCs and DECs in cases of LT-KI corporate venturing.

Furthermore, strong transcendental synthesis of the big five group denotes a well-built capacity of receiving data, stimuli and opportunities (***receptivity***) and of shaping the business concepts through ***judgmental decisions*** on the created manifolds (***spontaneity of concepts***). These cases present afterwards quite strong sensing and seizing processes (as just seen above) indicating potential links among TS, sensing and seizing following the Penrosian idea of judgment (i.e. that it "involves organization of information-gathering" Penrose (1959)) and supporting further the argument of Casson (1982) that judgment assists the "coordination of scarce resources".

Therefore the strong cases of W&F sector indicate that transcendental conditions can be regarded as mainly *antecedents and be partly embedded* in sensing processes while TS can be regarded as *an antecedent and a base* of both sensing and seizing. The transcendental capability as a whole may be even portrayed as *a potential provoker* of the transforming dynamic capability.

Bricolage capability seems to ***be embedded*** mainly in sensing; dimensions of repertoire building such as problem making together with 'resourcefulness' appear to underlie sensing (in terms of both exploration and exploitation according to Teece, 2010). Similarly, problem making together with creative resource recombination seem to be embedded in seizing processes underpinning the capacity for sound strategic investment decision-making. For example, the search for knowledge in various scientific areas and the repetitive nature of experimentation for the realization of the novel "boxing concept" seems to orient the interactive learning dimension to a more organized way of learning; in the early years WCo8 renewed its resource base essentially through learning which led to new product and process developments. It also focused on the Greek market due to own "think globally, act locally" strategy.

Information flowing dimension of the improvisational capability seems to be an antecedent and partly embedded mainly in sensing capabilities enabling both market and technology adaptation. For most cases of corporate venturing it was achieved through formal business contracts, supported by a strong network that allowed synergies and co-operations. It seems that it becomes a mechanism of sensing since it

enables the creation of fast responding processes and mechanism in market shifts, new raw materials or technologies and adaption of novelties.

Improvisational capabilities affect also the underpinnings of new product development. WCo10's experimental culture and many try-and-error loops led in an unbiased way to novel processes for mattresses and novel approaches of customers. The entrepreneur claims that improvisation happens for the sake of improvisation; it appears as if it underlies all processes of improving, excelling, innovating, and even involving people into a more natural way of living (and sleeping).

On the other hand, the four cases of this group designated the nature of the provocative competencies; it appears that they have to be there at the right time (i.e. the time of venturing), although they seem to be useless all the other time of the company's life-course[264]. As discussed above, WCo2 and WCo10 present excellent provocative competencies. WCo9 revealed certain dimensions of them, such as diversity, moderate use of regulation and control with a tolerance of mistakes, a sense of urgency, promotion of experimentation and action. Avoiding routines was a main guideline of the entrepreneur in order to establish a successful new venture. However, it was quite evident that they did not manage to escape their former way of acting.

The group of cases with moderate DECs comprises of only new-to-the-world firms (WCo1, WCo3 and WCo4). The main and common feature of these new firms is their focus on the domestic market. DCs are developed but in an informal and rather loose way with sensing to be the strongest one since the firms are too new and small. All three cases follow routines on information collection such as regular meetings with suppliers and attendance of novel techniques seminars, visits to international material and machinery shows and internet. All three cases participate in trade shows, develop processes of customer feedback selection and elaboration, and get regular information by technological institutes, sectoral experts, journals and Internet. WCo1 and WCo4 have further developed processes for regular meetings with designers, suppliers, architects, association representatives and WFDT Department to assist recognitions of shifts in markets and adaptation of best practices. For these two cases, research focuses on experimenting with innovative material elsewhere produced, and alternative processes following mainly the try and error method. WCo1 has developed

[264] However, this deserves further investigation.

benchmarking and mechanisms of monitoring competitors. WCo4 has further entered research clusters[265] exploring all potential for NPD such as waste, by-products and energy production. For WCo3 the Italian cluster support seems to be vital until the day the firm abandoned the cluster (2011).

However, networking and collaborations do not seem to be very popular especially for WCo3. This can be attributed to the moderate role of CCN in this DC dimension development; WCo3 was trapped in small concentric cycles avoiding aggressive hunt of knowledge and becoming unable to follow the open culture of a cluster. Limited social and business capital of the case, inability to totally escape introversion – which is a main feature of Greek W&F sector – and lack of trust to bigger companies can be also traced behind weak bricolage dimensions.

All three companies have entered research projects with WFDT Department but this is mainly due to the personal contacts of the latter and not the developed relevant capabilities of the firms. All three companies have established long-lasting relations to their machine and raw material suppliers for NPD, production and process advancing purposes. Yet, **WCo1** is the only one to have performed licensing agreements and technical co-operations on a regular basis till now. All three companies appear also rather weak in any kind of networking capability regarding ***market processes***.

There seems to be an embedded culture of constant learning and experimenting, while know-how is achieved by technology transfer and development at least for WCo1 and WCo4. WCo1 collects, combines and generates knowledge while embedding a relative culture of constant learning; the WCo1 team exploited their initial experience on knowledge management which was gained by visiting and training in the manufacturing and the non-competitor company, the veneer suppliers, TEI and designers. However, it is more a sort of constant experimentation than the existence of organized knowledge management. This may be due to the fact that WCo1 is a very new company.

The entrepreneur of WCo1 engages open innovation continuing and deepening the co-operations developed at the founding process (i.e. TEI, veneer suppliers in Italy and Spain who become his "teachers" on innovative materials' behavior and use, and the non-direct competitor in whose plant the entrepreneur was introduced in new design techniques and in the culture of eco-friendliness and waste elimination). He further

[265] K-cluster, Bioclus

starts co-operations with designers and architects outsourcing conventional work (to avoid purchase of machinery) and putting emphasis of novelty. He invests on novel syntheses of existing and innovative raw material, design and flexible manufacturing to serve different market niches. In parallel he invests in the development of exporting capabilities. In 2009, WCo1 starts e-business investing mainly in marketing. In 2010 the company starts offering turn-key solutions being engaged in big architecture projects. In 2011 the company signs its first big order (a turnkey solution) abroad. In 2013 it can still fight crisis co-operating with high-value furniture producers.

It is quite obvious that WCo1, a company counting only five years of life in the middle of the severe Greek crisis owns significant DCs. We think it is not irrelevant that it was the only company of the second group with almost all its DEC-dimensions strong; it was rated as moderate due to its moderate transcendental conditions - dimension. This indication can support the above mentioned observation of the role of strong DECs in sensing and especially of strong TS in seizing as well as the role of the transcendental capability as a provoker of reconfiguration in general as discussed for the big five group. The very new company (established in 2007 on the verge of the crisis) was found in an extremely volatile and hostile environment which seemed to change day after day. Due to its satisfactory DECs, the company managed to develop quite fast relevant processes to sense and seize the environment while we can also see hints of reconfiguration such as the co-specialization (turn-key solutions) and the shift to export, putting emphasis on e-marketing. These actions indicate that WCo1 basically renewed its very new dynamic capabilities by enhancing them and identifying new opportunities for their use.

On the other hand, a major problem for WCo3 was exactly the fact that it did not cultivate learning either as a base for DCs or as a micro-foundation of them. Actually, the new firm seems to become very early “tired” of trying to incorporate too much knowledge and drive novelty in the sector. This can be attributed to its small size, the fact that DECs were quite moderate and not actually transferred in well-developed DCs and the fact that the new firm could not manage knowledge-intensiveness properly.

WCo1 and WCo4 own very strong improvisational capabilities. *Real-time information* seems to be embedded in the ability to sense the environment all along the value chain and be able to incorporate changes, trends and novelties although the start-up course

had started with different directions. Market fitness can be partly responsible for imposing such processes of market trends' and gap identification, try and error loops and collaboration setting with various stakeholders all alone the value chain. WCo4 assigns its *high improvisation capabilities* to the strong experimenting dimension and the exceptional provocative competencies the agents own. On the other hand, WCo3 owns rather moderate improvisational capabilities. This seems to further affect sensing and seizing; the company avoids NPD and further collaborations, while it lowers its standards for market research and seizing processes.
Actually, WCo3 presents the weakest DECs of the second group as well as the weakest DCs. Sensing, supported by the Italian cluster until 2011 becomes weaker in the aftermath of the company's withdrawal.

It is quite clear that DCs of the first group are much stronger and better organized than of the second one. The "big five" appear to have developed even formal routines although not always written. The second group presents certain weaknesses although WCo1 seems to try quite hard to overcome them.

In both cases of ***weak DECs*** the entrepreneurs seem to realize the importance of DCs but they are unable to organize relevant processes. Even sensing is not properly developed – all processes formed are directed mainly to problem solution[266] and not exploration (Teece, 2010); for example market-sensing rests on a limited number of sources being unable to translate feedback or respond to challenges and exploit opportunities. This seems to be the natural follow-up of weak DECs.
Weaknesses of transcendental conditions affect their initial core choices limiting the chances for effective sensing and seizing development. Both our "weak" cases (**WCo5** and **WCo7**) get trapped by their own beliefs and rest on sources provided by third parties; WCo5 on the big customer and WCo7 on the Italian technology providers. Weak transcendental capabilities result in many inconsistencies regarding competitive advantages, instability in strategies and incapability in advancing and communicating novelties.
Both companies present very limited CCN, while initial pieces of information and knowledge are limited and insufficient for creative combinations. Both WCo5 and

[266] Especially in the case of WCo5 one can detect more an effort to solve unexpected problems than create a problem even during the venture creation period.

WCo7 show a *reluctance* of further adding knowledge, hindering the very important dimension of learning. Instead of developing creative resource combination abilities, the two cases preferred to "hang on" others. This seemed to further affect the development of the sensing and seizing processes. They actually present weak market penetration from the very beginning and **no processes** to identify target market segments, changing customer needs, or customer innovation. Both companies seem to rest on internet, sectoral journals, WFDT (occasionally) and personal contacts and appear rather unable to establish long-lasting relations with customers, suppliers or NPD partnerships. According to the narrations of WCo5's entrepreneur all efforts to form any type of collaboration have ended to failure. Weak repertoire building and its sub-dimensions and poor judgment seem to lead to weak seizing as well; both companies did not invest further on R&D, did not invest further on technology or expansion of their networks towards research and other co-operations. Initial innovative technology was not supported by further investment in technological capabilities.

These two cases could not even recognize failures. This is an *episode* of failed improvisation as already mentioned indicating that weak information flowing can contribute to the development of weak sensing capabilities. Further major weaknesses in improvisational capability to be named are weak communication and interaction with the environment, a false approach to knowledge management, inadequate human capital and no teamwork. They affect the venture's choices and the evolvement of the competitive advantage they had developed. These weaknesses have further affected their approach to experimentation and market penetration and hindered the proper development of DCs.

DCs are recognized as important elements of strategic management by all agents of the two groups at least. Knowledge management is rated as very important although not exercised with the same intensity by the firms of the two groups. Sensing appears to be the strongest one focusing on NPD and market sensing. This "is rather sensible for new companies that are striving to earn and keep a piece of the pie by creating or entering markets" (Protogerou and Karagouni, 2012). With the exception of the two ventures with weak capabilities, all companies present NPD where **"P" stands for products and processes.** Thus, development includes products and processes, the

creative use of innovative materials (e.g. a mattress of seaweed is not just the use of seaweed but a completely novel concept) and creative design (e.g. the case of WCo8 with the supernatural kitchen product of aluminum). We have also noted novel services as in the case of WCo4 which develops a novel service in conjunction with a novel product (wooden "bricks" specially designed in cooperation with decorators on specific projects; i.e. a combination of technology innovation, product innovation, design and service novelty) or the services by WCo10 (boutique hotels to try the mattresses, the multicultural show rooms), e-marketing and special marquetry design by WCo1 etc. **It appears that the firms try to design revenue architectures in order to capture value.**

All eight cases own the capacity to adapt the products and services to the specific needs of different customers. Running throughout the text cases, it is evident that flexibility is always a major strategic element of Greek wood and furniture companies, since they primarily address the small Greek market. On the contrary, the relevant inability is a major characteristic of the two firms with weak DECs. Besides NPD, market sensing is deemed as a significant element of sensing for the cases. Actually, it seems to be much more important than R&D. This is also quite natural since the specific industry's innovations are mainly market-driven and it is in line with the findings of relevant research (Kreinsen, 2013). The only successful case which boasts not to sense the market in order to produce innovation is WCo10. The company's motive is *"I pay attention on the product and I train the market"*.

All new-to-the-world firms of both groups lack distinct reconfiguration processes since they are all small and young. Such processes can be found in the cases of the corporate venturing of the first group instead; here, reconfiguration capabilities are strong in order to address markets which became rather volatile due to globalization. They particularly focus on learning capability in order to identify new production opportunities, satisfy niche markets or even create new markets. WCo10 appears to redesign its business model and realign assets by adding diverse methods of increasing value to the firm (e.g. engaging bartering in 2004 which was expanded to WCo10 Hotels). WCo9 does the same within the new niche market it created. WCo6, WCo2 and WCo8 engaged mainly customer solutions as combinations of base

products, specialty products, supporting equipment and services (a practice called "bundling") in order to create unique opportunities for the customers.
All eight cases present a tendency to knowledge management but this can be attributed to the fact that they are fundamentally knowledge-intensive companies and they sustain their existence and competitive advantage on knowledge. All companies (of both categories of strong and moderate DECs) have developed distinct –more or less formal – technical departments and pay a great importance on the design activity.

In a nutshell, we could conclude that strong sensing is a natural follow-up of all three DECs and should be expected by all new knowledge-intensive low-tech ventures. Certain dimensions of the dynamic entrepreneurial capabilities can be assumed as antecedents of sensing; bricolage as knowledge and resource hunting, improvisational capability with the constant interaction with the environment and the transcendental capability as a constant reshaping of the transcendental conditions and a constant loop of the mechanisms. We have also traced routines and processes of the seizing micro-foundations such as processes to delineate the customer solution and the business model and stronger ones mainly regarding the selection of technologies and specific machinery. Therefore we can conclude that:
Dynamic Entrepreneurial Capabilities are significantly related to Dynamic Capabilities in cases of knowledge intensive low-tech companies of the wood and furniture sector
a: Strong DECs create the conditions for strong DCs
b: Weak DECs create a negative environment for the development of DCs
c: Dynamic Capabilities in established organizations may hinder the performance of DECs in cases of LT-KI corporate venturing and more specifically, the more the path dependency, the less the effectiveness of the dynamic entrepreneurial capabilities.

7.5.c.2) Food and Beverage sector
All ventures of the first group with **strong DECs** present significant Dynamic Capabilities αat the time of the interview. **Sensing** is again the strongest one followed by **seizing**. The sizes and partly the ages of the cases (since foundation) explain why **reconfiguration** is not so strong or even evident. A detailed description of each company's DCs is given in tables A13 – A15, Appendix A.

Similarly to the W&F sector, *the four parent companies of the corporate ventures* owned DCs even before the venturing. Interestingly enough, the two categories observed in the cases of W&F sector are found again in F&B cases of corporate venturing.

In the cases of **FCo5** and **FCo10** DECs emerge without being dominated by the parent company's DCs. One can detect the will and strong decision of both cases' entrepreneurs to **depart from current status to a totally novel business ecosystem**; advanced areas of food technology for FCo5 and production of innovative, environmental sensitive and gourmet products instead of just the upgraded packaging of extra virgin oil backed up by strong marketing in the case of FCo10. Therefore, **both cases develop their DECs consciously on a quite novel basis**.

The parent companies of the other two corporate cases, i.e. of **FCo6** and **FCo8**, own strong dynamic capabilities[267] and seem to integrate the new ventures (a new SBU and a spin-off) in their culture and type of management[268]. The entrepreneurs' strong personality, unconventionality and personal involvement seem to play again a very important role[269]. ***In this second subgroup*** the entrepreneurs are also unconventional since they question the status quo of the traditional products and their process technologies and search for the novelty, but, still, they stay trapped in secure ways in contrast to FCo5 and FCo10's entrepreneurs who risk "swimming in unknown waters"; i.e. **FCo8** tries LT-KIE by a focus on quality and production process excellence and **FCo6** through a clear technological orientation. In addition, entrepreneurs of the first two cases are deeply and personally engaged, while the ones of the second group are only strategically involved.

Moreover, we should underline that both parent companies owned quite strong DCs. Especially in the case of FCo6 it is quite interesting to observe that DCs were actually developed consciously after 1995 when the new generation took the lead. The new knowledge-intensive SBU can be considered a result of the parent company's reconfiguration capabilities. The main strategy is to become the experts on rice and pulses by deepening knowledge and research on these products: *"Our vision is to be*

[267] Derived by narrations of interviewees (FCo6) and expert's narration (FCo8)

[268] Although this fact does not seem to affect the sales and the future of the companies, we still think it deserves further research on investigating how DECs can come up again in an established organization successfully, in order to produce positive results and avoid pitfalls.

[269] We remind again that comparisons are among the questioned knowledge intensive and innovative ventures and not the mean venture and firm of the sector.

the first to introduce all novelty in Greece and Balkans. That means knowledge verticalization instead of a plateau of products under the brand of our company".

However, both cases did not manage to totally escape routines, or develop and apply DECs in the degree they should, although they both tried to separate the venturing from the rest activities of the organization (even in a spatial manner) contradicting the relevant assumption for the role of local proximity in the W&F industry. We again call the DECs of these two cases "DC-addicted" DECs since they appear to be much affected by the parent companies' DCs.

Therefore, in both cases of the first subgroup, after-venture DCs become stronger with a wider range of application engaging science-based R&D, science-directed networking and relevant business model redesign. In the cases of the second sub-group, DCs seem to become again "micrography" of the organizations' relevant capabilities; e.g. there is no separate R&D or market identification administrative team, while processes especially for seizing and reconfiguration are directed by the mother company.

Despite the above differentiations, **all four cases present significant DCs.** More specifically, in the first subgroup's cases ***sensing*** is enlarged, enriched and further organized. Both companies have developed strong ***market sensing capability***; they observe sectoral markets at global level with well-organized information collection on their direct and indirect competitors[270] and filtering processes such as regular market research. In particular, **FCo5** has developed a fast-response mechanism to customer feedback which is then translated into product improvements and New Product Development. Promotion methods and best practices are also significant for altering or even creating novel competitive advantages. **FCo10** developed a routine based on the motive "Need-listen/open up - create value". On that basis, regular executive meetings are held to present ideas selected by a constant monitoring and other parts' proposals. Regular meetings are also held on development issues to exchange knowledge and experience gained by trade show visits, personal contacts, relevant literature search, patent searching and benchmarking. There are certain processes for ideas selection and further elaboration. Some of the ideas are developed either in co-operation with Universities or other stakeholders or by the company alone. FCo10 builds especially on strong distribution channels all over the world and develops

[270] E.g. bio-functional, healthy food and gluten-free products or gourmet products

advanced marketing and promotion strategies. **FCo8** has routines of monitoring social and consumer conditions, best practices around Europe and competitors' movers. The company reacts to competition and follows successful practices such as fresh juices production and the "selected" milk idea adding to technology and special competitive advantages.

Technology sensing and NPD: **FCo10's** strategy relies on constant innovation at all directions: NPD, total innovation, reinvention (retro-innovation; e.g. oxymelo product), process innovation (carbon -neutral, water footprint), marketing innovation etc. Both cases reflect a complete restructuring of the former organizations; **FCo5** shifted from a conventional small flour milling to an R&D-based special product firm, while **FCo10** from a selective retailer to a creative producer of high-value novel gourmet products based on novel technology. The new product development process turns from non-existent to highly formalized and new products are subject to extensive testing prior to launch. **FCo6** owns quite significant dynamic capabilities but they are assigned to the mother company; however, they were extended becoming more knowledge-intensive after KIE. The company has shifted to science-based research, continuous technology and product improvement, aggressive NPD and further development through expansions.

FCo5, FCo8 and FCo10 have developed formal and well-organized R&D departments since their establishment while **FCo6** has extended its R&D activities with offices located in Athens for both plants.

All cases have developed analytical processes for R&D, combined with the search of exogenous science and technologies and intense market segmentation in order to carry out fundamental long-term research targeting innovation as precisely as possible. Indicatively, we can refer to the launch of long-term cooperation with specific and high technology research institutes, the detailed analysis of target groups and their needs and the design of specific mechanisms to capture value. More precisely, they all complement in-house R&D by co-operating with Universities, research institutes and other firms in diverse areas such as Biotechnology, Chemical engineering and medicine, transcending national or sectoral borders. *"We want to be absolutely international. Our first collaboration was with an American company and a British research institute"* (FCo9, CEO)

Additionally, all four develop knowledge management as a necessary tool to advance all three axes of venture (i.e. business, technology and market). Indicatively, **FCo6** places great emphasis in *learning and knowledge management*; there are training programs on a regular basis for all human capital levels (two for the whole personnel, three more advanced for the executives), followed by personal/individual training in Greece or abroad which cover not only production issues (as more common in Greek traditional firms) but issues on communication, management, psychology, etc. There are also short courses on technology and knowhow subjects for department heads and the technical personnel. Training of the production groups (each group consists of 7-8 producers) is vital since they have to engage new cultivation methods avoiding certain fertilizers or other chemical treatment. The company invests in aggressive technology transfer, new process technologies, skilled staff and know-how, in order to improve efficiency and quality, raise productivity and enhance flexibility. There are also processes of connecting customer feedback with the production of new ideas, rewards and adaptation of best practices. According to the entrepreneur's narrations the company has developed absorptive capacity ranging from a thorough knowledge on the properties and potential of rice and pulses, to the use of biotechnology (today) and food technology. Absorptive capacity was developed through training, individual studies and efforts, co-operations with clients and suppliers and the creation of a competent research team devoted to the company's vision. However, processes such as technology sensing, NPD, networking and collaborations became more knowledge oriented after the establishment of the LT-KI new venture: the company seeks constant and close cooperation with Universities (e.g. NTUA, University of Thessaly and University of Western Greece where one of the entrepreneurs holds an active role), BIC of Patras and other research Institutes and joint research projects on novel research and innovative technologies; sometimes such projects produce even new theory. Innovation is actually a core strategy of the company:

> "We want to innovate and I think we ought it to people to innovate. We want to be pioneers at least at European level. Of course we watch our competitors worldwide, we produce many ideas but most of them stay on the shelf. An idea is not good enough unless it thrills us, unless it makes us say Oh my God. That's unbelievable!" (FCo6's Entrepreneur)

Innovation projects follow a specific (although not written) routine (described in Table A13, Appendix A). The R&D and Innovation Department (as it is called within the firm) orients the efforts towards an agenda reflected in a relevant slogan which

can refer to a rather abstract challenge; for example under the slogan "Nothing to be wasted" there has been a number of research projects in order to exploit the ash and the rice by-products.
Several knowledge-intensive novelties and innovations are results of knowledge-intensiveness in the other three cases as well: for example, neutral carbon oil for higher ecological value and biscuit bars of the patented food for athletes to carry and minimize need of conservation.

Both nascent cases of strong DECs present significant DCs with *sensing* to be the strongest. However, DCs are much looser than in the cases of corporate venturing. ***Market sensing*** is exercised mainly by the entrepreneurs themselves. Both companies target foreign groups (mainly in Europe) such as groups who seek special tastes, singles, gourmet lovers or people on special diets. Participation at international trade fairs, search through internet and super markets all over the world are counted as very important. The entrepreneur of **FCo9** claimed further to use Euromonitor on a regular basis, as well as the feedback by the quality system relevant routines (customers are companies as well). The last one played a significant role in the change of the brand name three years later.
FCo1, as private label supplier, is process oriented but places special emphasis on both NPD as well as process innovation. **FCo9** is more technology oriented: international trade shows, technology literature research on general subjects such as gluten and nutrition trends, patent searching, and participation in research projects (with Universities and research institutes) have been mentioned to play a critical role in ***technology sensing***.
Knowledge is deemed important in both cases but knowledge management is not exercised in a structured manner as in the cases of corporate venturing. Knowledge transfer and integration takes place mainly among suppliers and company or gained after try and error processes in FCo1 while there are sporadic training programs. **FCo9** appears to be more knowledge-based; 12 out of 18 employees are higher education diploma holders with 5 of them to hold a PhD, 5 with an MSc and 2 with a University degree). There is a learning culture which expands to capture nutrition specialists, gastroenterologists and customers revealing a constant osmosis of science, technical, technological and practical knowledge. FCo9 has been described to develop R&D agreements with academia, chemical industry, food firms, laboratories and other

research institutes. *"We prepare a very detailed briefing about our targets, sign an NDA (non-disclosure agreement) and a commercial agreement" (Entrepreneur of FCo9).*

They further develop technical co-operations with machine manufacturers, packaging companies and suppliers in order to manage production issues. The company builds on strong distribution channels all over the world and develops advanced marketing and promotion strategies.

For both companies, *seizing* comes with the aggressive market penetration, intense NPD, and export orientation. For **FCo9,** processes of building strong brand images are a vital part of their strategy as the entrepreneurs refine their idea and move from "just snacks" to high value healthy products. Furthermore, investments in physical technology and seizing of new market opportunities in new niches by adding new or altering existing products are evident in both cases.

Therefore, it appears that there are certain links among strong DECs and strong DCs which once again **appear from the very first steps of the new venture.** More precisely transcendental capability seems again to direct sensing and seizing. All six cases have chosen specific "spaces" to develop their business ideas and DCs seem to be directed in these areas. For example, FCo8 chose to compete in the area of excellence and developed bricolage (through CCN and repertoire building) towards this very direction; all subsequent processes to date seem to work in this direction too. The company has not tried to enter other areas such as nanofood or functional food. CCN started mainly with technology providers and extended to all production processes (e.g. innovative packaging). On the other hand, FCo5 and FCo6[271] chose the way of science-based research and their DCs *do* support this choice. Especially **FCo5**'s agents focus on R&D innovation, novel products and excellence in science through co-operations with Academia for LT-KIE. It extends research to the medical world and includes pharmaceutical channels in distribution. However, they also create network action for marketing strategies as well with doctors, nutritionists, patient associations and relevant organizations; CCN and strong resourcefulness and information flowing seem to have been embedded in well-developed networking and NPD dynamic capabilities and strong sensing and seizing processes. For example, the first, above-mentioned contacts are well nourished and extended with participations in

[271] We remind that FCo6 named it "knowledge verticalization"

health events, organizations of seminars to stakeholders, development of common awareness actions and so on. In the same vein, the excellent real-time information they received from their special customers such as the celiac disease patients was then transformed in an excellent process of receiving customer feedback and relevant reaction mechanisms.

The strong F&B cases have presented **very strong transcendental conditions**; entrepreneurial teams start seeking novelty with an excellent knowledge of global markets on the areas of interest and the ones that surround them. **Strong PEA** and spaciousness allow for a significant sensation of the new firms' positioning and a dynamic view of potential markets and opportunities **supporting our suggestion on its role as an antecedent of sensing capability**; they seem to direct both market and technology sensing, NPD and necessary networking. **FCo6**, for example, took advantage of its capabilities on spaciousness and sought opportunities in many areas: horizontally towards new food combinations that suit different customers' needs and vertically towards co-specialized products in intra-sectoral areas (Pharmacy, chemistry, construction materials, biotechnology etc.) indicating a highly developed sensing capability.

In the same line with the W&F sector, we can assume that the four cases of corporate venturing own part of their high-level PEA to the dynamic capabilities of the parent company; sensing, seizing and reconfiguration in combination with prior knowledge and previous experiences and successes, existing strong networks or a strong starting knowledge pool appear to assist PEA's development triggering recognition of the value of every piece of new information. Strong sensing capability adds to entrepreneurs / managers' PEA and cultivates spaciousness (combined with all other factors as discussed in the relevant chapters). Therefore, it seems that DCs as managerial and organizational processes affect the development of entrepreneurial capabilities and more precisely DECs, at least in cases of LT-KIE. As an example, we can refer to the characteristic case of **FCo5**: sensing assisted the acknowledgement of market shifts to special groups, technology shifts to bio-functional food as well as a deeper knowledge of the specific wheat market. These triggered the need for broadening existing PEA and creating the dimension of spaciousness. Then, transcendental conditions assisted the re-development of *de novo* sensing and seizing capabilities.

Thus, the four successful LT-KI corporate cases support the co-existence of DCs and DECs in cases of LT-KI corporate venturing and indicate that the dimension of transcendental conditions has a significant impact on core choices. On the other hand, transcendental conditions (TCs) seem to guide the development of DCs in the nascent cases as well; for example both companies with high TCs and global panoramic awareness turn to global markets sensing such as global trends and market shifts such as gourmet and health food and increase of singles. Networking is in parallel developed embracing a broad and versatile number of suppliers, skilled labor and distributor channels. On the other hand, they are not science-based from the very beginning although technologically advanced. This can be however found in their technological sensing processes as well. Considering the innovations the six cases present in their lifespan, we can assume that spaciousness drives in certain ways the areas where sensing and seizing processes are directed and more precisely:

a) i*nnovative products at a global basis* for FCo1, FCo5 and FCo9

b) *innovative process technologies at global level* for FCo6, FCo7 and FCo10,

c) *addition of innovative characteristics to products and processes* for FCo4 and FCo8

Furthermore, transcendental synthesis seems again to affect significantly the development of sensing and seizing processes in terms of defining processes of information and knowledge selection as well as judgmental decisions regarding the whole new firm's value chain such as relative production technologies, marketing strategies or business models. Within the dimension of judgment, applied rules reflect directly the internal structures of the entrepreneur's environment (nascent cases) or the organization (corporate cases) and get embedded in seizing processes enriched by markets' feedback and reactions (which do not exist in the beginning since the new ventures address mainly niche markets).

Therefore, the strong cases of F&B sector indicate that transcendental conditions can be regarded mainly as antecedents and may be partly embedded in sensing processes while TS can be regarded as an antecedent and a base of both sensing and seizing. It also seems that transcendental capability, as a strategic capability, marks further the new ventures' strategies and more precisely:

- The *"cosmopolitans"* i.e. FCo10, FCo1 and FCo9 follow a strategy of conquering the world with a combination of innovative products based on novelties regarding either marketing or packaging or of both types.
- the *"science approachers*" i.e. FCo5, and FCo6 follow mainly research-based strategies while,
- the *"industry masters"* : FCo6 and FCo8 choose to be always leaders at least at national borders.

As evident by the above categorization, F&B sector adds a quite significant LT- KIE group which we called the "science approachers" and which was not observed in the W&F sector. **FCo6** starts KIE mainly as an "industry master" but it is more science – oriented than **FCo8** since the very beginning. In the same line with the relevant cases of the W&F sector, FCo6 and FCo8 approach the problem-creation issue targeting differentiation or new niche markets. However, in the case of the two specific cases, this is a matter of choice. Both companies owned strong DCs before venturing and seem to have used the part of DECs they needed; this indicates a "maturity" in the re-development of DECs which was not evident in the W&F sector. Indicatively, information flowing is evident although mainly through formal business contracts supported by a strong network that allows synergies and co-operations. Furthermore, selected executive teams of devoted members were responsible for the realization of the business ideas securing a certain level of provocative competencies. The constant bidirectional knowledge flow of both embodied and disembodied knowledge through skilled personnel, training, plant and equipment designs and descriptions, consulting, mutual experimenting, machinery and equipment indicated that both parent companies intended to shift to KIE; especially FCo6 becomes strongly R&D based and oriented. In both cases bricolage appears to be embedded mainly in sensing while creative resource recombination becomes a mechanism for seizing processes. Both firms' DCs appear to be well developed during the following years of both companies' lives towards a more knowledge-based culture but still seem to be dominated by the parent organization.

The significant role of strong bricolage capabilities is evident in FCo1, FCo5, FCo9 and FCo10 – thus two nascent and two corporate cases. All four cases got out of conventionality surprising in different ways. **FCo10**'s agent exploits the company's already extended networks and stretches further in new areas and directions such as

technology providers (climate neutral olive oil success with a Swiss company, water saving with an Israeli expert etc.), package designers, marketing experts, chefs, research institutes and academia. This strong CCN and repertoire building is then continued by a steady and rather aggressive use of sensing and seizing transcending national and sub-sectoral borders. Moreover, the excellent shift to eco- and retro innovation in combination to the production of high value luxury gourmet products was achieved by experimenting and many try-and-error loops in relation to market reactions and responses. This dimension of improvisational capabilities and more precisely the interactions with the environment seemed to affect mainly the seizing capability of the later formed dynamic capabilities.

FCo5 embedded a strong science-based culture and laid the foundations for the subsequent sensing and seizing capabilities. With scientific innovation as leitmotiv, **FCo5** exploited its bricolage capability (e.g. the resourcefulness, contacts, human and physical capital, knowledge and the ability to learn) and a full spectrum of improvisational prowess enabling creative solutions around the main challenge to maneuver among ideas, demand and obstacles. All these abilities are then found in the firm's DC processes and mechanisms as described just above supporting our assumption on the relevant links.

On the other hand, the two nascent cases present a gradual evolution of DCs; they have both developed strong CCN starting from a specific initial pool which soon was extended towards more knowledge-intensive co-operations and collaborations affecting the quality of human capital and other resources and building strong NPD capabilities. Both companies seem to develop mechanisms and processes to identify target market segments within their niche markets quite soon, investing further even in new technologies. It is important to remind that although CCN refers mainly to the entrepreneurs' efforts to make contacts, a successful evolvement is when other agents contact the new venture. FCo9 narrates of such contacts: *"We are approached by many University Departments and other institutes.*[272]*. We do know now that our next co-operations show the direction of Academia"* The high level abilities for information flowing as well as the ability to react to real-time information seem to have played a role in the subsequent sensing and seizing processes of the two nascent cases. Together with *flexibility and experimentation* embedded mainly in NPD

[272] Examples: R&D project with EKETA and Biotechnology Dpt, New cooperation on an R&D basis for an American company with cooperation with an English research company,

processes, the two firms present a high tendency to adapt to specific customers' tastes and requests, find gaps and reframe their image[273].
All six companies have created products to introduced niche markets[274] and invest heavily in NPD to maintain the competitive advantage of being the leaders within them. They have presented a significant number of new products since establishment, which are further adapted to specific needs. FCo5, FCo6, FCo8 and FCo9 patent their new products and develop advanced marketing and promotion activities.

In the case of the new-to-the-world company of ***the second group***, **FCo4**, DCs are developed but in an informal and rather loose way. *Sensing* is again the strongest one as a natural follow-up of the DECs. *Seizing* is moderate and looser and this can be attributed to both the size and the age of the company. Still, all processes follow the mode of try and error efforts and form informal routines. FCo4 lacks distinct reconfiguration processes since it is a small and very young company. The company presented a rather weak market-sensing capability in the form of response-to-customer-feedback mechanisms and monitoring processes regarding bio- and eco-friendly trends. Lack of resources and the insignificant percentage of exports are claimed as the main reasons for such weaknesses. FCo4 has relied mostly on personal contacts and internet. Networking capability is moderately developed through formal and informal collaborations with University (plant and food technology) and bio-food stores and drugstores as main distribution channels. Yet, advertising, promotion and export-oriented activities are rather underdeveloped. The company has developed significant technology sensing and NPD. In 2013-2014 it started expanding networking, collaborations and export activities. It is still lagging behind in market sensing, the access of distribution channels and promotion.

FCo7 did not appear to own DCs before corporate venturing. This can be attributed to both the very small size of the established firm but mainly to the extremely traditional way of company running, which were rather the reason for limiting business potential to local demand of purely traditional dairy products. In 1997 the son took over the

[273] E.g. the inclusion of exotic ral material and the creation of nation-specific tastes and flexible packages for FCo1 and the creation of cheese –up of specific tastes for FCo9
[274] For example in the areas of bio-functional and medical food, health and wellness food and quasi-pharmaceutical

family company and turned it to Industrial and Commercial SA at the age of 29 after a diploma in Philosophy and an effort to teach Greek literature in Crete. The young entrepreneur started collecting information about competitors and national cheese market. In 2002 the young entrepreneur having five good years of total involvement and experience as the head of the company[275] turns the company to a successful knowledge intensive, innovative firm. DECs (as seen in the relative section) seem to lead to DCs: ***Sensing capability*** although not strong in the known sense, becomes very important mainly in the form of aggressive NPD and regular sector monitoring mostly through internet and trade shows. Monitoring market reactions to new products is also very important. As an example, we could refer to the enormous success of the first gourmet cheese products that turned back too much market information and knowledge. In this case, sensing embraces understanding and response to market intelligence (Pavlou and El Sawy, 2011). **FCo7's** "Achilles heel" seemed to be actually the CCN dimension, which is significantly related to the entrepreneur's weaknesses regarding PEA of the Transcendental Capability. These deficiencies led to inadequate sensing and seizing resulting in slow rates of growth and a "very careful" growth strategy. Moderate bricolage can be also considered the reason of weak networking and collaborations; indicatively the company has not attempted any networking with academia or other type of research institute. Actually, FCo7 presents a reluctance to develop research-based networks in order to expand knowledge limits. As an alternative, the firm prefers to share knowledge and experience with the best in Europe and USA.

However, strong improvisational and transcendental synthesis' capabilities seem to have affected positively the company's *aggressive NPD;* FCo7 not only responds to competitive moves, but it also engages research based process and product development to create constantly novel competitive advantages stretching to all kinds of products containing milk. It scans for potential technological opportunities, directs mostly internal R&D activities engaging networking to select knowledge (e.g. on botanology), technology (e.g. new process lines or innovative packaging) and design. Lately (2013), market adaptation was also extended from a simplistic form of customer feedback to advanced market processes such as collecting information about direct and indirect competitors, exploring export opportunities, advertising and

[275] He was involved in the company since childhood but father was in command

promotion. A new contact with the entrepreneur in summer 2014 revealed extended networking with gourmet cheese producers in Europe, the production of novel products in his spin-off and the creation of the company's own retail network of a unique identity through franchising following the standards of the foreign small 'gourmet boutiques". It appears that FCo7 has improved its sensing and seizing capabilities than the day of the first interview (August, 2010) **indicating that LT-KI companies that start with moderate DECs may need more time to develop strong DCs than the ones that start with strong DECs – at least in the F&B industry.**

Therefore, although both **FCo4** and **FCo7** presented certain weaknesses regarding spaciousness, their strong transcendental synthesis' capabilities together with much deepened conviction and a strong need for achievement led to promising competitive advantages. **FCo4** is an excellent example of creating opportunities in a saturated market, dominated by big Greek and foreign companies. The entrepreneurs manage to create novel differentiated knowledge-based products in the high-quality niche market they opened on a steady, constant basis. However, moderate DECs created initially moderate DCs as well; indicatively, *market sensing* was too weak and rather narrow in the first 4-5 years and quite moderate afterwards; this can be attributed to the moderate transcendental conditions as well as the moderate bricolage capabilities. The same goes with *networking and collaborations*; entrepreneurs have admitted problems even in contacting the right experts in academia. We assume it is not irrelevant that they have started with weak CCN and very limited initial "resourcefulness'. However, strong improvisational and transcendental synthesis' capabilities seem to affect positively the development of significant NPD. The company presents high innovativeness rates while transcendental capability although moderate seems to provoke the reconfiguration capability[276] in a positive manner; the company starts seeking new areas besides chocolate, exploiting the "fruits" of market and technology sensing and developing moderate seizing. FCo4 presents a parallel to FCo7's progress of advancing its DCs, **supporting the assumption on time needed** mentioned in the previous paragraph.

[276] There are no distinct processes developed but there are certain activities such as new –completely different products, use of super- foods, new marketing methods (direct marketing -phone/mail) in 2014

It is worth mentioning that all above companies (of both categories of strong and moderate DECs) have developed distinct –more or less formal – R&D departments and pay a great importance to packaging and relevant design.

Both companies with ***weak DECs*** present weak market penetration and almost no NPD. Still, there are efforts which refer to knowledge-intensive improvements and solutions but to existing process problems or improvement alternatives. Neither company managed to build a brand name although they both were pioneers in their novel areas of entrepreneurial activity. They did not invest further on R&D, technology or expansion of their networks towards research and other co-operations. Initial innovative technology was not supported by further investment in forming technological capabilities.

In both cases of weak DECs the entrepreneurs do not actually seem to realize the importance of DCs and the need to organize relevant processes. Existing DCs are very limited. ***Sensing capability*** is the only one to appear. **FCo2** developed some cooperation with experts from academia and consultants on novel seed varieties and process improvements but this was mainly a "matter of momentum". **FCo3** has continued its cooperation with the Department of Vetinary (University of Thessaly) regarding improvements on processes and packages. There was some follow-up with new products (sugared whole egg, salted whole egg) for the Greek market, production increase and further refinements. The company has entered two research projects but this was rather an acceptance to participate than the creation of a research need. Actually, there seems to be no real wish or tendency for further relevant processes to be established. There are no processes to identify target market segments, changing customer needs, or customer innovation. The interviewees have referred to the use of internet, trade fairs, and business journals as sources of information but there was no reference of how they exploit the information they get. Both companies differentiate from the average sectoral enterprise, have created new markets and ecosystems, but we cannot claim that they have developed a proper set of DCs.

In these two weak cases spaciousness was sought within tight national limits and regarded mostly technologies (FCo2) and products (FCo3) not existing in Greek territory. Actually, the rather satisfactory sense of spaciousness was followed by weak judgments combined with mediocre receptivity and spontaneity; this led to rather

weak transcendental syntheses, as well as weak bricolage and improvisational capabilities defining a moderate width and quality of sources to seek, resources, ways and combinations required. FCo3 rested on sources offered by the Italian process technology manufacturer and FCo2 in the use of hydroponics without further exploiting the pioneering method. **Weak DCs then seem to be significantly related to weak DECs.**

Therefore, compared to W&F sector, ***sensing*** and ***seizing*** appear stronger and more intense in the F&B sector and in cases of targeting global markets, transcending sectoral limits too. In all new-firm cases sensing and seizing processes are quite loose and informal and not structured as in the cases of corporate venturing. This is quite normal since new-born firms cannot have adequate resources to build *ab initio* strong, well-structured internal processes. However, the cases of both strong and moderate DECs reveal a tendency to build strong DCs and translate the sensing findings into promising products and process innovation by both implementing existing potential and investing in new technologies and scientific or technology advances.

We should further mention than in contrast to W&F relative cases, we cannot claim that local proximity increases the danger of core rigidities. This is due to the fact that FCo6's new SBU, FCo8's spin-off and the new plant of FCo10 are well away from mother company, while FCo5 can be characterized even a new-to-the-world case since it was established only in the end of 2002 and the corporate venturing took place in 2004. FCo7, on the other hand, had not developed any type of DCs or any organized processes and routines before KIE.

Findings of the F&B sector are quite the same as in the W&F sector. Certain DEC dimensions can be assumed as antecedents of sensing; bricolage as knowledge and resource hunting, improvisational capability with the constant interaction with the environment and the transcendental capability as a constant reshaping of the transcendental conditions and a constant loop of the mechanisms.

In line with the findings regarding the W&F sector, all new and established companies which developed strong and dynamic improvisational capabilities present a constant evolvement of action regarding innovation, core choices and NPD. Certain of their sub-dimensions and most precisely of the information flowing are found then

embedded in the sensing and seizing processes of the new firms. The level of human capital of the entrepreneurial team seems also to be significant for the development of strong improvisational capabilities and consequently the development of DCs. However, improvisational culture exists in certain cases even underlining and supporting DCs. When asked about any existing routines on NPD development, **FCo6's** entrepreneur explains the applied routine, adding the following:

> "In our way [to NPD] we usually have to improvise, since there is a lot that happens and almost forces us to change. Sometimes we would start from a specific idea and then end-up with a completely new one! Besides, the market and the consumers create consumer patterns which they are not able to specify – and this is the best case. When you suspect a need you have to create an answer. Then, we may suspect a need, but we may have to change initial plans many times. You see, knowledge entails both research and imagination!"

We remind that a similar improvisational culture underlining DCs was also discussed in the case of WCo10.

We have also traced routines and processes of the seizing micro-foundations such as processes to delineate the customer solution and the business model and stronger ones mainly regarding the selection of technologies and specific machinery. Therefore we can conclude that:

Dynamic Entrepreneurial Capabilities are significantly related to Dynamic Capabilities in cases of knowledge intensive low-tech companies of the food and beverage sector

a: Strong DECs create the conditions for strong DCs

b: Weak DECs create a negative environment for the development of DCs

c: Dynamic Capabilities in established organizations may hinder the performance of DECs in cases of LT-KI corporate venturing and more specifically, the more the path dependency, the less the effectiveness of the dynamic entrepreneurial capabilities.

7.5.c.3) Textiles and Clothing sector

The T&C sector is quite exceptional regarding dynamic capabilities in relation to the other two industries. Most cases of the research are well-established, medium and large organizations; similarly to the corporate cases of the other two sectors, they also presented well-developed and highly organized dynamic capabilities even before venturing. This was a consequence of their co-operations with global sectoral leaders and the need to confirm to global policies, processes and methods. ***Sensing*** and

seizing were major capabilities of such companies which prospered in the 90s and were characterized leaders in the Greek economy. However, sensing led them to realize the changing landscape of the sector which was becoming very volatile due to a number of reasons among which globalization and trade liberalization. Their ***reconfiguration capabilities enabled them*** to try to match the new conditions in order to create and capture value, address the new markets and maintain competitiveness. More precisely, DCs led T&C companies to several reaction activities, such as:

1. The creation of identifiable brands.
2. Competition in multiple markets with a wide variety of products at different qualities and cost levels.
3. Provision of service to niche markets and specific segments.
4. Licensing agreements with well-known brands.
5. Introduction of organic product lines.
6. Shifts from a manufacturing mind-set to market- driven orientation
7. Formation of strategic partnerships to with cut-and-sew facilities in Balkans
8. Market 2-3 layers deep in the supply chain; marketing directly to the retailer or apparel manufacturer to create demand.

It is evident that almost all strategies revolve around customer service while sensing focuses mainly on market research and awareness of market trends.

> "The companies that were not envisaging any restructuring and modernization were condemned to face competition from countries with lower labor cost. Today, most of the Greek textile companies have closed or delocalized their production".(Entrepreneur of TCo2)

According to Winter (2000) a crisis may raise aspirations and motivate the organization to improve the level of capability. However, improvement seemed not enough; for a small number of Greek T&C organizations the transforming capabilities drove them to KIE by which they tried to redraw their boundaries to respond to the foreseen dramatic changes in the business environment. More specifically, in the specific cases, the need for a "reformulation of their business model" bred the need for departing from the traditional reliance of suppliers of machinery and turning to a more advanced use of knowledge; the majority of them attempted a complete

reconstruction by turning to KIE in the beginning of the new millennium, while others did not manage to survive[277].

The "survivors" brought up their dynamic entrepreneurial capabilities and stressed emphasis in getting out of path dependencies. Some of them succeeded more while others did not manage to escape their former cultures and routines. Since then, these companies focus particularly on learning capability in order to attain strategic renewal and identify new production opportunities, satisfy niche markets imposed by global leaders or combine high production capabilities to market trends. Especially the large and well-established companies of the textiles sector have developed strong strategic competitive response capabilities to address the shifting environmental requirements of the last decade after the China's accession to the World Trade Organization (WTO) in November 2001. This is in line with the wider literature regarding the industry's course after 2000 (e.g. Innova Final report, 2008; Boeheim, 2008).

Therefore, it appeared that the third research question of how new LT-KI ventures overcome resource base weaknesses and evolve applied more for knowledge than for physical resources in the T&C cases. These were further the cases that underlined the need to explore deeper the relation between the existence of strong routines and path dependency and DECs in LT- corporate KIE.

In the more capital intensive T&C industry, knowledge-intensive venturing appears more technology-oriented**.** New knowledge-intensive business ideas are innovative, but they do not create *a priori* knowledge. As discussed in the relevant section, the entrepreneurs are in all cases personally involved and develop high-level PEA but transcendental synthesis then is mainly re-productive. Furthermore, in cases of big and well-established parent organizations, bricolage and improvisational capabilities cannot escape the parent organization's path dependencies.

All three cases of the first group with ***strong DECs*** **(TCo2, TCo7 and TCo1)** are corporate cases of former micro or small T&C companies which did not appear to own significant DCs or to have developed routines and formal processes of any type. More specifically, **TCo7** was one of the many similar small companies working under contract for large denim and other clothing organizations during the 80s and 90s. It was the time that all European large branded clothing companies were subcontracting

[277] Such as Peiraiki-Patraiki, Vetlans Naousa, ETMA, Lanara spinning mills, Petalouda, Tria Alpha etc.

to Greek micro-firms due to very low labor costs. The decision to move ahead with branding (against names such as Levis and Diesel) with no compromises since the entrepreneur wanted to create competitive products and not just substitutes required great doses of transcendental thinking, improvisation as well as CCN. Narrations of the executive as well as our own knowledge of the company[278] allowed for the assumption that the parent company did not own any DCs till the time of turning to KIE.

TCo2 appears to realize the need for organization in 1998 according to the entrepreneurs' sayings:

> "We should mention that changes performed at the organizational level of the company are related to the new plant at Oinofyta in 1998 which actually was planned to accomplish our new vision: administrative restructuring, and a harmonic coordination of production and strategic organization in order to achieve better flexibility and faster decision making to satisfy our new customers"

The narrations allow for the assumption that there were some DCs developed before 1998. It appears that there was certainly some technology and market sensing, moderate NPD and the development of certain collaborations. Indicatively, there was the shift to the army and health sector in 1980 and the introduction of technical yarns and fire-resistant clothing in 1993 which entails both market and technology sensing as well as NPD and networking.

After KIE, the company entered new niche markets such as bullet proof and customized products for personal safety and decided to invest in vertical production in order to increase value added. In 2004 it entered the production of final garments for special use outsourced till that time and a new sewing plant. They developed a cutting department, invested in modern equipment (warping machine for technical textiles) and recently they started e-commerce and tried to develop their own retail network for direct access to the customer.

TCo1's parent company was established in 1994, therefore it was actually a new company when it created its spin-off company mainly to virtualize production and add value to its products moving up the value chain. However, the company owned certain DCs by then; it had developed significant market sensing at European level and collaborations at national and European level. Technology sensing was also important for the company while NPD was limited to the use of pilot fibers and

[278] The author was in the T&C industry from 1990-1998 and collaborated with TCo1, TCo7 and TCo9.

yarns[279]. Yet, DCs were rather loose and not consciously developed at that time. TCo1's entrepreneur, however, decided to treat the spin-off as a totally different and knowledge-intensive firm (the parent firm is by no means knowledge-intensive); he actually named the parent company as TCo1's "customer".

Therefore, **it seems that T&C corporate cases of strong DECs stemmed from parent companies with no or rather loose types of DCs.**

Regarding DCs of the new ventures in all three cases, sensing is again the strongest one followed by **seizing**. This is due to the new business environments that these companies enter mostly by moving up the value chain; from contract sewing to branding and fashion/innovation design (TCo2 and TCo7), entrance to other (existing) subsectors (all three) and change of the distribution channels' map (all three). The companies renewed and expanded the content of almost all micro-foundations and managed to broaden scope and strengthen their image. A major characteristic of this group is the "transformation" of parent companies engaging entirely new business concepts capable to capture new markets. Former slack DCs are improved and extended. Sensing is enlarged, enriched and further organized extending to R&D and aggressive NPD (all three cases) combined with intense market segmentation in order to target innovation as precisely as possible.

They all develop in-house R&D either after customer's demand (mainly TCo1 and TCo2) or on a regular basis (all three) to prepare a portfolio of novel concepts or novel designs for the annual collections (TCo7). **TCo2** spends approximately 150 to 200 thousand Euros per year (2% to 4% of annual turnover) in R&D investing in innovation for niche markets. **TCo1**'s strategy is the introduction of new methods and products every two years. The company gathers information mainly through the innovations in the main tradeshows of the sector, as well as the related companies of areas such as the chemical industry, textile and fabric industry and machinery which leads to innovative ideas. New ideas are assimilated and exploited by forming the needed parameters and when the company gets the desired result it goes on by creating the preconditions for new information.

[279] This information is based on the author's personal knowledge of the company. At that time the author was the technical director of a cotton-spinning mill organization and had developed collaborations on quality control issues for the novel yarns. The mill became also a supplier for TCo1's parent company.

> "We see innovative products in the trade shows and then there is the challenging question if this product can be elaborated in order to gain value with our machines. Then we ask for the new material and some special dyeing and we start experimenting" (TCo1's chemical engineer)

The entrepreneur refers to an innovative manufactured but not synthetic fiber developed by Courtaulds Fibers (now Acordis Cellulosic Fibers), an international supplier of rayon[280]. He narrates

> "We saw it in the trade show of Frankfurt. Then we decided to try to dye it. I mean both the innovative raw material as yarn and as fabric. We would never think of it if we did not have this dyeing plant. And we succeeded and our bed clothing of it are unique till now and this is the third year [in 2010]….We had the necessary know- how to produce it and our finished fabrics have a smooth, lustrous handle"[281].

The company has also established a routine of collecting present and future requirements of the customers, since colors and fashion in the apparel industry is a completely other sector and the mother company cannot have a direct contact with its trends, although attending the common trade shows (but different events), in order to get direct and accurate information.

Three graduates of Bocconi University and one of a fashion institute of technology in Athens constitute the NPD department of **TCo7** while 10 people work on constant market information selection together with TCo7's salesmen:

> "Monitoring the international market is very important in order to feel the pulse of the targeted market (main targets are 15-25 years of age). I mean really close monitoring of their habits, the trends they follow etc. … This is also a task of my own sellers; they are all among 25-30 years old. Age is important…"

Networking *"is everything"* according to CEO of **TCo7**. The company invests heavily in networking to learn about and enter desired markets[282]. It has developed strong marketing capabilities with well-communicated culture, messages and branding. It also uses networking for NPD, technology upgrading and new processes.

> "In order to be among the leaders we are working closely with fiber, machinery and dyestuff makers on exclusive basis to add value to our products, which could sell at a premium."

Feedback is further collected by all three company's networks. They all invest on close and long lasting relations to suppliers and customers while international shows are among the main knowledge sources. Try and error is the usual method while

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[280] It is made from wood pulp harvested from tree farms for this purpose. Because it is made from a plant material, it is cellulosic and possesses many properties of other cellulose fibers, such as cotton, linen, ramie, and rayon - another manufactured but non-synthetic fiber.

[281] Comment: In case to understand the difficulty of successful lyocell dyeing one can see that there is already a patent of lyocell finishing and dyeing, registered in 2005

[282] "*This is how we entered the powerful Italian market*".

reverse engineering is occasionally engaged. **TCo2** has systematically built on the technology and know-how initially obtained with reverse engineering and in cooperation with technical consultants and suppliers. They developed strong design and product development capabilities and in this way the company became a constant innovator (at least for the Greek market) developing innovative products for very small niche markets. TCo2 is a member of the Nomex Quality Partner System and certified manufacturer by DuPont for special flame retardant fabrics and garments in order to be the first to tap any of their relative innovations. It has developed a long lasting relationship with Gore for waterproof, windproof and breathable fabrics and 3M for reflective material and clothing. The narration reveals a gradual development of networking with Universities and research institutes which becomes more advanced by means of a progressive scale over the years. The company started with "borrowed" technology, went on with reverse engineering and today performs its own high-end R&D. *"At this moment we want to be further differentiated. When you get the know-how and you gain the experience needed then you try to develop significant competitive advantages"*

Additionally, all three firms develop knowledge management as a necessary tool to advance all three axes of venture (i.e. business, technology and market). TCo7's entrepreneur claims that wide knowledge is very important in order for the NPD department to question the future dreams of the customers.

However, personnel's training is not very popular for any of the three. Employees are occasionally trained when new systems are adopted (e.g. in the case of RFID technology).

In all three cases ***strong dynamic entrepreneurial capabilities*** enabled again significant market penetration, intense NPD, building of strong brand images as part of the new strategy and export orientation. More precisely, strong DECs seem to be related to high level *sensing and seizing* which appear from the very first steps of the ventures in several forms such as processes to identify target market segments, capture customer needs and shifting trends, together with raw material and process innovation for sensing capability or investments in novel technology and new market exploration for seizing processes.

In the **TCo7** case, the transcendental capability is clearly assigned to the entrepreneur as the ability to cognize the nature of what is going to offer competitive advantage;

the parent company was a clearly outwork firm with no DCs. Yet, the entrepreneur developed strong transcendental capabilities due to its own wish to seek for knowledge all around the jeans phenomenon and to obtain PEA and spaciousness regarding the specific business ecosystem at global level[283]. The new LT-KI venture appears to have developed mechanisms of seeking knowledge and processes to use resources in order to match both intentional and unintentional changes and thus dynamic capabilities. Experimental culture developed during venturing turns to R&D and open innovation processes, strong CCN to strong networking, collaborations and acquisitions[284], repertoire building in product innovation processes and absorptive capacity. It has actually developed formal but not written processes for industry innovation monitoring on areas such as production management, sales networks and automation and joins research projects regarding activities such as logistics, environmental protection and RFID technology. Formal and informal ways of getting real-time information seem to be incorporated in the existing market sensing mechanisms: 10 people work on constant market monitoring while all salesmen who are selected in the ages of the target groups are educated to select information of target groups through customers. Feedback is also collected by the networks achieving a macro and micro environment monitoring on a constant basis. In parallel TCo7 monitors industry innovation (on production management, promotion, sales networks, robotization) by co-operations with the leaders (mainly Italian), networking, trade show visits (twice a year in Japan and USA) and its strong design team (Italy-Greece).

Bricolage together with improvisational capabilities get embedded even in organizational structure reconfiguration "always *en route* to the better" (Kant): from capturing denim treatment and thus the technological dimension of the innovation, TCo7 soon turned to fashion design and then branding in order to create its own culture. TCo7 is actually a beautiful LT-KI case: it reflects the transformation of a mediocre subcontracting company with no strategies and organizational culture to a highly dynamic, well organized and globally accepted fashion Jeans Company while

[283] This can be also assigned to the cases of WCo2 and FCo8 with the difference that the parent companies were bigger and better organized than TCo7's parent company. However, the entrepreneurs of the three cases share the same characteristics.

[284] Such as the acquisition of the Italian "Uniform" in 2003; the company was among the strongest jeans brands in Italy (better than Diesel according to the entrepreneur). This was a strategic choice for TCo7 to enter the Italian jeans fashion market and secure brand awareness in Europe.

this transformation happens due to devotion to knowledge, R&D and finally the development of high-level DCs.

The parent companies of the other two cases appear to own some loose kind of DCs. However, it is more the entrepreneurs' DECs developed due to their experience within their low-tech company than the existing loose processes that drive them to KIE. Serving as suppliers of mass produced and highly conventional products, but all with strong educational backgrounds, they develop significant transcendental capabilities to form the novel KI-business concepts. Yet, the former market sensing DC and the already existing networking assisted bricolage and improvisational capabilities. DECs in turn with a focus on knowledge and R&D assisted the strengthening of the former DCs such as NPD, R&D-based innovation (especially for TCo2), networking, technology sensing and market monitoring. Initially small teams will assist information flowing and then embed the culture needed for advanced sensing, NPD and networking. Bricolage will be embedded in DCs extending to other KI partners besides the leaders such as quality labs, universities, other material and know-how suppliers (e.g. for the production of the innovative helmet, an R&D product of TCo2).

These three cases present the strongest improvisational capabilities of the T&C group**.** **TCo1** and **TCo2** succeeded in refreshing improvisational capabilities and especially provocative competencies when venturing. This was both due to the careful avoidance of routines as directed by the entrepreneurs as well as the fact that parent companies did not own strong DCs before venturing. This dimension will later be embedded in the ability to sense the environment all along the value chain and be able to incorporate changes, trends and novelties. Innovative products, processes or even models had to fit with the demands of the market environment thus covering existing markets (all cases) or expanding them. However, the provocative competencies sub-dimension seems to become inactive for TCo1 while it seems to be partly used in the cases of TCo2 and TCo7. For example a meeting with a policeman emerged the issue of design on a personal basis. The entrepreneur has also discussed the policy of the company to treat emergent "messages" as sources of creativity and knowledge in the sense of emerging opportunities exploitation.

The five corporate ventures of the second group (the one of moderate DECs) represent the survivors described above; the parent companies were medium to large well-established organizations with strong DCs and significant success – sometimes at global level such as TCo4, TCo6 and TCo9 - before KIE. These cases have undergone major restructuring in view of the full reintegration of textiles and clothing in normal WTO rules. They engaged KIE and business model in connection with restructuring trying to either

a) **Change role in the value chain** by changing, reducing or expanding their core activities along the value chain, for instance by changing from being only a production company with a few number of big customers to focusing on design, logistics, and marketing and even outsourcing part of the production (TCo4, TCo5, TCo8 and TCo9)
b) **Turn to specialization and niche products by** focusing on innovation regarding products and/or production methods that increase the added value and are (to the same extent) less subject to competition from manufacturers who use cheap labor to produce for the mass market. Examples are high-quality or environmentally friendly products or use of specialized sewing techniques and other innovative processes (TCo4, TCo6 and TCo9)

However, these cases did not manage to totally escape their own well-developed organized routines and core rigidities imposed by path dependencies and success of the past. This hindered their performance regarding the development or the re-vitalization of DECs with subsequent consequences in the venture's growth. Teece (2007) had underlined this danger by arguing that "Success will cause the enterprises evolve in a path-dependent way" since it breeds some level of routine. **The observed inability to "refresh" DECs appears in T&C sector to be the major danger in cases of corporate venturing as in the other two industries' relevant cases but in a more intense way.** The quite significant receptivity and spontaneity was followed by unexpectedly low judgment which actually led to poor transcendental synthesis; this was attributed to certain levels of teleology due to former success, which was not that evident in the other two sectors. This can be assigned to the significant history of the T&C sector in Greece and the former global success of the non KIE-model for most of the sampled firms. Therefore, it seems that **strong path dependencies may**

hinder the shift to KI corporate venturing if DECs are not deliberately developed.

This danger was also evident in the other two sectors. The attitude seems to be stronger in this sector because the parent companies owned already high-level DCs and were far more organized with formal routines and procedures since they cooperated with large global leaders of high standards. In accordance, mainly to the W&F sector, DECs for LT-KIE were observed to be rather organized and better structured; parent companies were rich in relevant experience of developing routines and processes and could devote even more resources (either tangible or intangible) in order to get creative answers. The superiority in human and other resources is evident in all corporate cases too.

Information on ***pre-existing DCs*** was collected by the interviews –although DCs did not actually constitute an issue of the planned interview- , companies' reports and other information by internet or sectoral experts. More precisely:

TCo9 before venturing had developed an informal type of *NPD* in collaboration with major customers and significant *sensing* through *collaborations* with suppliers and customers as well as new contacts made at international trade shows. The company was among the few ones in Greece to develop routines in the 80s due to the joint venture with a relevant Dutch company:

> "The experience gained from this cooperation was significant: we had learnt some concepts pioneering for Greece such as the internal reporting, the internal control – we refer to the 80's; this entire staff was totally strange for Greece…" (TCo9's entrepreneur)

According to its annual reports, **TCo6** presented DCs even at the beginning of the 90s. Sensing and transforming had led the company to the creation of the R&D Department and a shift to technical yarns in 1992, at a time when the majority in Greece would produce combed, carded and blended cotton yarns.

> "We translated all messages we selected regarding the sectoral development and the requirements of the international trade. Since we had a global view, the prosperity in Greece did not breed complacency."(Entrepreneur of TC6)

With the support of external consultants, the company develops a pilot yarn laboratory. It also turns to ecological issues anticipating the forthcoming impact of ecology on consumers[285]. The combination of marketing, R&D and coordinating collaborations leads to the production of new specialized products. At the same time

[285] In 1994 the company was among the first to acquire the ÖCO-Tex Standard 100 certificate by the German Hohenstein which is renewed on a yearly basis.

the company invests heavily in personnel training and its human capital in general. Indicatively, there are more than 50 educational courses annually referring to more than 2500 man-hours of education.

Actually KIE came as a result of the company's reconfiguration capabilities; the company is already aware of the use of knowledge but in 2000 it makes a conscious shift to the knowledge-intensive business model. The new vision covers the research, knowledge and innovation triangle regarding raw material, technology and specially trained personnel. The entrepreneur argues about:

> *"*We live in the era of the multifaceted knowledge and information. Monitoring and networking are required on a constant basis. Networking should be multidirectional: firms and institutes and new openings."

TCo8 was actually concentrated on technology sensing before KIE.

> "We would search for pioneering raw material mainly though international fashion shows and suppliers. We searched only technology to reach innovation. Till the beginning of the new millennium we had focused on production with heavy investments, use of consultants and acquisition of relevant knowledge. Imagine we scanned productions in 1986. Actually we could not find a relevant ICT firm to support such activities. We had even tried to develop cell production which was very fashionable in the 90s[286] but it didn't work out."(Entrepreneur and CEO of TCo8)

According to the entrepreneur, KIE through corporate venturing

> "brought a total, in-depth restructure of a traditional company. By then the classical search for raw material and for new technology ready by suppliers was enough. Then we invested in new knowledge regarding unknown sectors: design, technical staff well beyond the familiar cotton and synthetic ones which required knowledge on chemistry and a shift to mass customization which was in its infant stage for the sector; this was painful. It required significant changes in production technologies, new systems such as ERP, modernization of the administrative and the commercial parts a change of the company's image in the market; thus completely new skills and capabilities".

TCo5's report reveals significant reformulation of the business model "redrawing the firm's boundaries to respond to changes in the business environment" (Teece, 2010) and ensure improved value capture, which points to the existence of certain sensing, seizing and reconfiguration capabilities. In 1997 the company creates distinct departments of NPD, marketing, human resources and the position of Franchising Director. It also restructures ICT and logistics. Its major invest seems to be in the

[286] Cell production (in Japan) or Cellular manufacturing (in USA and Europe) were quite popular since 90s together with the concepts of lean production and keizen.

creative part of NPD contacting designers in Greece and abroad (mainly Europe). However, the business environment changes rather dramatically after 2000. With KIE and through academia contacts TCo5 challenged its already well-planned organization in order to address the challenges and survive.

TCo4 is a case of a globally successful company which proves the impact of former success and path-dependency on a firm's choices for change. Path dependency "not only defines what choices are open to the firm today, but…also puts bounds around what its internal repertoire is likely to be in the future" (Teece et al., 1997, p. 515). Path dependency is here grounded mainly in knowledge and resources familiar to the firm (cf. Monteverde and Teece, 1982). The company used to have strong sensing regarding target market segments, changing customer needs and customer innovation. They gathered economic information on their operations and operational environment. It developed complementarities and expanded along the value chain. Seizing was equally strong and mostly technology oriented. In 1988 they moved up the value chain with a dyeing plant of cutting –edge technology. It further created a spin-off to add value to woven fabric, developing in parallel the relevant know-how. The company had developed certain R&D cooperation on novel applications. They have collaborated with big global customers as well as with big organizations like DuPont and other firms of the chemical industry.

> "We were among the best organized companies in Europe and this is why big companies like DuPont or Adidas chose us as their partners. We used to present novel products, products that they were not easy to be found… I don't mean that we were the only to produce them but the producers were really few all over the world. Therefore demand was greater than supply"

The company invested in finding solutions for their customers and was one of the two companies that used to participate in the biggest fabric show worldwide.

TCo4 had also sensed the changing environment. However, the entrepreneur believed that since it addressed the upper and high value segment of the market it would not be affected by mass production in China. In 1997, a fire became the cause and reason for the entrepreneur to invest further in knowledge, differentiation and specialization and offer *"the impossible for the other firms" (TCo4's CEO)*. It actually turned to expensive R&D with foreign companies in the chemistry and machinery sector, committed money in innovative technology with substantial renewal of business processes and designed methods to capture value. It had also engaged the open

innovation model and structured knowledge management with constant learning and technology transfer mechanisms. All above strategic movements were in accordance with the related theories on dynamic capabilities for purposeful creation, extension and modification of a company's resource base to sustain competitive advantage (Helfat et al., 2007). However, TCo4 appears to have missed the entrepreneurial side of the corporate venturing. Quoting Teece (2012):

> "This entrepreneurial management involves not merely the practice and improvement of existing routines or even the creation of new ones. In dynamically competitive enterprises, there is also a critical role for the entrepreneurial manager in both transforming the enterprise and shaping the ecosystem through *sui generis* strategic acts that neither stem from routines (or algorithms) nor need give rise to new routines… Entrepreneurship is about sensing and understanding opportunities, getting things started, and finding new and better ways of putting things together." (Teece, 2012, p. 1398)

Just like plain entrepreneurship, KIE is associated with the individual who starts a new business that provides new or improved products or services or novel ways to produce and offer them. However, as Teece (2012) clearly states "it is important to recognize that the entrepreneurial management function embedded in dynamic capabilities is not confined to start-up activities and to individual actors" (Teece, 2012, p. 1398). This precisely implies the need for the development of DECs. TCo4 did not manage to escape its well-developed routines and processes and maybe this was the reason of achieving mediocre results and performance besides the heavy investment and the shift to KIE.

TCo4 did not pay any emphasis in separating the venturing from the rest activities of the organization. It actually appeared to have developed "DC-addicted" DECs more than any other case of the three sectors. This observation encourages further the suggested research on how DECs can come up again in an established organization in order to produce positive results and avoid pitfalls. The matter of proximity as stated in the relevant discussion for the W&F sector can be brought back in this case; KIE happens within the yard of existing plant and headquarters. Path dependences and habits seem to be even stronger and did not allow for a proper development and exploitation of the emerging DECs. The case will be further discussed soon after.

DECs are affected significantly by former DCs in the rest four cases as well although not to the extent of the TCo4 case. Furthermore, the new ventures

presented quite significant DCs at the time of the interview in spite the development of rather moderate DECs. This can be attributed to path-dependencies and the predominance of DCs in their life before venturing. However, they did not appear to be "micrography" of former DCs as in relevant cases of W&F sector. All companies (with the exception of TCo4) renewed and expanded the content of almost all micro-foundations[287], broadening scope and supporting KIE.

Within KIE, **TCo9** developed well organized R&D Department presenting new products twice a year. Although there is an R&D budget, which counts of the1.5-2% of the total costs, expenses are usually higher since a part of it "is lost" in the production costs according to the entrepreneur's sayings. A wide range of experimentations regards fabrics and treatment as well as novel fiber uses. The company co-operates in research projects; the latest regards applications of nanotechnology while sometimes there are also exclusivity agreements with six-month or annual duration. TCo9 develops knowledge and innovation linkages with suppliers of innovative material (machinery, material) and customers. Novel proposals derived by research are also presented at international trade shows. The company monitors closely the denim developments at global basis while it has a certain process of organized visits to customers to detect new and latent demands and hopes (with observation, discussions, suggestions) and processes of reverse engineering. Knowledge management is evident through knowledge seeking and diffusion at meetings, try and error processes, supplier and customer requirements and research. Emphasis is given to developing the knowledge and skills of the company's manpower. Part of the yearly budget goes towards training and education at all levels of the workforce, such as participation of executives in post-graduate programs, educational programs on technical issues, information systems, finance, accounting, management, health and safety and even foreign language courses for managers.

Links among DECs and DCs: In the case of TCo9 the main idea of shifting to KIE regarded a complete reconstruction towards strong R&D, innovation and fast fashion. However, provocative competencies were weak due to strong procedural memory and a well-build management system inherited by the Dutch company. Besides the exceptionally high transcendental conditions of the organization, former path dependencies and success limited transcendental synthesis while CCN was rather

[287] Resembling WCo10

weak and limited in known "network cycles" in an environment of rather problem-solving than problem-making. *The inability of the case to let high-quality DECs emerge was quite evident to the researcher.*

On the other hand, the company attempted a holistic renewal of capabilities and the application of new ones to fit mass customization. High level of resourcefulness, and information flowing, strong creative resource recombination and interactive learning, led to the development of new processes of R&D and marketing, new production planning and a new philosophy of customer treatment. Processes such as the investment in and recruitment of suitable human capital, co-development of innovative products and collaborations, a later verticalization (with a cotton ginning mill) seem to be results of significant bricolage capability. It seems that the case of TCo9 supports our suggestions on the interaction among DECs and DCs: former DCs did not allow for a high-level emergence of DECs limiting perhaps the potential of the attempted KI-venture; this can be evident at least by the economic results and the level of further market penetration. On the other hand, DECs are then again embedded characterizing the new DC type which is more knowledge-oriented in terms of resource bases as evident above.

TCo4, TCo6 and TCo8 regard also big, well-established organizations. They exploit the company's already extended networks and stretch further in new areas and directions along the value chain. They present rather mediocre bricolage capabilities, with a reluctance to widen the concentric networking cycle and a rather reactive attitude preferring problem-solving than rather creating which further seems to affect repertoire building. It is quite evident again that bricolage as well as improvisational capabilities cannot escape the parent organization's path dependencies. All three are technology-based; CCN turns mainly around technological contacts as well as customer target groups and R&D co-operations. In the same line with TCo4 and TCo9, they all present moderate improvisational capabilities revealing their difficulty in escaping procedures and pre-defined processes.

However, **TCo8** appears to make "deliberate efforts to interrupt habits" (Barret 1998) since according to CEO, *"Sometimes everything is formalized, it is very well documented and in other times there is very much implicit knowledge"*. Therefore, there was a conscious effort to apply improvisational capabilities in order to achieve

the restructure towards more flexible, fashion-oriented and faster changing operations. More precisely: TCo8 presented strong bricolage capabilities (the strongest CCN of this group) and an excellent case of knowledge seeking in diverse areas and knowledge bases. The analysis indicates strong repertoire building with equally strong sub-dimensions such as resourcefulness, creative combination and interactive learning. The company uses consultants and trains personnel in an attempt to change the established culture for KIE.

New DCs: The new KI-venture has developed a dynamic NPD Department with eight designers and modelists while it collaborates with foreign designers as well. Besides design, the company focuses on fiber technology, novel spinning and knitting technologies and innovative supplementary material. It devotes almost 8% in R&D with an additional amount allocated in production costs. It has developed close contacts with laboratories (e.g. ETAKEI), sectoral experts and fiber, fabric and supplementary material innovators. Close monitoring processes regard design, fashion and trends as well as material, technologies regarding process and logistics and in industrial design (it is not an atelier according to CEO). TCo8 places great emphasis on knowledge management; there is constant training and knowledge selection at all levels and all Departments.

> "We train our human capital on a constant basis. We sponsor their participation at seminars and training programs regarding adaption of new technologies, new trends and demands of the markets we target. There are many in-house tailor made programs for all of our departments. We have entered the "lifelong learning" project too". (Shareholder and CEO of TCo8)

Appropriability although required the very first years of the big change (a certain amount was devoted for rights) was shortly abandoned since there was no practical reasons for such costs according to the interviewee. Knowledge and technology transfer is mainly performed through co-operations with suppliers and designers. The company invests on experimenting and diffusing new knowledge. Practical and technical knowledge comes from new technology acquired although the group had decided not to invest further significant amounts on new technology.

TCo5 turned to the development of strong branding. R&D is translated into creative design; NPD department consists of ten designers which is a quite impressive number, considering the size of the company and relevant Greek companies according to the entrepreneur's saying.

> "They receive continuous training and visit fashion fairs. They are the ones to study the books. They have a diploma of designers or modelists. Yes, we have a considerable number of graduates after the reconstruction."

Knowledge is collected via international fashion shows and industry information. The company has developed strong networking with University and companies for logistics and product management. It further has developed co-operations with the fashion schools of France and Italy, *"We buy their "books", which are very-very expensive. They provide us with the norms and the trends for the new fashion trends"*

The company performs individual research at national level, as well as direct and indirect competitor benchmarking. There is constant training mainly on fashion issues, sales and merchandising. Franchisees are trained to open a shop for a period of two weeks before starting the business and at regular intervals.

The company presents quite interesting *transforming capabilities* as well, in order to capture value through a cycle of knowledge acquisition and diffusion. In 2007 it built a new corporate identity and a new image, and decided to outsource costly operations. In 2010 restructured further the production part. It seems that reconfiguration capabilities allow the company to change roles in the value chain and adapt to the dramatic changes of the clothing sector, in Greece and Europe.

TCo6 built KIE mainly on the use of innovative technology. CCN was limited due to former strong networking among already known knowledge providers which are mainly machine manufacturers, customers and academia (the relevant technology department in Aachen). However, networking after venturing is again very strong and is extended to new knowledge providers as well. The company develops more the open innovation model; technology acquisition and diffusion by developing partnerships referring to new technologies regards results of *strong seizing* due to *technology sensing.* However, due to the rather moderate repertoire building it seems that knowledge and thus relevant sensing processes are restricted to certain areas of ginning/spinning supported by the knowledge of specialist suppliers. Appropriability is not an issue for TCo6. Yet, interactive learning was quite strong especially among the company and leading European manufacturers (e.g. Rieter, Schlafhorst. Lenzig) and this DEC-dimension together with the significant experimental culture seem to support and to be partly embedded in the learning and NPD micro-foundations. During its lifespan (till the day of the interview), the company has *sensed* new market trends such as the need for more healthy cloths and has shifted to organic and eco-

friendly products; besides the use of relevant raw material it has developed an excellent quality control laboratory, among the best at European level. Exploitation of the new innovative processes and products is significantly due to the focus on the needs of special categories of high value products[288]. The company supports training at all levels even at "difficult times".

TCo4 cannot escape routines and well organized procedures even at the stage of venturing. Indicatively, information-flowing seems to have been applied more as a sub-process of regular NPD than a distinct dynamic entrepreneurial capability as described in the relevant section. Furthermore, a great dose of teleology and a stubborn devotion to the value of technology lead to false judgments and a series of inconsistencies regarding the receptivity-spontaneity sub-dimension. Therefore, DECs seem to be rather under-developed.

The company became knowledge-intensive but in favor of its existing customers and mainly due to investments on suppliers' knowledge (both of machinery and raw material)[289]. However, at the time of the interview and according the entrepreneur's narrations, firm's documents and press, the firm owned significant DCs. The R&D department started with fifteen well-educated engineers. Furthermore, the company is a qualified partner in an R&D network. According to the entrepreneur, the R&D department is the core of the business followed by the design team to create unique designs on a two-season basis yearly. There is strong networking with suppliers, customers, European designers and the chemical industry. The company organizes meetings with customers' designers, collaborations with European designers and frequent visits abroad (mainly during the fashion weeks in the four fashion capitals of the world). The company engaged open innovation resulting in at least two patents at European level and obtained significant flexibility in tailor-made and highly sophisticated products. The last years collaborations with external designers along with the research, the information and the ideas that TCo4's creative team daily brings forward, function as a springboard for creating and constantly updating its four main fabric collections developed on the preceding five years: fashion, second skin, easy-

[288] Indicatively, we remind the "Harry Potter of yarns" in 2005, after the presence of compact technology, Q-Cotton and Tencell ®.

[289] We remind that by the time of venturing unique and extremely expensive equipment was combined with high automation, a strong R&D Department, a design department and later a Quality Control Department.

wear and hi-tech. Even in today's difficult conditions R&D goes on with five projects on innovative fibers development and four regarding new technology adaptation.

> "Amongst [TCo4]'s latest innovative products is one that applies both to intimate apparel and performance sportswear. It is a highly technical product that interacts with the body by stimulating blood microcirculation and thermoregulation; these benefits promise to enhance collagen synthesis so the skin becomes healthier, smoother and more elastic
>
> ***(Clash of plenty** autumn/winter 13/14, Munich fabric start)*

TCo4 has also established a quality control laboratory of international standards which contacts pilot tests and studies on fabric properties such as twist and oblique garments and adds to knowledge in an out-of-the door, more general sense.

Sensing processes regard again mainly cutting edge technology. There are regular meetings of heads of all departments with supplier representatives (such as yarn and color suppliers and companies like Dupont, Dystar and Bayer), as well as regular meetings of the Design Department with customers' designers. The company has developed a significant number of co-operations with all the above mentioned. Actually, the relationships with customers were very close until 2008. Market sensing refers mainly to international trade show visits and meetings with customers. Regular meetings would be held to discuss special requests or work out new ideas incorporating all value chain stakeholders in the developing innovation. TCo4 is proud of its world famous clientele as well as its two patents at global level. After 2008, there is a more aggressive market monitoring but with less success, according to the sayings of the entrepreneur and the CEO. However, the company insists investing on technology and innovative equipment.

Training regards mainly technical and quality subjects, as well as health and safety issues, while know-how is mainly achieved by established suppliers and plant equipment installation. Knowledge is restricted to certain areas (especially treatment - dyeing processes) supported by the knowledge of specialist suppliers. In terms of transforming to adapt to the environmental shifts the company attempted a partial verticalization from yarn to clothing through alliances and affiliations with known underwear and clothing companies.

TCo4 is a case of a strong, well-established low-tech, conventional T&C (fabric) company which invested in knowledge and innovation, addressed international high-value markets but these investments seemed not enough for the company to resist the global and the Greek fiscal and economic crisis. It is actually the case that indicated

to the author that KIE does not rest only on the development of knowledge-based innovation and investments on cutting edge technology and oriented the present research towards the search of a set of capabilities which could lead to successful LT-KIE. Furthermore, innovative opportunities (as named by Malerba et al., 2011) indicated the fact that types of actions and decision-making must be also engaged in[290]. Therefore, the author started searching for the specific patterns and behaviours which would justify LT-KIE regarding all three axes of a new low-tech venture and namely technology, market and organizational. Later, in their first integrated Aegis report, Malerba et al. (2011) stated that "'Innovative opportunities' is a somewhat more complex concept than the ones which exist in the literature, including entrepreneurial, technological and productive opportunities", justifying the above major assumption of the present research.

In the case of TCo4, core rigidities and the exclusive commitment to technology did not allow the proper DECs' development and mainly of the improvisational capability as stated above. TCo4 had already had its time of glory due to high-tech equipment in combination to high quality, which had turned global leaders to its customers. Yet, it did not manage to see that these were the needs of the outgoing decade.

The transcendental capability appears to be the weakest of all besides the high level of both PEA and deepened conviction of the entrepreneurs. Although they had developed high receptivity and they had sensed the environment at global level, they appeared to lag behind in translating them while one cannot overlook significant signs of teleology. Besides the deep knowledge of both the internal and external environment of the firm, the entrepreneurs seemed unable to develop productive TS and counted on technology to solve the differentiation gap. That is, they cannot think paradoxically and exploit their well-developed innovation and R&D capability in original and unconventional ways (which is the sense of the transcendental capability). They actually appear to have almost disregarded the other two dimensions and mainly the marketing one. This is also approved by the company's DCs; sensing is mainly technology-oriented and seizing regards mainly investments in technology and R&D such as the above mentioned technical products and the innovative fabric treatment (2013) targeting EU markets in order to survive.

[290] Still, when that missing link occurred to the author (February, 2010), these finding of Malerba et al. were not yet stated

Is then TCo4 a case of LT-KIE? Definitely yes, since it satisfies the KIE-definition. It is also a successful case compared to other firms of the sector. Although moderate to weak DECs can be traced, their core dimensions are more or less, better or worse, developed while the importance of knowledge, creativity and innovation is evident.
We should also discuss the high level **PEA** and spaciousness of all ten cases exposed in the context of the extremely "crow ded" T&C sector. This is partly due to the well-established organization behind the corporate venturing in the majority of the cases and the deep experience and involvement at the sub-sector in the case of TCo10. The two PEA categories which can be traced in this group are again: The *"cosmopolitans"* such as the agents of TCo1, TCo2, TCo3, TCo7, TCo8, TCo9 and TCo10 and the *"industry masters"* such as TC4, TCo5 and TC6. Furthermore, in all cases the entrepreneurs adopted a global view even if some of them started from the national market as in the case of TCo2 and TCo7 and TCo9, they were targeting global novelties and markets. This is a major difference with the W&F sector as well.

It should be mentioned that the only case where DCs were not easy to detect is the **TCo10** case which further constitutes a unique case of high fashion. In this nascent firm there is no deliberate seizing while sensing seems to be more intuitional.
The entrepreneur's significant transcendental capabilities get embedded in sensing which regards mainly market and the world of the fine fashion creative industry. The entrepreneur visits and participates in international trade and fashion shows, he reads a lot of fashion magazines and he is actively involved in the world of fashion. On the other hand, he updates knowledge on fabrics and leather technology and collaborated with manufacturers. He also gets new knowledge on specific markets like the ones of Russia and USA. *"I travel a lot, I visit fairs and trade shoes abroad, I have my eyes open. When I watch a film I observe everything, I listen to music – everything is actually inspiration."*
Normally it is said that designers find inspiration in everything everywhere, but to be in touch with contemporary and future tendencies, ideas for the entrepreneur and fashion designer of TCo10 are complemented with all the above mentioned as well as inputs from online fashion predictors and test samples. The company can be considered innovative since most product innovation refers to fashion design (Faust,

2005). However, the entrepreneur is also responsible to manage the entrepreneurial processes and bring his NPD to marketplace.

Actually, sensing resembles more to CCN and bricolage capability in general than the routine DC process while improvisational capabilities are related to the creator's inspirations. The entrepreneur seems to go on relying on his initial network pool as his primary means of access to the welter of resources needed during and after founding; however the company extents to new contacts as well (e.g. the fashion show in USA). He makes use of an extraordinarily broad variety of means and resources at hand. A fine blending of NPD, bricolage and improvisation can be observed for example in the designer's own interview (10 Jan., 2013) (note: bold added by the author):

> *The end* of 2012 saw the V. Z. fashion house celebrate its 10-year anniversary with the toughest but most beloved collection yet**.** Running a luxury brand during a financial crisis is no easy feat, and the designer had to **dig around his fabric vault for leftover scrap**s instead of ordering countless yards of fabric from the Taroni silk weaving mill in Como, as he had before. **An old skirt was taken apart and sewn into a gorgeous rainbow dress,** while the construction of every single of the 42 outfits he sent down the runway was similarly painstaking. "***There were a lot of two-toned outfits, because I didn't have enough fabric to keep them monochromatic****!*" he says with a smile. "*But I never compromised quality. Now, more than ever, is a time to be* ***resourceful*** *and* ***creative****. When a fabric ran out before the outfit was done,* ***I'd go back and redesign it, but it all came together in the end****. I think if* ***we all do the best we can with the resources that are available to us****, we'll be better people for it in the end*".[291]

The case is not a representative one for the present study but belongs to this sector and represents a significant part of it with design as a main competitive advantage. Its exploration may open a new path of research of the relative creative industries and their relationships with knowledge-intensiveness as well as DCs and DECs.

TCo3 is the only case of weak DECs and subsequent weak DCs. Actually, there seems to be no market sensing while networking and collaborations are directed mainly by the companies of the two entrepreneurs of the joint venture. *"TCo7 brings the necessary information for the international trends. Feedback is also achieved by big customers – a fashion house like Versage will always give certain information"*

[291] http://www.yatzer.com/vassilis-zoulias-and-his-enchanted-kingdom

In the same line, selection of suppliers and access to distribution channels do not constitute processes of TCo3. Furthermore, the assistance in arranging taxation, finance and other legal issues as well as the recruitment of human capital are directed by an external consultant engaged by the other two entrepreneurs while there are no advertising and promotion processes.

However, there are certain processes of technological adaptation and NPD. The technical director of the company (a chemical engineer) describes a certain process of NPD: it can be either customer driven and then the company's policy is to offer at least three solutions per request or company-developed solutions (called "internal projects"); which are presented to customers twice per year due to the regular two collections per year in the fashion industry.

R&D comprises of research and experimentation regarding combinations of raw material under different conditions of temperature and humidity. Lab results are then tested in a pilot production (there is a simulation machine) and then for proper production. There are also cases of reverse engineering after customer's request. However, even NPD is well supported by the R&D departments of the two "parent" companies; there is a constant knowledge and know how transfer. Although there is significant knowledge generated inside TCo3 referring both to treatment and energy production, the main knowledge management seems to be directed by the two companies of the entrepreneurs.

Therefore, it appears that weak transcendental capability affected in a negative way initial core choices limiting innovativeness and areas of activation. Weak bricolage capabilities end up in weak sensing, no learning mechanisms and limited networking and collaborations**.** Actually, TCo3 shows a weakness in further adding knowledge of any kind, resting on the two "quasi-parent" companies.

TCo3 can be regarded a special case since it is a knowledge-intensive innovative joint venture of two successful entrepreneurs which seems to have been treated more than an SBU than a new start-up. It appears to the author that this treatment was the main reason for both weak DECs and the failure of the company to develop its own DCs.

All ten cases' DCs seem to support their categorization as

a) the ones that rely on in-house R&D, with well-developed dedicated R&D departments and R&D expenditures which we called ***"technology oriented"*** and ***strategic innovators:*** TCo1, TCo2, TCo3, TCo4, TCo6, TCo9.
b) The ones that apply mainly for organizational and structural innovations tightly linked to design competence and creative business concepts (***"fashion dominated"*** and ***intermittent innovators)****:* TCo5, TCo7, TCo8 and TCo10.

In general, DCs are recognisable by all agents as important elements of strategic management; all cases own the capacity to adapt the products and services to the specific needs of different customers. Running throughout the text cases it is evident that flexibility is always a major strategic element of Greek T&C companies, since they use it as a strong competitive advantage. Besides ***NPD***, ***market sensing*** is a significant element of sensing dynamic capability which in many cases is combined with intense ***R&D*** regarding not only products but innovative technologies as well. This is also quite natural since the specific industry's innovations are mainly market-driven and it is in line with the findings of relevant research (e.g. Bender, 2004). Almost all cases have developed processes for tapping developments in industry and technology and processes for open knowledge-intensive innovation. They usually achieve a good balance between the various types of innovation combining product – process and service knowledge – based innovation.
Training is also evident in most cases and may regard new methods of production, advances in technology, design and trends, and even storage and distribution of products, production and supply of raw materials or environmental protection.

Seizing appears to be also quite strong. Most cases present a strong focus on specific target groups' selection and a high capability on continuous product improvement and development with fast change cycles. Value adding is undertaken by several ways such as revenue architectures based on design, sales networks, company acquisitions, production costs, business model restructuring and marketing models renewing. There is also - but not always- a constant rethinking of strategies regarding customer loyalty building and commitment. Seizing is further evident through efforts for total or partial verticalization moving up the value chain, co-operations, alliances, subsidiaries and acquisitions, new capabilities building and outsourcing.

Reconfiguration capabilities continue to be strong in the T&C group to address markets which are volatile due to globalization and trade liberalization, being already well exercised by the established companies as mentioned in the beginning of this chapter. They particularly focus on capabilities to attain strategic renewal and identify new production opportunities, or satisfy niche markets in times of considerable market turbulence: Customers' product preferences change quite a lot over time with fast fashion to impact all relevant value chain. Furthermore, new customers tend to have product-related needs that are different from those of existing customers. Thus, the large and established companies of the T&C sector have developed strong strategic competitive response capabilities to address these shifting environmental requirements of the last decade after the China's accession to the WTO.

Corporate venturing "within the yard" seems to play a role in T&C cases too: TCo2 establishes a new plant in Oinofita moving from Atalanti with completely new production plans, strategies and culture. TCo7 builds the new impressive plant in the Industrial Zone of Larissa with a new structure, a design and an R&D department while a strong Marketing Department is run by the Entrepreneur himself. TCo1 is spatially "in the yard" of parent company but it was deliberately designed to have its own rules and culture and a completely different operation and field of action. Finally, the new culture of TCo5 has led to a re-organization of all departments proving the transformation of the whole company and its "transfer out of the yard".
On the other hand, such core rigidities due to "proximities" of the new ventures with the parent ones are evident in the cases of the second group. New plants are close to old ones but the most important is that new cultures are similar to old ones. New NPD processes are again highly formalized following the former ways of thinking. New DCs are mere replicas or imitations of the old ones. For example, seizing is again oriented towards technology as well as cospecialization even in the cases of fashion development strategies. Actually t**he closer the new to old strategy, the weaker the DECs developed for corporate venturing,** as seen in the other two industries as well.

Strong DECs enabled aggressive market penetration, strong NPD, export orientation and building of strong brand images. All three, strong-DEC companies established combinations of internal and external approaches towards development; i.e. in-house

innovation capabilities by year to year investment in technology or/and know-how, as well as joint research with equipment and raw material providers building strong technological capabilities. They also invested in human capital, structure-and-process novel activities and relevant knowledge, as well as network expansions mainly by direct approach of customers and suppliers.

The six cases of moderate DECs seem to invest more in technological capabilities building, than to completely change strategies. Furthermore, in contrast to the other two sectors, the cases of moderate DECs present strong R&D intensiveness since they have emerged by well-established organizations which devoted rich resources to venturing. Still, these efforts refer mainly to knowledge-intensive improvements and solutions to existing process problems or improvement alternatives as also observed in the other two sectors' ventures with moderate DECs. In their majority, they seemed to hesitate to expand networks while the initial innovative technology was not supported by further investments in forming new market-oriented capabilities. However, almost all of them have developed ***trademarks,*** while ***awards*** seem to be a privilege of only the well established organizations of the second group.

All cases of this second group also approach problem creation in a quite narrow and specific view; their very initial target and aim was the answer to already expressed needs such as

- high-tech fabrics for TCo4,
- denim fashion for TCo9,
- fashionable underwear for TCo8) or
- differentiate within already set frameworks (TCo6)

instead of creating broader concepts as described in the relevant proposed theory of DCs in LT-KIE and observed in the most successful cases such as WCo10 and FCo5. Therefore bricolage is weak both by problem definition and reluctance to expand CCN. Improvisational capabilities are hindered by the inability to surpass the tendency to routinised processes or exist only at strategic planning level. Transcendental capabilities seem to be "struggled" by former core rigidities due to former success and strong path dependencies.

The parent companies had followed routines for years, had built procedural memory and had developed a precise culture around the i**mportance of technology and**

automation which was tightly connected to high performances. Entrepreneurs and their teams did not manage to depart from former ways of thinking and acting which is a major criterion for DECs' development. This is in line with literature; indicatively we can read in Teece et al. (1997): "The notion of path dependencies recognizes that 'history matters.' Thus a firm's previous investments and its repertoire of routines (its 'history') constrain its future behavior".

Are there then DECs developed in these cases of LT-KI corporate venturing? The answer is once again emphatically ***"yes!"*** Bricolage capabilities are needed to tap distributed knowledge and competence even for a network of known stakeholders. CCN is weak in some sub-dimensions, but team-based structures are essential, as well as all other dimension of this DEC dimension. The same goes for improvisational capabilities too; weaknesses are traced mainly in the inability of established organizations to re-develop the provocative organizational competencies dimension. The same applies also for the transcendental capability, where weaknesses can be traced within transcendental synthesis.

However, the ten cases of the T&C sector support further the suggestion that sensing is a natural follow-up of all three DECs and should be expected by all new knowledge-intensive low-tech ventures. **Once again,** it is evident that certain DEC dimensions can be assumed as antecedents of sensing; bricolage as knowledge and resource hunting, improvisational capability with the constant interaction with the environment and the transcendental capability as a constant reshaping of the transcendental conditions and a continuous loop of the mechanisms.

Similarly to W&F sector, all cases own the capacity to adapt the products and services to the specific needs of different customers. Running throughout the text cases, it is evident that flexibility is a major strategic element of Greek T&C companies to address demanding global customers against the cost advantages of Asian mass production

> "We have to survive. This requires flexibility and customization to customers' wishes. We also have to produce for them what is too urgent and therefore Asian plants cannot achieve…" (TCo4's entrepreneur)

In the same line with the other two sectors, the cases show that agents need to develop **the whole set of strong DECs** which are actually interacting among them to start viable and successful ventures with strong initial competitive advantages in textiles

and clothing industry. Yet, LT-KIE here is provoked mainly by the need for change than the need for nascent entrepreneurship, stressing the sectoral and partly institutional impact on the phenomenon. The interesting point is that change is knowledge-directed; this can be traced in all entrepreneurial and managerial processes: they are actually based on sectoral and sometimes trans-sectoral knowledge. The T&C sectoral group strengthens further the assumption that former strong dynamic capabilities may hinder the emergence of strong DECs in cases of corporate venturing; on the other hand they may reserve a high level of the after-venture-DCs.

Therefore, in line to the other two sectors, we can conclude that:

Dynamic Entrepreneurial Capabilities are significantly related to Dynamic Capabilities in cases of knowledge intensive low-tech companies of the textiles and clothing sector:

a: Strong DECs create the conditions for strong DCs

b: Weak DECs create a negative environment for the development of DCs

c: Dynamic Capabilities in established organizations may hinder the performance of DECs in cases of LT-KI corporate venturing and more specifically, the more the path dependency, the less the effectiveness of the dynamic entrepreneurial capabilities.

7.6. Sub-section 5:

Hypothesis 4: Production technologies play a significant role in LT-KI new ventures creation and as operational capabilities are related to DECs.

7.6.1) Introduction

Our research so far indicates that KIE within mature industries may satisfy the necessity of firms to change, mainly in order to face changing business environments. Although this was more evident in the T&C sector, this necessity to spawn knowledge-based innovation exists in the other two sectors too; all three sectors have to confront the intense pressures of low-cost products, changing composition of consumers, globalization and more rapid demand changes or even the pressure to produce safer, more environmentally friendly or more sophisticated and attractive products and lead niche markets. Thus, *consumer needs, technological opportunities*

and competitor activities are constantly in a state of flux (Teece, 2010, pp 702). Novelties may vary from patented novel products to novel combinations of production with sophisticated logistics and ICT systems. In all cases, advances in science and technology assist the innovative ideas.

This perhaps constitutes a specific feature of LT- KIE: while in the "before-KIE" era, machine manufacturers and raw material producers would lead the development in mature industries, it seems that within LT-KIE the entrepreneurs of the observed sectors take the lead and co-operate to develop machinery and equipment or excel technology to satisfy their novel ideas. For example microfibers, artificial and synthetic fibers became areas of experimentation for **T&C sector** while they are always branches of the chemicals industry. **F&B industry** may be inappropriately classified as low-tech. Although market-driven, we cannot "reasonably leave technology out of the picture" (Fagerberg, Mowery and Nelson, 2006). The range of expertise and knowledge bases spans from science (e.g. microbiology and bio-technology) to engineering, production technology and conditions sanitation, quality and environmental accessibility. With KIE, **W&F industry** moves - almost literally - from the hands of the craftsmen to more sophisticated entrepreneurs who try to produce innovation combining new materials with design and ICT or approaching quality and environmental issues in novel ways.

Thus, in all cases, traditional reliance of suppliers of machinery is being overtaken by needs for technologies from advances instrumentation such as lasers, electronics and computing, eco-technology, pharmaceuticals and smart materials supplied by high-tech firms. Seemingly simple advances such as packaging in the food industry or vintage jeans and light furniture in fact required quite sophisticated analyses of smart materials to combine with conditions such as heat responsiveness, pressure and humidity, novel ways of treatment and so on.

With the 4th hypothesis, we argue that **production technologies'** choice or development plays an important role in low-tech but knowledge-intensive venturing. Production technologies and more generally, the management of new technologies are lately receiving increasing attention in strategic management research (Greve, 2009) either as important factor of innovative efforts and firm performance (e.g. Danneels, 2002; Garcia & Calantone, 2002) or **as core elements of technological capabilities** (e.g. Lee et al., 1997; Westphal et al., 1985; Lall, 1992).

The **important role that production technologies** appear to play in almost all thirty cases of the research cannot be considered as unexpected and it surely deserves further exploration. Focusing on these empirical cases of the three Greek low-tech sectors, we purport to capture the *technical aspect* of the low-tech-knowledge-intensive venture creation problem; we actually explore how new low-tech ventures use knowledge from multiple and often trans-sectoral fields to intensively create and deploy many forms of production-relevant knowledge in order to develop innovative production technologies, build their initial competitive advantage and enter mature and saturated markets in alternative ways.

The findings so far have highlighted the necessity of knowledge-based innovation for the beginning of a viable low-tech but knowledge-intensive venture. It has also been often mentioned that all types of low-tech innovations include - to a greater or lesser extent – novelties in production technology which can be incremental or radical. Entrepreneurs were found to own specific traits and skills and to be more than just passive technology adopters. Corporate venturing presented also certain advantages compared to the new-to-the-world ventures regarding both sources access and necessary human and financial capital.

Furthermore, we suggest that **dynamic entrepreneurial capabilities affect this development of production technologies and therefore may be antecedents to functional competences and particularly the technological capabilities.** Therefore, DECs can be conceptualized as higher-order strategic processes that generate and combine the initial technological competences; these - in turn - will support the novel business idea via investment and create the initial competitive advantage intended to offer differentiation through concept realization (i.e. products, processes and/or models).

Operational capabilities are mainly based on technological knowledge which is called to fill the gap among business vision and physical implementation and which most times transcends sectoral limits. Adopting the definition of Dosi and Grazzi (2010) for technology as "a set of pieces of knowledge ultimately based on selected physical and chemical principles, know-how, methods, experiences of successes and failures, and also, of course, physical devices and equipment" we purport to stretch the significance of DECs in technological capabilities building. External technology needs to be located, transferred, combined and altered in order to form machinery, equipment,

processes and production routines. Bricolage capabilities will support the selection of distributed knowledge, processes and skills in order to find the best way of transforming the innovative concept into products or processes at an industrial scale.

Interactions between scientific knowledge, technological innovations, and industrial evolutions are enabled by improvisational capabilities. From conception to production, each step consists of a complex sequence of operations generally undertaken by different people who, however, must be coordinated although they may belong to different industries, firms and cultures. This is the procedural level which is "deeply intertwined with the analysis of how business organizations actually work since big "chunks" of activities occur within single organizational entities" (Dosi and Grazzi, 2010).

Yet, in order to convert business concepts into reality, the building of operational capabilities is based on the challenging of the fundamental mismatch between the nature of reality and the common predominant ways of thinking about that reality. That is technologies and processes have to be adjusted to novel business concepts, without stagnating into *"what seems not to fit"*. Therefore, transcendental capabilities are the dynamic entrepreneurial capabilities needed to establish novel technological paradigms which decide the rate and direction of novelty, impose the need of repeated attempts to solve constraints and cope with imbalances. Transcendental capabilities will actually guide and rate bricolage and improvisational capabilities in order to form technological capabilities and production processes, develop innovative knowledge-intensive business and capture novel niche markets.

Observations led to the suggestion that it is the creative combination of various technology sources and multiple knowledge bases that leads to the initial competitive advantage. The development of significantly innovative production technologies laid the foundations for a major number of the on-going innovations of the new firms in their lifespan becoming their core technological capabilities. The combinations could regard the manufacturing plant and equipment, manufacturing know-how, engineering know-how and quality assurance tools. They would include the co-design and embodiment of technology and production systems together with materials/supplier relations, knowledge, skills and experience bases.

7.6.2) Some explanatory notes

According to Eisenhardt and Graebner (2007), theory-building process *occurs via cycling among the case data, emerging theory, and extant literature* (p. 25). In this vein, the emergent patterns regarding knowledge-based innovation, DECs and DCs within LT-KIE so far became subjects of research in relation to:

a) The significance of production technologies in the state of physical creation of a business concept in venture creation, as stated in relevant literature (e.g. Naudé and Szirmai, 2012; Parker, 2008; Schumpeter, 1934; Tan et al., 2009) and
b) The importance of production technologies as operational technological capabilities of a firm

After a subsequent detailed multi-disciplinary investigation in the wider fields of technology management and technological capabilities research, we noted that the traced patterns could support our 4th hypothesis which was actually developed in order to answer a part of the second research question:

How do LT-KI entrepreneurs / entrepreneurial teams locate the new sources of knowledge, manage access to these sources and use knowledge in order to produce innovation and ***how do they transform the innovative result into production lines, products****?*

More precisely, the data analysis confirmed the fact that knowledge is mainly incorporated into production via investment (Smith, 2000). The transformation of the innovative business concepts into marketable products presupposes the choice and set up of the suitable production technologies and the function of investment is precisely to implement **new knowledge in production technologies.** The commitment to physical creation is thus a significant transition point in venture creation. Certain businesses require considerable resources for the set up of production technology and most of them besides the use of standard equipment and technology, **develop production technology novelties** in order to create respective products.

In our investigation on the role of production technologies as core elements of the technological capabilities new KI-LT ventures build to support innovative efforts and competitive advantage, we adapted Lall's (1992) classification of technological capabilities with regard to their functions in facilitating particular productive activities. Quoting the warning of Lall that the proposed functions "may not be exhaustive, and not all of them have to be performed for every industrial venture", we indicate the existence of technological capabilities when we trace:

1) technology search, process and new product design (investment dimension of technological capability according to Lall) and adaptation of manufacturing technologies to the new venture's requirements,

2) process, product and industrial engineering (production dimension) and

3) linkage within the economy translated as the ability to receive information, skills, know-how and specific technologies (e.g. with suppliers, academia ,other research institutes and/or other firms)

We further add the intention or the development of a technical NPD department from the very beginning as indication of the advanced technology level.

The above dimensions[292] support our assumption that production technologies are significant technological capabilities in LT-KIE. In order to serve knowledge-intensive entrepreneurship they have to be of high- or at least advanced-complexity according to Lall's matrix[293]. This regards mainly technologies internally developed or co-developed in cooperation with other stakeholders including potential patents obtained either by the new venture or by any other stakeholder.

Conditions will be particularly important when the machinery in question is **notably complex, embodies recently innovated technology in a machinery industry which may be a cooperation project with the LT-entrepreneur, is expensive and may have be patented**. While simpler, cheaper, mature or slowly changing equipment might simply be bought 'off the shelf' (having been developed by the producer in isolation from the user), acquisition of complex machines requires extensive interaction between user and producer (Lundvall, 1992).

The assumption is further supported by the definition of **technology capabilities** by Abernathy and Clark (1985). The authors name them alternatively production technologies and argue that their dimensions are the following: design and embodiment of technology, application of production systems and their organization, the cultivation of relevant skills (i.e. technical, organizational), the development of relationships to material suppliers, the capital equipment knowledge and experience bases. Technological capabilities are also considered the prerequisite for being able to produce complex products at a high level of performance (Klocke, 2009).

[292] For more details please refer to the relevant literature review
[293] For more details please refer to the relevant literature review

Therefore, production technologies as core technological capabilities focus on technology development and manufacturing processes while they are fundamental for new product development. Furthermore, links among DECs and production technologies will strengthen

a) the role of DECs in LT-KIE as higher-order, dynamic capabilities, and
b) the assumption on the relationships among DECs and DCs, since DCs have been found to impact technological resources (e.g. Protogerou et al., 2011)

In sum, the present developing theory on production technologies and DECs within knowledge intensive low-tech firms purports to offer a first systematic link between the strategic side of creating competitive advantage on the one hand, and the more mundane world of idea implementation and innovative production which appears to be vital for the foundations of entrepreneurial success in low-tech KIE.

7.6.3) Production technologies and LT-KIE

Klocke (2009) in his paper *Production Technology in High-Wage Countries – From Ideas of Today to Products of Tomorrow* argues that the application of correct strategies is not enough to create value if not combined to processes of technological know-how. The research analysis so far indicates quite clearly that the issue of production technologies and more generally initial technology selection or creation constitutes a significant part of LT-KIE. This is in line with literature: according to Teece et al. (1997) the future of a firm is decided by previous investments and the developed repertoire of routines. *Irreversibility* plays a role together with the initial conditions of a process (Teece, et al., 1994). Actually, the notion of path dependencies recognizes that "history matters" supporting further our hypothesis on the important role of the production-technologies capabilities.

Within the notion of LT-KIE, technology regards certain pieces of knowledge from an extremely varied range which have to be combined by entrepreneurs and all other stakeholders in creative ways to introduce novelties. According to Keith Smith in his paper *What is the 'knowledge economy'? Knowledge-intensive industries and distributed knowledge bases* (2000) "knowledge cannot be incorporated into production except via investment, and the function of investment is often to implement new knowledge in production technology". Much of the knowledge intensity enters then as embodied knowledge incorporated into machinery, equipment,

methods, techniques and production processes or as intermediate inputs such as components and materials[294]. Activities such as design / customization, the installation and preparation of equipment and trial production are knowledge generating activities. Many times users decide even to produce their own complex machinery in-house in order to protect proprietary process technologies that constitute a significant part of the firm's competitive advantage.

Altogether, entrepreneurs have to locate and organize the individual and often miscellaneous pieces of knowledge, information, product and/or process technology they need. According to our thirty cases, all types of novelties seem to entail a certain level of innovation regarding production technologies which may eventually range from production lines to engineering and operating procedures.

Furthermore, as seen in the previous sections, prospective innovation challenges with regard to process innovation lie in new process (production) technologies, automation and flexible high-tech processes that, for example, can offer tailor-made clothing in a mass production system. Staying in the textile and apparel sector example, challenges are related to new textiles and composite materials and their need for process and production innovation. Novelties regarded denim production technology, washing-prewashing processes, design and garment finishing. With regard to new machinery, processing methods and processing activities, challenges will lie in breakthroughs in technology areas such as biochemistry, biotechnology, plasma, laser and nanotechnology. As seen, **TCo6** delineated the initial idea in the triptych "innovative high-value products, other than cotton, for the European markets / shift to ecology-based processes and novel production technologies for cotton".

W&F "big five" cases introduce LT-KIE with novel production technologies, two of which are patented. **WCo2** caused significant changes mainly at national level, introducing novel production technology and patenting the relevant innovative process. On the other hand, weak cases present weaknesses in production technologies as well. The extremely innovative F&B knowledge-intensive cases accompany always novel products with novel production technologies and processes, while certain cases base KIE on purely innovative processes (e.g. FCo6, FCo8). In a more general view scholars nowadays tend to regard product and process innovations as interdependent revealing dynamic relationships between product and process

[294] "Embodied flows involve knowledge incorporated in to machinery and equipment" (Hirch-Kreinsen, 2006).

innovation (e.g. Don Simms and Trott, 2013; Heidenreich 2009; Reichstein and Salter, 2006).

Accepted the fact that the requisite knowledge and skills are distributed across many agents, production technologies are made in turn by tapping together appropriate technology made of components of a vast range of origins. Thus, the nature of knowledge upon which technological activities draw is multifarious regarding types of knowledge bases and skills and the ways they are used and applied in order to transform a concept into products and processes. Besides focusing on a few technological core competencies, most of the cases sustain competencies in multiple technology fields (in accordance with Granstrand, 2000). Because of increasing technology convergence, these fields are often relatively different from the core technologies (Garcia-Vega, 2006), and this puts further emphasis on the importance of successful technology exploitation (Patel & Pavitt, 1997). This is in line with literature; more and more traditional firms now acquire a substantial part of their technologies from external sources (Lichtenthaler & Ernst, 2007). Yet, one of PILOT's[295] results was that the purchase of equipment for innovating firms in traditional sectors is the only really relevant factor for the development of innovations. However, innovation rests not only on discovery but on learning, which can equally be based on activities which recombine or adapt existing forms of knowledge or the purchase of licences to use protected knowledge.

Therefore, it is quite clear that sources of knowledge play a significant role in the development of production technologies within LT-KIE. According to relevant literature (e.g. Hirsch-Kreinsen, 2008) most traditional sectors are supplier-dominated; **suppliers** of machinery and equipment and material suppliers then are significant sources of knowledge and expertise[296]. Close relations to the developers and manufacturers of production technologies are crucial particularly if technical equipment is custom designed, or if at least certain components and functions are adapted to the particular user needs. Naturally, this presupposes relatively close coordination, communication and learning processes between the partners concerned. New technologies are embodied in new components and equipment or enabled by innovative raw material while the diffusion of new technologies and learning takes place through learning-by-doing and by using.

[295] Policy and Innovation in Low-Tech, FP5 research project
[296] For more please refer to the relevant literature review

Most often, the knowledge internally generated by the firms is not enough if not complemented by knowledge emanating from external institutions such as universities and public laboratories and from other industrial actors such as suppliers and customers (see for example the relevant discussion in Dosi, 1988; Dosi and Grazzi, 2010 or Freeman, 1994). Actually, knowledge and technological solutions tend to permeate through *sectoral boundaries.* This holds especially true for the case of production technologies where there are special links and interactions among machine manufacturers, technology, raw material and complementary asset suppliers. Embodied flows are based on the fact that most research intensive industries (such as the advanced materials sector or the ICT) develop products that are used within other and most usually traditional industries. The receiving firms (or ventures) must of course develop the necessary skills and competences to use these advanced knowledge-based technologies; success of applied production technologies depends heavily on the ability to access and use such technologies. Therefore, it seems that production technologies constitute the media through which high-tech industries develop co-operations with low-tech ones with mutual benefits such as the exchange of knowledge, common R&D and even the mutual progress of firms and sectors within a dynamic- interactive supplier-customer framework. Indicatively, the analysis of the thirty cases made evident the significant role of ICT, as well as of other industries such as the chemical sector and the areas of biotechnology in LT-KIE.
Accordingly, we expect that:

Production technologies play a significant role in LT-KI new ventures creation.

LT-KIE appears to involve a mixture of existing production technologies with new innovative ones which may be borrowed by, and composed of many knowledge areas in the first stages of the entrepreneurial process. Production technologies then seem to be further significant in the co-formation of the strategic directions for the new LT-KI venture with quite obvious impact on the marketable products and services as well as the formation of organizational procedures and even the formation of the new venture's culture.

7.6.4) Dynamic entrepreneurial capabilities and production technologies

Production technologies include the capability to design machinery, acquire turnkey facilities which require more sophisticated R&D expertise, operate technological/production processes, assure quality control, do preventive maintenance, debugging and adjustments of the equipment to the local conditions or to the technological line. They have been deemed fundamental or implicit in order to produce novel products or services in most low-tech sectors (Spanos and Lioukas, 2001; Danneels, 2008). They constitute ***basic or operational technological capabilities*** according to Lall (1992) or otherwise the zero-order competencies that are needed for producing particular products (Protogerou et al., 2011). More precisely, the technological capabilities literature distinguishes between innovative and production capabilities (Lall, 1992; Bell and Pavitt, 1993), assigning the quality of 'advanced' to the prior and 'basic' to the latter.

In their general form, technological capabilities have been defined as the knowledge and skills required to identify, appraise, utilize and create appropriate technologies and techniques for the purposes of novel production facilities and production processes. They refer further to the engineering and organizational adaptations required to establish the potential of continuous upgrading and innovativeness on these process and product technologies (Acha, 2000; Lall, 1992; Iamarrino et al, 2009). They institutionalize research and development (R&D) activities; and carry out more basic technological activities, that is basic research (Fransman, 1984). They are built through interactions both within the firm and with external actors (Malerba, 1992).

On the other hand, DCs have been discussed to impact the operational technological capabilities of firms (e.g. Protogerou et al., 2011; Teece, 2014; Wilden et al., 2014; Winder, 2003). They are actually considered as the higher-order capabilities that integrate, recombine and generate new technological and marketing capabilities and which, in turn, shape firm performance. Our developing theory indicates DECs as higher-order capabilities and antecedents of DCs. We are therefore expecting them to support the realization of novel LT-KI business concepts, incorporate knowledge into production and assist the building of the initial competitive advantages. They are actually expected to be the tools by which functional production-technology

competences can be created, totally reconstructed and manipulated by entrepreneurs and managers so as to assist the formation of strong, innovative initial competitive advantages. Therefore, accepting the notion that higher-order capabilities serve as a basis for acquiring and reconfiguring lower-level capabilities (Protogerou et al., 2011), we expect that

Production technologies, as significant functional technological capabilities, are related to DECs.

7.6.4a) Bricolage capability and production technologies

Dosi and Grazzi (2010) claim that "in the most general terms, a technology can be seen as a human-constructed means for achieving a particular end…. This means most often entail procedures regarding how to achieve the ends concerned, particular bits of knowledge, artifacts and specific physical inputs necessary to yield the desired outcomes". The procedures of realizing a pioneering, novel and most usually knowledge-intensive idea draw upon specific elements of knowledge, partly of the existing know-how variety and partly of a more theoretical and creative variety.

Therefore, the availability of technological knowledge and access to sources of information pertinent to innovative technologies constitute key dimensions of LMT research (Hirsch-Kreinsen, 2013). According to Henderson and Clark (1990) technological knowledge is composed of two dimensions: knowledge of the components and architectural knowledge i.e. the linkage between the components. Furthermore, it seems that the requisite technological knowledge is composed of both internal knowledge and skills as well as knowledge and skills distributed across many agents; production technologies seem to be made by tapping together appropriate technology components of various origins. Then, a crucial issue concerns *when and how they are called for*. The answers to this issue are set during the development of **the environment for problem-making**; more specifically, this dimension sets explicit questions almost concurrently with the concept capture and the provocative need to realize it. Any satisfactory answer to the question of 'what technology and processes are needed?' and how they will be implemented usually embodies the representation of the specific forms of knowledge on which particular activities will be based. Such representations cannot be reduced to a set of well defined blueprints

but primarily concern problem-solving activities, involving also tacit forms of knowledge embodied in individuals and organisations.

Instead of focusing on a few technological core competencies, most of the case-ventures seem to seek for competencies in multiple technology fields. Because of increasing technology convergence, these fields are often relatively different from the core technologies (Garcia-Vega, 2006), and this puts further emphasis on the importance of successful technology exploitation (Patel & Pavitt, 1997). More and more traditional firms now acquire a substantial part of their technologies from external sources (Lichtenthaler & Ernst, 2007).

In order to tap this "distributed knowledge" (Hirsch-Kreinsen and Schwinge, 2012), agents need to develop bricolage capabilities as it has been discussed in detail above. According to Orr (1996), whenever bricolage is involved, an approach towards organizational knowledge as emerging from a network of social relations, experiences, and personalized memory will remain essential. Most often, knowledge internally generated in new knowledge-intensive traditional ventures is complemented by knowledge emanating from external institutions such as universities and public laboratories and from other industrial actors such as suppliers and customers (Dosi and Grazzi, 2010). In terms of finding the best way of transforming the innovative concept into products or processes at an industrial scale, novel technology is developed and promoted jointly with partners that entrepreneurs search and find along the value chain or even out of sectoral borders.

Consequently, the physical implementation of the usually novel business concept is unavoidably connected to the purchasing or co-design of quite expensive, long-lived products (i.e. machinery) whose full potential and qualities are usually unknown to the buyers and sometimes to the developers as well. Therefore, **close relations to the developers and manufacturers** of production technologies are crucial. This holds well particularly if technical equipment **is custom designed**, or **if at least certain components and functions are adapted to the particular user needs.** Naturally this presupposes relatively close coordination, communication and learning processes between the partners concerned. Entrepreneurs tend to establish teams at all possible levels (strategic, operational) in order to realize their ideas through machinery, processing methods and relevant organization. Of course, completely new, customized machinery or tailored to meet particular needs, possibly gives

entrepreneurs important competitive advantages. Such extended interactions with machinery makers produce usually much information and know-how which may not simply be embodied completely within the physical equipment itself, but can only be produced and transferred through joint processed of learning. In addition, many important technological insights originate with users, and producers' interaction providing essential sources of innovative ideas.

Even when referring to mere adaptation procedures, usually required when installing the purchased equipment or the *ex ante* specification for systems to be constructed in an application-oriented manner, there is much accumulated practical knowledge of the respective user company to be adapted, digested and further manipulated (Hirch-Kreinsen, 2003). What is common in all cases is that **learning** is always resorted to in a targeted and selective way to create and solve practical innovation problems. Although theory is rarely sufficiently robust to predict performance under operating conditions, it has to be incorporated in the new organization's body and cannot eliminate sometimes costly and time-consuming construction and testing efforts of prototype and pilot plant (paraphrasing Pavitt, 1987).

In certain cases and most often in corporate LT-KIE, the exploration and development of new techniques and product architectures is likely to occur in the "neighborhood" of the techniques and architectures already in use (Antonelli, 1995; Atkinson and Stiglitz, 1969; David, 1975).

Therefore, the **transaction of capital equipment co-development and consequently the development of LT-KI production technologies** is characterized by a high degree of uncertainty; consequently an enduring relationship based on trust is important in ensuring an effective transaction. Even the act of machine acquisition is *not* a one-time-only transaction as commonly thought, but rather a process of significant duration starting from the very design and development of it, going through installation and start-up which constitutes a significant stage of learning, and reaching regular operation.

It appears that the development of production technologies embraces both learning and social aspects. Continuous learning processes – especially for the tacit elements of know-how - cost substantial money and time. However, they enable the absorption as well as the creation of novel technical knowledge through accumulation skills and due to the existing knowledge abilities of the establishing teams. Entrepreneurs pose

spontaneity and creativity which can be observed in multiple approaches of technical problems when transferring an idea on a machine design, or building certain equipment or even customizing existing ones in order to produce innovation. Moreover, technological learning processes influence the rate of the emerging technological capabilities accumulation, facilitating further operational performance; these will be later embedded in relevant dynamic capabilities. Interactive learning capability further facilitates the trouble and turbulence of unexpected changes and reactions against designs and plans (which however imply also improvisation), throughout installation and pilot production where changes can occur due to inspirations of the moment or unexpected problems.

The social aspect of the above processes requires frequent interactions, which presuppose proximity of physical or at least some other dimension. In many cases cultural (i.e. language, managerial culture) and/or organizational proximity (i.e. harmonisation of the level of technology, homogenisation of procedures, a similar approach to quality control) may be more important than spatial proximity. Entrepreneurs' policies should then also focus on handling these aspects as these factors are often responsible for blocking successful cooperation activities.

Hence, entrepreneurs rely at first on their pre-existing networks as their primary means of access to the welter of resources needed. Personal and business networks are of great importance during production technology development, while usually new contacts are sought when problems or limitations occur, in a way of adding links to a chain. Furthermore, because of the customization, modification and adjustment which will likely take place during this production establishment process, each application of a given technology is, to some significant extent, qualitatively unique. Subsequently, the **expansion of networking** presupposes a high level of trust besides proximity (spatial or information-flow enabling).

Lundvall (1988) argues that the above considerations are particularly important where the machinery in question is particularly complex, embodies recently innovated technology undergoing rapid change and is expensive. Consequently, when production technologies are *sui generis,* complex, and embody new technology subject to rapid changes clustering of users, producers and other relevant stakeholders to enable frequent face-to-face contact becomes extremely important.

In most of the research cases it is not actually the products themselves that knowledge-intensive entrepreneurs have in the centre of their novel concepts, neither are equipments and inputs. It is more a matter of design and interaction followed by a series of modifications and a constant refinement of procedures planned by a team and not by a single agent. There are always cases of turn-key production-lines, but there are rare in knowledge-intensive novel business concepts and even then "bits and bites" of technical knowledge have to be collected. Moreover, the tacit elements involved in know-how imply that learning cost and time can be substantial. The exploration of "pieces of knowledge" that suits and development of new techniques and product architectures can be inspired by techniques and architectures already in use in similar or completely different sectors, be borrowed and modificated or be totally novel within the sector, which is rather rare.

Synergies can accrue from access to machinery that can be customized or tailored to meet users' particular needs, possibly assisting the core competitive advantage of their concept. In addition, many important technological insights originate with users. Producers' interaction with them provides an essential source of innovative ideas and information. Synergies are further needed to acquire the relevant capabilities and develop joint processes of learning by doing. The technology-oriented CCN and repertoire building will be then embedded in networking regarding technology collaborative agreements and more precisely common R&D and development of new products/services, machine and new production technology co-development and even operations management as seen in the relative section.

Therefore, bricolage capabilities seem to enable the creative use of a wide variety of technologies and equipment which leads to complex sets of production activities. It also allows the emergence of a certain level of organizational knowledge that CCN, and repertoire building together with personalized experiences and memories contain; this appears to be quite essential for the choice or co-development and the successful installation of the production technologies needed to realize their innovative ideas.

Proposition d1: Production technologies, as significant functional technological capabilities, are related to the bricolage capability in the emerging stage of knowledge-intensive low-tech venture creation

7.6.4b) Improvisational capability and production technologies

After the commitment to physical creation, i.e. the building of the physical structure, LT-KI entrepreneurs garner resources and use them toward technology set-up in parallel with organization creation and marketing. Physical implementation of innovative knowledge-based ideas seems to be partly driven by repeated attempts to cope with technological imbalances that it itself creates. For example, **FCo9** faced a significant challenge in the effort to turn experimental creation to commercial production; machinery and all relevant equipment had to be completely developed from scratch. Therefore, technological knowledge concerning methods, processes, arrangements and products is created, replicated, modified or co-produced. No matter the way, it is a painstaking and often quite expensive business (Mansfield et al., 1981).

According to our literature review, improvisational capability allows modifications, novelties and new insight to happen in a cumulative way, building upon initial plans using experience and real time information by all partners involved, tangling scientific with practical knowledge and mixing bricolage with new resources of all kind. It blends long-planned arrangements with inspirations of the moment[297], past experience and good practice with innovative perceptions. Our cases present such activities when ideas and acquired knowledge and information have to be transformed in processes and products leading to certain novelties on manufacturing and production processes as well as new unthought-of till then, products; sometimes patents arise from such extemporaneous solutions during the try-and-error processes of the novel product development, or even the erection phase. Improvisational capability enables coming up with difficulties in the transfer from vision to reality, from plans to implementation. This phenomenon appeared while trying to implement R&D to mass production, add or introduce innovative product properties and characteristics, or even during an effort to come up with a novel business or production model.

Inevitably, improvisation affects and becomes a part of the organizational processes that surround production technology at the core (Thompson, 1967). It is popular within LT-KI ventures to provoke the traditional character of their industries in terms of practical knowledge, otherwise by innovation in process specialization. They

[297] We remind the case of WCo2

stretch out into unfamiliar technological territories "interrupting deliberately habit patterns" (Barret, 1998).

Literature acknowledges that **real-time information** increases awareness and alertness (Vera & Crossan, 2005) of both the internal and external environment and makes diverse teams be 'present in the moment' (Hatch, 1999) in order to coordinate their actions (Moorman & Miner, 1998a) even when physical proximity is not obtainable and gain immediate feedback on them (Brown & Eisenhardt, 1997). It can be formal (e.g. through a business contact with partner organizations) or informal (a personal contact with academic professors or even with customers). It may regard the status of resources including information on machines, raw materials, tools and labour or the status of jobs includes tracking data for each operation (Ehlers and Van Rensburg, 1994).

Regardless the degree and type, available information especially on technical and scientific knowledge allows a fluid communication and interaction among founders and the manufacturing environment, translating ideas into machinery and transferring lab experiments into pilot and mass commercial production. Each particular body of knowledge shapes and constrains the rate and direction of technical change. The use or real-time information in low-tech industries is achieved mainly by persistence on remodeling by try & error and fixing processes, sometimes engaging customers in testing (e.g. WCo5, TCo4). In fact, technical change within the research cases of LT-KIE is mainly driven by repeated attempts to cope with technological imbalances that the initial idea itself creates and occasionaly through R&D activities. Together with bricolage capability, it enables the use of unconventional tools and methods which result to custom-made or even totally novel technical solutions.

However, the interactions among stakeholders all along the value chain in creating production novelties presuppose the capability of continuous learning, no matter the level and extent of innovativeness. As Pavitt (1984) puts it with regard to technological knowledge: "most technology is specific, complex . . . (and) cumulative in its development. . . It is specific to products and processes, since most of the expenditures are not on research, but on development and production engineering". This kind of specificity leads inevitably to the need of improvisational capability and shared cognition.

Fluid communication and interaction with the environment entails further the required *fit with the demands of the market environment.* The importance of this "fit" reveals the contradictory nature of the LT-KIE introductory innovations: they have to be astonishingly innovative and at the same time they have to be familiar. Information feeds try and error loops either in the form of testing the new products or processes by pilot market launching, check reactions and alter initial processes even when already installing machinery (e.g. FCo8) or multiply processes to response to the spontaneous reactions of the market or new scientific work (e.g. TCo9, FCo4, FCo1) and change processes to encounter difficulties and other specificities (WCo1,WCo2).

It also presupposes **flexibility** as discussed in the relevant section. Flexibility has been traced in the way of resources' use and combination to adapt technologies, the ways they acquire know-how or arrangements of R&D solutions. It engages imagination and bricolage, while there is some great deal of try and error in order to reach successful and satisfactory results. Most times difficulties appear in the transfer from pilot to mass production (e.g. FCo8) or the change of a certain model (e.g. TCo9). Then, improvisational capability enables agents to be flexible in changing and reacting against designs and plans even under the risk to jeopardize time to market or core characteristics of the products and the new venture's image. In all our research cases, flexibility appears to strongly affect the development of production activities, their efficiency, cost and time effectiveness as well as the desired outputs.

In sum, improvisational capability through real time information and continuous learning enables agents and stakeholders combine a range of skills, capabilities and resources to quickly find out the real 'size of the prize', bridging critical gaps in operations demands, business novel vision and information flows.

Proposition d2: Production technologies, as significant functional technological capabilities, are related to the improvisational capability in the emerging stage of knowledge-intensive low-tech venture creation

7.6.4. c) Transcendental capability and production technologies

According to our developing theory[298], entrepreneurs of knowledge-intensive low-tech industries are able to compose initial competitive advantages when they *exceed the sphere of common entrepreneurial phenomena*. Hence, they have to overcome the notion that cause and effect are close in time and space (Senge, 1990) and develop *a priori* knowledge through *transcendental capability (TC)*. TC is fundamental in forming innovative knowledge-intensive concepts in order to create the initial competitive advantage of a new low-tech venture, holding a significant role in the evolution of production technologies as well. Common entrepreneurial processes in low-tech sectors follow well trodden paths, complying with market and manufacturing *status quo*; i.e. use of existing technologies to satisfy and penetrate existing markets, seeking advantages in low prices, productivity increase, and better delivery terms. On the contrary, TC holders overcome the apparent difficulty in converting their business concepts into reality, by challenging the fundamental mismatch between the nature of reality and the common predominant ways of thinking about that reality. That is, they adjust technologies and processes to their novel business concepts, without stagnating into *"what seems not to fit"*. Innovative products or processes often need machinery not even invented by relevant manufacturers, while novel business concepts are based on innovative adjustments, re-arrangements or combinations of existing manufacturing technologies. Yet, in all such cases realization is the result of a process to determine the origin, the extent, and the objective validity of knowledge, having to deal with the laws of market and technology understanding and reason, ***but*** in so far only, as they refer *a priori* to set objects, and not, as general logic (as it may be in academic research), in so far as they refer promiscuously to the empirical as well as to the pure knowledge of existing sources, internal or external.

The development of needed technologies entails "an act of discovery, a speculation on the future, but also the creation of a new path through the distributed efforts of many" (Berglud, 2010). Idea implementation rests on combinations of activities which range from pure novelty to modest adaptation but in their essence "they reflect the pragmatic nature of most expressions of technological knowledge" (Pavitt, 1984). Scientific knowledge and new technologies are indeed indispensable for most low-

[298] Please refer to relevant chapter

tech knowledge intensive innovations (Hirch-Kreinsen, 2008). Yet, *a posteriori* knowledge alone is rarely sufficiently robust to support operating conditions, processes and performance.

The goal of generating values in a targeted way refers not only to the formation of proper business strategies but also to the creation and processing of the necessary production know-how. This is a strategic issue too: in knowledge-intensive low-tech firms value is added, in most occasions, through production technologies which are either the mediators or the much intended scope of innovation. The term "value-oriented production technology" is illuminated within the topic areas of production planning, flexibility and technological capability (Klocke, 2009). Technology understanding can enhance creativity not only for product and process requirements but also for product and process design, machining and analysis of complex ways of translating a conceptual schema into marketable products.

In this context the development of new values is accelerated by a combination of technological know-how in different areas of competence, whose location though is not as simple as it may seem. It actually depends on the agents' *sense of spaciousness* that defines the width and the quality of sources to seek, resources required and combinations made. More precisely, **PEA** pertains to the *nature of knowledge* upon which technological activities – including of course production – draws. From this angle of observation, PEA may define and direct the types of knowledge bases and skills which are called upon in, say, the transformation of pieces of vegitable, feta cheese, fruit, and so on into innovative gourmet products. We should mention that this puts further emphasis on the importance of successful technology exploitation (Patel & Pavitt, 1997). A strong sense of PEA then stretches to production technologies and technological capabilities building for an initially abstract business idea, depends on the agents' attitudes and cognitive capabilities and enhances possible co-operations and solutions while getting out of the sectoral limits. It appears in different modes according to the traditional sector profile. As innovation, it may be sector-specific and more rapid when it refers to developments and appliance of scientific knowledge developed in the relevant, connected or even completely different sciences. For example, in our research, food industry reveals a significant dynamism regarding innovation; it refers to appliance of scientific knowledge developed in food technology but also other sciences such as biotechnology and organic chemistry. In

the other two sectors, technological knowledge appeared to be developing in parallel with design and business models, as well as the appliance of novel raw and supplementary materials.

Then, novel production technologies are developing robustly to implement "out of the lab" novelties into production and hence **spaciousness** is highly related to such processes. In any case, the range and intensity of such movements depend on the level of view of global value chains and intra- and inter-sectoral industry potential. High-level PEA allows for recognizing connections among different input and translating information in novel technologies: it enables a wider search of partners for production technologies development even out of the common sector technology producers and manufacturers, benchmarking and stronger focus on the relevant arising problems when trying to advance from novel idea to physical creation. Many times it defines the framework of cooperation with the business concept visionary to be the leader and not the follower of the production technologies project. That allows for bolder experimentation and closer cooperation which are both enhanced where mutual benefits are expected.

While ***transcendental conditions*** refer to the ability to extend horizons, seeking novelty and getting out of the limits, ***transcendental synthesis*** strategically organizes the value orientation of technological knowledge and processes to seek. As a coherently organized bottom-up and top-down multifaceted information processing capacity, it ensures that technology-information codes are flexible and complex; scientific and, even more so, technological knowledge, shares, to a different extent, the property of being tacit and is *scattered* over diverse sources. It may be further of variable quality, not equitably accessible and insufficiently 'translated'. LT-KI entrepreneurs confront rapid and discontinuous changes, where technological achievements, information and knowledge are the drivers for the new venture success. In that chaotic world, they have literally to struggle with the dissipation of knowledge. Transcendental synthesis enables the control over the creation, capturing, storing and managing often trans-sectoral unstructured and scattered in many different formats knowledge toward the physical implementation of the novel idea. Receptivity and spontaneity apply further to the *pre-existing knowledge* leading to any discovery and also to the *prerequisite knowledge* to interpret and apply whatever codified information is generated" (Dosi, 2010). Therefore, once again, it depends on the

cognitive properties of the agents, their knowledge on ways to interpret imagination into concrete issues and ways to locate, retrieve and store relevant data, their mechanisms to process them as valuable information and combine them with relevant resources in order to prepare the manifold.

Knowledge-intensive entrepreneurs through transcendental synthesis amass a great number of concepts that allow them to interpret their needs in different ways. The abstract concept of "seeing kitchen cabinets *not* as furniture" was captured due to *receptivity* (i.e. the conscious harnessing of existing technologies, specificities of the national market, new potential due to arising technologies, knowledge and experience of other industries) and interpreted through imagination to the a priori-knowledge based "boxing concept" providing it with contents which would lack without transcendental synthesis dimension (such as the introduction of production flexibility from mass- to one-piece production, parametric structure etc). These contents were translated and filtered with knowledge mechanisms into requested knowledge on technologies, processes and new relations within the value chain arising structural and manufacturing challenges and alerting the bricolage capability for novel reconciliations. Synthesis (regarding production technologies) resulted through the other DECs as well, to ***innovative machinery*** (patented later by the machine manufacturer), ***novel processes and product design***, as well as different but equally important benefits for all stakeholders (e.g. the machine manufacturer won the first award in technology for innovative machinery in the following international relevant machine exhibition).

Therefore r*eceptivity and spontaneity* can combine business concept requirements with technology which can exist, can need modifications or extensions or must even be created by manufacturers who are keen to do so. Technology understanding can enhance creativity not only for product and process requirements but also for product and process design, machining and analysis of complex ways of translating a conceptual schema into marketable products.

However, spontaneity can be also traced in approaches of technical problems (e.g. by manufacturers –suppliers and the new venture stakeholders) on how to transfer an idea on a machine design, or how to build certain equipment or even to customize existing ones (e.g. WCo1, WCo8, FCo8). It is of special interest when time is a scarce resource; for example when there are already existing orders to fulfill such as in the

case of FCo1 or when conditions of time pressure together with ambiguity and uncertainty are created (e.g. FCo3, TCo4).

The dimension of **judgment** is also evident in the cases and constantly exercised by applying processes that order and structure the sometimes abstract objects of the business concepts so as to make them cognizable. Together with experience, it seems to be very important for the development of new production systems especially in the absence of established design methodologies (Alic, 1990). A judgment consists then of a match between technological potentials, be them technologies, capabilities or science, and the main concept. It is a mediator in the cooperation with manufacturers, a provoker when ideas are too much "out of the box" and a major driver of the synthesis**.** Mechanisms of comparison, combination, separation and further elaboration of the amorphous collected knowledge mass are activated to produce machines, processes or even manufacturing models either using a priori knowledge and producing rapid innovation or producing novelties by differentiating.

Transcedental capability seems to be the capability that supports high novelty which results in innovative product and/or service development; these, in turn, are accompanied by advanced production technologies. As the foregoing discussion indicates, there is more to technology and the ability to select, employ and creatively recombine technological elements effectivelly than just obtain machinery and information about "how to do things". Therefore, TC appears to be an important part of the picture; ***it actually creates the knowledge of how to create value.*** Innovative knowledge-intensive strategies together with value –oriented technologies represent decisive potential for the creation of strong initial competitve advantages.

Proposition d3: Production technologies, as significant functional technological capabilities, are related to the transcendental capability in the emerging stage of knowledge-intensive low-tech venture creation

7.6.5. Hypothesis 4 and sector-level analysis

I. WOOD AND FURNITURE SECTOR

Although our research started without seeking ventures of certain types of introductory innovation, it turned out that knowledge-intensive W&F ventures develop mainly **process innovation** (Table 7.18). Even in cases of innovative products or business models, process changes and novelties were necessary to support the initial innovation. This is in line with relevant literature (e.g. Heidenreich 2009, Fagerberg, 2005) as mentioned before. Hirsch-Kreinsen (2008b) further notes this close relationship between product and process innovation.

We remind that cases were distiguished in **three types of knowledge-intensive venturing**. The **first type** represents a more balanced emphasis on different dimensions of knowledge[299] and relies mainly but not solely on external knowledge seeking (BKD, i.e. Balanced Knowledge Dimensions). Five cases belong to this type. The **second type** develops only the technical dimension of innovation combining both internal and external knowledge development (TIEK, i.e. Technical – Internal-External - Knowledge). This group contains three cases and only corporate ventures, raising certain questions on KI corporate venturing. The **last type** focuses again on only the technical dimension of innovation relying on only external knowledge and refers to two new-to-the-world ventures (TEK, i.e. Technical-External -Knowledge).

Besides focusing on a few technological core competencies, most of the cases sustain competencies in multiple technology fields. Table 7.19 provides an overview on the respective partnering activities

Machinery suppliers and suppliers of raw and intermediate products play the most important role. They belong to various fields which somehow are connected to different links of the relevant value chain. Because of increasing technology convergence, these fields are often relatively different from the core technologies and this puts further emphasis on the importance of successful technology exploitation (Patel & Pavitt, 1997). Other knowledge sources (denoted as consultants and other organizations) are also involved confirming the view in the literature (e.g. Granstrand,

[299] ***Note:*** *Actually it covers the three axes of a new venture: technology axis which is relevant to the technical development of a novel concept up to full scale production, Market axis which refers to the interaction with the market and the business axis which includes the business steps needed such as commercialization and business scheme selection, business and relative model development and IPR protection.*

2000; Garcia-Vega, 2006; Bender, 2004; Hirsch-Kreinsen and Schwinge, 2011) that low-technology sectors rely on a variety of knowledge sources and make use of distributed and trans-sectoral knowledge bases. The contribution of high-tech sectors is also observed mainly in the form of ICT providers (all cases) or manufacturers of electrical and electronic instruments (most cases). Table 7.19 does not include sources such as databases and internet, published work, patents, conferences, trade fairs or exhibitions. Such public sources of knowledge have been used of the majority of the interviewees of all groups accroding to their sayings.

50**Table 7.18:Main venture targets of W&F KIE**

a/a	Main Activity	Type of KI	Main Type of Initial Innovation	Main functional parameter	Patents	Involve supplied innovative material
WCo1	Veneers, veneer stitching	BKD	Process* (products)	Quality (Reciprocal interdependence)	(the machine maker)	yes
WCo2	Lacquered/printed MDF laminate flooring	TIEK	Process (products)	Functionality (Reciprocal interdependence)	yes	no
WCo3	Kitchen, wardrobe	BKD	Process and business model	functionality		no
WCo4	Panels, flooring, glue – laminated products	BKD	Product, (Process)	Reciprocal interdependence	yes	no
WCo5	Evropanel for furniture - walls	TEK	Process (products)	Exploit innovation elsewhere produced		yes
WCo6	Marine Plywood wooden flooring decorative panels	TIEK	Process	quality		no
WCo7	Wood pellets	TEK	Product using novel Production Technologies	Exploit innovation elsewhere produced		no
WCo8	Kitchen, wardrobe	BKD	Process / Technology	functionality	(the machine maker)	yes
WCo9	Decking fences	TIEK	Product/ (Production Technology)	Reciprocal interdependence	(the production technology provider)	yes
WCo10	Mattresses	BKD	Business model			no

* this means that the initial innovation was process-based (to improve stitsching quality) but it produced novel products as well

51 **Table 7.19: Technology knowledge-based sources used during venturing**

Cases / Knowledge source	WCo1	WCo2	WCo3	WCo4	WCo5	WCo6	WCo7	WCo8	WCo9	WCo10
Customers		1			2					
Suppliers of raw materials & intermediate products	4	3	7	2	1	1	2	3	3	4
Suppliers of machinery, packaging	3	20	4	3	2	5	4	6	4	5
Competitors *	1	2			1		1			
Other firms**	2	4	2	2	3	2	2	4	2	3
Universities, Technical Colleges	1	2	1	1	1	1	1	2	1	2
Consultants	1	3	1	1	1	1	1	1	2	2
Other actors / organizations	1			1		1		3	1	3
Total	**13**	**35**	**15**	**10**	**11**	**11**	**11**	**19**	**13**	**19**

* firms from the same sub-sector
**firms such as ICT providers, electrical machinery, special electronic equipment, chemical industry
*** quality controls or other parallel activity knowledge providers

It seems that new LT-KI entrepreneurs or entrepreneurial teams usually develop novel business ideas and consume resources to combine or modify existing technologies or even support the development of new ones. Thus, they develop linkages which go beyond traditional buyer-supplier relations being more interactive and inventive. In most cases, they co-operate with machine manufacturers to develop extremely specialized equipment to fit specific requirements. **WCo8**'s entrepreneur co-developed a multi-task machine to fit his novel "box-concept" of line production. The CNC machine was then patented by the machine manufacturer (with the entrepeneur's permission) and won an innovation prize in a world machine exhibition.

The most impressive case is **WCo2**, a woodworking corporate venture. The entrepreneur engaged 20 machine manufacturers of various fields, which were ranged as global leaders in specific technologies to co-operate under the guidance of a leading consultant international company to produce "*his technological miracle"*. This impressive operation ended with a patented MDF production technology which had cost more that 70 million Euros.

All major technologies are developed mainly by European manufacturers. American machine suppliers are also used in two cases; WCo8 and WCo2. Greek companies are used for supportive constructions and ICT solutions. This is however not strange since Greece lacks relevant industries; the same phenomenon is observed in other countries and other sectors as well (i.e. Trippl, 2010).

In table 7.18 there are three cases presented where the novel initial business ideas turn around innovative products (WCo4, WCo7 and WCo9). Yet, all three cases developed novel production technologies as well. **WCo9** bought patented technology by an American research organization. However, this technology had to be modified to suit local conditions and raw material. An almost "turn-key solution" turned to a new research project; problems of the pilot production led to a formal European research project (COST). This case denotes a further direction towards the potential hidden behind the so-called "purchase of embodied technologies".

On the other hand, all cases demonstrate the existence of reciprocal relationships between product and process innovation indicating that technological contexts *do moderate* the physical implementation of LT-KI initial business idea, whether it is product or process-focused. More specifically, **the cases make evident that novel product development leads to process development and *vice versa*.**

However, all cases show a rather weak relation to Universities and other research institutions. This can be attributed to the fact that there is only one relevant educational and research institute in Greece to fit the relevant field and it has been contacted by all ten cases (Table 7.19).

Among the cases, there are also two cases where the initial business idea is a novel business model. In both cases innovative production technologies, although incremental, supported the basic idea advancing existing ones as already described in previous sections. Both cases needed and developed co-operations with different technology areas and occupied international organizations.

In all cases wood processing technology, wood behavior science, chemistry, mechanical engineering, material engineering, ICT and extruding technology are engaged while certain other fields are involved in each case. A creative bricolage of research work and industrial practice results in innovative products and processes covering technologies for an extremely wide range including areas of high-tech industries. In parallel, improvements, parameterization and automatization are

involved to solve problems and create new directions. These cases indicate that low-tech companies may be something more than just "borrowers" of technology. Yet, they verify the fact that entrepreneurial or managerial teams locate and organize the individual and often miscellaneous pieces of product and/or process technology they need in order to innovate.

The cases verified also existing literature (e.g. Smith (2008); Robertson et al., 2009) regarding the significance of raw materials and intermediate products in low-tech innovation. However, their role during venturing does not appear to be that important; **they rather support than guide the initial novelty.** In most cases novel material adds to properties of the final product or constitutes part of improvements. There is only one case (WCo9) where the innovative material gave birth to an innovative production technology and the opening of a new niche market. Once again suppliers of innovative raw materials are in their majority foreign companies.

A quite interesting issue is the fact that novel production technologies as venture enablers arise either as solutions to specific problems in the cases of corporate venturing and as a *vehicle* to create niche markets in the cases of new-to-the-world firms. All cases indicate that entrepreneurs (even new ones) have a satisfactory knowledge of the sectors - at least - and significant relevant experience. This is rather tautological; innovation in production technology cannot start without any previous involvement in the relevant fields.

Table 7.20 presents the dimensions of technological capabilities according to Lall's matrix as traced in our LT-KIE cases of the W&F sector. They regard mainly technologies internally developed or co-developed in cooperation with other stakeholders. They are considered particularly important when the machinery developed is notably complex, emboding recently innovated technology or the "fruit" of a cooperation project with the LT-entrepreneur. We have further added the intention or the development of a technical NPD department from the very beginning as indication of the advanced technology level.

The table indicates quite clearly that the two cases of weak DECs (and weak DCs as well) lag behind regarding production technologies and consequently technological capabilities too. It is also quite evident that almost no W&F case tried any in-house machinery buiding or process engineering with the exception of WCo5 which built a

certain type of machinery but with no great success. At the opposite lies WCo10 which manages to produce massivelly ecological products:

> "Let me tell you this example: there is no machine in the world to process cotton. We are actually "rowing against the mainstream". Such production is always too risky; it is prone to static electricity and fire. Our production is against conventional industrial production. Our efforts for ecological mass production for the world market make us live in isolaton; all adapt easy solutions". (entrepreneur of WCo10)

52**Table 7.20:Dimensions of technological capabilities according to Lall's matrix**

Case / **Investment and production dimension**	**WCo 1**	**WCo 2**	**WCo3**	**WCo4**	**WCo5**	**WCo6**	**WCo7**	**WCo8**	**WCo9**	**WCo10**
technology search	√	√	√	√	√	√	√	√	√	√
process design	√	√	√	√		√		√		
new product design	√	√		√	√			√	√	√
adaptation of technologies to new venture's requirements	√	√	√	√		√		√	√	√
Linkages										
Co-development*	√	√	√	√		√		√	√	√
Customization*	√	√	√	√	√	√	√	√	√	√
In-built*					√					√
Intention for NPD Dpt	√	√	√	√		√		√	√	√

* regarding machinery, equipment, methods, processes, material

All four cases of corporate venturing present certain advantages compared to the new-to-the-world ventures. Resources are richer and abundant, networking and contacts are easier, organizational capabilities are higher and better developed. This is in line with literature which states that corporate ventures can benefit from their parents' resources, which are an important requirement for enhancing the innovation process (Thompson, 1965).

Most cases develop production technologies as a means to keep leadership and enhance innovation in their lifespan, underlining the significance of production technologies not only during venturing but afterwards as well. Indicatively,

WCo2 invests on **aggressive technology and NPD almost every year: By the end of 2006 a *new product*, lacquered MDF enriched product portfolio advancing quality of innovative products. It is *further improved with printed designs.***

In 2006-2007 the company invested on a *new ultramodern production line* of laminate flooring which, until that moment, was an exclusively imported product. At the same time, a new unit for veneer jointing is taking effect while the logistics system is enlarging to cover 4.000m2. Additionally, new spacious offices of 300m2 are inaugurated.

By the end of **2008** the company *buys the technology of Heat Regain System* with Direct Use of Exhaust Fumes in the Fiber Dryer, becoming **a pioneer in Greece and Balkans.** Additional innovative solutions have been applied during erection. E.g., within the context of the specific systems, the company stores in silos the wood sub-products that are discarded during the *production process by the use of an integrated suctions system*. Thus pollutants such as micro-particles are nullified and their highest possible quantity is used as fuel. This investment saves energy and money and protects the environment. The company also introduces *a new R&D product the fire-resistant MDF* (90 minute resistance which is under certification by a relevant European Organization – the new properties can save lives in case of fire)

In **2009** WCo2 invested further in the *increase of productivity* (8.000.000 €), with full modernization and the addition of 4 new production lines (unique in Greece and Balkans), in order to produce 120.000 m3 of raw MDF per year.

WCo9 was established only in 2006. Still it soon went on investing in R&D, focusing on quality, durability and aesthetics as well as the design and development of new landscaping solutions. In **2008-2009** it developed R&D on new designs and technical solutions to products such as to make WPC bars lighter or more compact or to improve WPC properties adapted to Greek conditions (quality and durability).

In **2010** the company developed a new foaming technology.

WCo4 invests in combinations of innovative products and technologies. After having secured survival they turn to their innovative concepts. They enter K-cluster research project to work on 3-part glue-laminated wood products with trapezoidal particles (innovation at least at European level) and biomass production in **2005-2006**. These two innovative ideas would also solve the problem of wood residue exploitation. Experimentation and control tests are run in the TEI's (Dpt of wood and furniture

technology) labs. The entrepreneurs expected a positive market reaction to the innovative laminated products due to the increasing eco-friendly and recycling trends. In parallel they develop a novel idea on limited production of special decorative parts, which is however not totally developed at this stage.

2007 was devoted to productivity increase with in-house innovation on technical parameters and specifically saw geometrical characteristics and ability to produce smaller diameters. The research was once again supported by the relevant TEI Dpt.

2008 was devoted to quality

In **2009** research starts again. Participating in a new research project of TEI, the firm works to build a process of receiving and working out information to group Greek timber according to European norms. The research went on till 2011 and now the company is at the stage of applying for the relevant certificates. The same year an R&D project results on wooden bricks development. They were presented at the most important relevant trade show in Greece in 2010. According to the entrepreneurs, this innovation was possible due to their ability to combine creatively design, cutting-edge technology and the know-how of producing a large variety of glue-laminated products.

In **2010** they entree the BIOCLUS research project in order to further exploit the particle possibility to produce "green" energy.

After the realization of the "box concept" which ended with the co-development of a machine that offered a patent and good sale to the machine manufacturer, **WCo8** went on with technological novelties.

2**001-2002:** CIM introduction

2003 – 2007: many fixtures and installations to solve specific problems of box-concept, introduction of corian and artificial plywood in Greece, novel design

2008-2009: new technology dyeing plant with many novelties to suit the atomization introduced by the entrepreneur.

Another point of interest concerns the issue of proximity among all engaged stakeholders; i.e. machine and other equipment manufacturers, suppliers, supplementary installation makers or science and technology producers. The fact that the majority of them were abroad caused significant trouble in the cases of the new-

comers. WCo1's entrepreneur consumed significant time and money to reach manufacturers and develop the desired technology. One of the reasons that WCo3's entrepreneurs entered the Italian cluster was the matter of distance to machine manufacturers:

> "In Pesaro all stakeholders are close to each other. They share knowledge and experience and can experiment. We have no manufacturers here. As members of the cluster we managed to have their assistance and expertise. Otherwise this would be very difficult. We are not [WCo2] or [WCo9]; for these companies, manufacturers would rush to find technical solutions to their inquires" (Entrepreneur of WCo3)

Distance appeared rather "disturbing" for the corporate cases too. Thus, actors representing large and important sources of demand for machine producing firms interacted effectively with foreign manufacturers, even over long intervening distances (WCo2, WCo6 and WCo9). It should be further mentioned that even after installation there would be local service personnel to represent the machine vendor. However, there are also numerous examples within the cases (as it will be seen in the other two sectoral groups too) of distant - even international- external supply links but for complex, specialized machinery (e.g. WCo1, WCo8 and WCo9).

> "Yes, in Italy and Germany machine manufacturers are next to plants similar to mine. After installing the machinery, they visit them, solve the arising problems, introduce improvements and inform for emerging novelties or about proper service. We, in Greece, are more or less isolated. We have then to develop other mechanisms. For example we build informal cooperation and technology transfer with the erectors and train in-house teams….. When a company installs a new machine there are of course frequent visits – you see I refer to much customized machinery. Our core suppliers are German and Swiss; they come here, they transfer their knowledge; we actually work too close – especially for the innovative stitching machinery". (Entrepreneur of WCo6)

It is quite obvious that even activities such as the installation and preparation of equipment and trial production are knowledge-generating activities. Knowledge-intensive W&F entrepreneurs through bricolage capabilities seem to disregard the limitations of technology and/or technical standards to find new production ways to fit their business concepts. This constitutes a significant part of their specific ***problem making*** dimension.

The four cases of corporate venturing have engaged a significant part of human, social and financial capital in reaching various knowledge bases and translate combinations

in novel production technologies. Path dependencies secure easier and faster co-operations, more trust and advanced planning. There is always a better mapping of the relevant areas of interest, while the problems of spatial proximity can be easier overcome as mentioned just above. Accumulated technical and practical knowledge can also secure and enable further advances required. Bricolage is found to engage mainly machine and raw material suppliers i.e. CCN includes mechanical engineering, IT and chemistry, material engineering and design.

New-to-the-world ventures reported many problems, and obstacles related to important lack of relevant technological knowledge, significant waste of time in searching for appropriate technical knowledge sources, severe difficulty in establishing contacts and trust with stakeholders, lack of proper human resources and many inconsistencies between planning and realization.

The two weak cases seem to fail mainly at the implementation phase; the excellent idea of WCo5 finds difficulties into its physical implementation; weak bricolage derives the company for the development of proper production technologies among the other weaknesses. **WCo7** contented itself to the patented technology initially adapted to local conditions. This technology became obsolete in a very short time since it did not try to update it improving properties and adapting to Greek needs.

Interactive learning appears to be a main sub-dimension of the "technical part" of repertoire building. In most cases it constituted a highly dynamic process: **WCo1** collects, combines and generates knowledge while embedding a relative culture of constant learning in order to build its novel processes. **WCo8** uses knowledge from various scientific areas to realize the novel production technology of the "boxing concept". **WCo2** invests mainly in technological knowledge to intervene in innovative ways to known processes increasing productivity, incorporate ecological aspects, achieve energy savings, and recycling while patenting innovative processes. In all cases learning comes besides conscious knowledge generation, through trial and error and experimentation.

Many times, even in cases of successful production establishment, new entrepreneurs missed the qualified, interdisciplinary team which would embrace the design, engineering, production, procurement and quality departments due to the emphasis

given on idea implementation through technology. Yet, all entrepreneurs admitted that learning was developed all along the founding stage.

Production technologies are also affected by the **improvisational capabilities** of the entrepreneurs / entrepreneurial teams. They have played a significant role in the case of **WCo2** resulting in a novel (patented) process during the erection stage *in pursuit of more novelty and differentiation.* **WCo4's** entrepreneurs use their improvisational capabilities and blend cutting edge technologies with innovative new-to-the market products such as laminated wood from particles and biomass energy novelties. **WCo1** is also a wonderful case proving the significance of this DEC on production technologies development: technical problems find excellent solutions, technical restrictions lead to innovative processes. Real-time information and spontaneous reaction seemed to play a significant role in decision making regarding the kind, the extent and the strategic role of the developed production technologies. **WCo3** uses improvisational capabilities to solve arising problems mainly *due to distance*, resulting in the ***modular design concept*** (benchmarking SWATCH) and the subsequent novel changes in machinery. **WCo10** started its long journey to new natural raw materials besides the classic ones (i.e. cotton and wood) by **experimenting and many try-and-error loops** regarding both processes of elaborating materials for mattresses and reactions of customers. **WCo9** revealed certain dimensions of improvisational capabilities, such as diversity, moderate use of regulation and control with a tolerance of mistakes, a sense of urgency, promotion of experimentation and action in order to make the best of the patented novel technology it had acquired by the American research organization. In the case of **WCo6**, improvisational capabilities are characterized by a conscious and stable communication and interaction with the environment in order to excel the implementation of the new technology, through the study of the results of the lab results and the engagement of customer's observations.

On the other side, weaknesses in all DECs lead to not properly developed production technologies to support the novel business idea for **WCo5** and to rapid product obsolescence for **WCo7.** Weak transcendental capabilities led to weak bricolage and improvisational capabilities thus defined a moderate width and quality of sources to seek, resources, ways and combinations required. **WCo5** rested on sources offered by

the honeycomb provider and **WCo7** in technology and perspectives as given by the Italian technology providers.

According to the analysis of the ten W&F cases, improvisational capability allowed modifications, novelties and new insights, tangling scientific with practical knowledge and mixing bricolage with new resources of all kind. Long-planned arrangements were blended with inspirations of the moment (e.g in the cases of WCo1 and WCo2), past experience and good practice resulted ininnovative technical solutions (e.g. in the cases of WCo6, WCo9 and WCo10). In almost all cases, incremental or even radical deviations from initial discussions with machine manufacturers were observed responding in this way to unexpected situations or technical limitations and resource shortage (WCo2), overcoming problems (WCo3, WCo5, WCo8), obstacles (WCo1, WCo3, WCo7) and deficiencies (WCo1, WCo3, WCo4, WCo5). Such deviations have led to innovative machinery –the case of WCo8 is quite an exemplary one; real-time information and cooperation led to a world-level patented new machine that won the innovation prize of the year.

W&F-KIE seems to start with a vague and not well-shaped idea (e.g. "sleep in nature" or "high quality") which will gradually take a shape getting out of commonalities and familiar ways of thinking in order to produce novelty. According to Senge (1990) it is quite difficult to put new insights into practice since existing images limit us to familiar ways of acting. Therefore, transcendental capability is further needed in the physical implementation of the novel business concepts: as seen in the majority of the cases, innovative products or processes often need machinery not even invented by relevant manufacturers, innovative adjustments, or combinations of existing manufacturing technologies. For example, **WCo10** creates a vision of eco-products massively produced. This stresses an "unconventional production technologies issue" from the very beginning.

However, it should be stressed that the cases indicate further that technology is only one of the axes for the success of a new venture; the entrepreneurs need to develop equaly the marketing and organization axes[300]. For example, **WCo4** presented significant technical innovation but did not develop equally all three axes. Both **WCo9** and **WCo7** introduced patented technology for innovative products into

[300] This is in line with literature as seen before.

Greece and Balkans. However, WCo9 managed to adopt the product to local conditions, train customers and open markets while the new venture stimulated further research of the novel product which ranged from design to formulation and properties. On the other side, WCo7 was unable to exploit its initial innovative idea.

The role of **transcendental conditions** appears to be of great importance. **PEA** pertains to the *nature of knowledge* upon which technological activities – including of course production – draws. Thus the level of PEA limits the range for sources, knowledge and co- operations to seek. This was evident in the **two weak cases.** The entrepreneurs seemed not to know where actually to focus, or whom to contact for co-operation. The lack of any search for partners regarding the relevant production technologies development is almost astonishing.

However, it seems to affect the cases of strong transcedental capabilities as well. As observed, the *"industry masters"* such as the agents of WCo6 and WCo9 focused on mainly technical knowledge-intensive innovation embracing parallel -novel or not- activities to support novelty such as top leadership models, quality excellence and novel training models.

On the other hand, the *"cosmopolitans"* such as the agents of WCo2, WCo8 and WCo10 presented a wider approach around the phenomenon of their business concepts being open to every chance offered, independently of origins and initial relevancy. They transceded the common sectoral technology producers and manufacturers, engaged benchmarking and stronger focus on the relevant arising problems when trying to advance from novel idea to physical creation and attempted . bolder experimentation. For example, **WCo8** was the only new-to-the-world case where the entrepreneur deliberately shaped a new ecosystem in kitchen construction for small companies *based on automatization, parametric design and flexibility.* The entrepreneur actually entered areas well outside the common business eco-system of kitchen manufacturers. Furthermore, he appeared to own significant transcendental synthesis as well: The abstract concept of "kitchen cabinets *do not* equal furniture" was captured due to *receptivity* (i.e. the conscious harnessing of existing technologies, specificities of the national market, new potential due to arising technologies, knowledge and experience of other industries) and interpreted through imagination to the a priori-knowledge based "boxing concept".

Technology understanding seems to be important; it is evident in all cases but for the two weak ones. Entreprenurs enhance their creativity not only for product and process requirements but also for product and process design and machining. It is further traced in approaches of technical problems (WCo1, WCo2, WCo3, WCo4, WCo5, WCo6, WCo8), the co-development of machine designs (WCo1, WCo2, WCo4, WCo6, WCo8), and even the customization of existing equipment (e.g. WCo1, WCo8).

Moderate transcendental conditions were observed to be related mainly with technical knowledge-based innovation which however was not translated in a relatively advanced venture (WCo1, WCo3 and WCo4). **WCo4** and **WCo1**'s entrepreneurs have a very good picture of the sub-sectors they belong to, they purposefully develop product and process knowledge-based innovation but they do not have a panoramic view of the wood and furniture sector which would allow them to create more opportunities and new markets in more extensive ways (mediocre sense of spaciousness).

Transcendental capabilities created the conditions for **WCo4** to enter the Italian cluster and end up with modular production – a rather complicated application of production technologies:

> "It is not easy to enter such a cluster – at least for us that we are not in the same area and did not share the same culture… Our production technology had to be flexible and efficient. This refers to customized technological and organizational solutions – it was not just a matter of choice and erection of existing machinery. Besides the production model, ICT and flexible automation systems were very important. The developed systems had to be modified for the modular design and production concept. However, this was achieved in cooperation with some manufacturing firms of the cluster and their experience regarding know-how and manufacturing".

We should further remind that all W&F cases continued as knowledge-intensive and innovative new firms. Further development of novel processes together with innovative products have been mentioned in the chapter regarding innovativeness (i.e. *Dynamic entrepreneurial capabilities and innovativeness)* and the relevant descriptions of the cases. An observation could be the fact that the following innovations in the lifespan of most cases are rather incremental and regard mostly product improvements, new product developments and applications of novel raw

material. Process modifications are also reported; still not at the scale of the initial innovation, while they attend issues such as energy saving, envirmental protection or efficiency and productivity increase and quality. All ten ventures have survived the usually used five years criterion (Ensley et al., 2006).

The empirical results have shown that Greek W&F ventures prefer to invest on production technology innovation in order to secure a position within mature and saturated markets. Technologies are developed as accumulation of various pieces of knowledge sources out of the strict sectoral limits, selected to fulfill conditions and limitations of the initial business idea and combined in novel ways ending up even with machinery innovation. The entrepreneurs interact with a wide range of stakeholders all along the value chain and at global level. Yet, machine manufacturers and raw material providers are the most important links; this was rather expected since we refer to production technologies, but not to the extent found. The results strengthen our assumption on the role of production technologies for LT-KIE. The analysis further supported our assumptions on the role of DECs on production technologies. Transcedental capabilities seem to hold the strategic role creating strategic problems in order to match the novel ideas to implementation and physical creation. Low-level TCs result in limited bricolage regarding both repertoire building and networking. This is evident in the case of WCo5 where the novel idea failed to be transferred in efficient production among other weaknesses.

Differences have been traced among corporate and new-to-the-world ventures. Established organizations seem to have the potential, capital and capabilities to develop far more advanced innovative production technology innovations than the newly established companies at least in W&F cases.

II. FOOD AND BEVERAGES SECTOR

The F&B knowledge-intensive cases seem to regard **product and process innovations as interdependent**. This is in accordance with literature; scholars discuss dynamic relationships between product and process innovation (e.g. Don Simms and Trott, 2013; Heidenreich 2009; Reichstein and Salter, 2006). Table 7.21 reveals that all ten cases sought their initial competitive advantage through knowledge-based innovative processes which resulted in radically innovative products

(FCo1, FCo5, FCo9) or significantly differentiated ones (FCo2, FCo3, FCo4, FCo7, FCo8 and FCo10). More precisely,

a) four cases started by a vague idea on innovative products and devoted great effort (try-and-error processes, co-operation and successive improvements and changes) to transform lab-products into commercial production: FCo1, FCo4, FCo5, FCo9.

> So how do you translate, let's say that little thought of yours into a product which will be able to be produced in a constant and industrial way? This question was followed by much conversation with machine makers; we had to find out the feasibility of our ideas at industrial level; on the other hand, the machine suppliers had to commit themselves that their machinery can satisfy our requirements; they had to assure us that they could manufacture such machinery. (Entrepreneur of FCo9)

> "Production technologies were the most difficult part of our venture idea: how would we fill olives with cheese? I mean at an industrial scale. We **had to** find the way…." (Entrepreneur of FCo1)

All of them have presented significant innovative products with most of them to be novel at global scale. They have all secured brands while FCo5 and FCo9 have further patented a number of their products[301]. FCo1 and FCo9 encountered bureaucracy problems due to the newness of their products). FC4, FCo5 and FCo9 had also some trouble with public services related to food safety and regulation, the General Chemical State Laboratory of Greece and the National Organization for Medicines due to the fact that as radical innovations, authorities were rather confused regarding health claims and licenses.

b) Four cases invested mainly on production technologies and process innovation for major differentiation in products: FCo6, FCo7, FCo8 and FCo10. There are all cases of corporate venturing which try to excel in quality, technology and alternative production methods that advance the status of their products as well as to combine such innovations with parallel investment in marketing, NPD and even its business model (e.g. FCo10).

> "We posed the quite simple question: Why should quality mean just following the set standards? Who makes specifications? So, we thought of milk of higher quality standards: this meant a combination of high-quality raw material (i.e. milk), process technology and innovative package

[301] FCo9 is in the process of patenting the production technology as well in Greece, Europe and USA.

technology[302]. We had to co-operate with the leaders. You see, we target the intelligent consumers". (Entrepreneur of FCo8)

"The new venture would cover the need to develop special, differentiated products. The plant would allow for more research on the product. We approached the German manufacturer in order to implement our plans and to have tier assistance in the following [research] stages. The innovative technology triggered many innovations. You see, strategies of coping or even reverse engineering act as boomerangs; you will be always second and you will have to pay whatever is offered to you – you will always depend on the others. On the other hand, if you develop your own technology, you can change it, improve it, you can do advanced research and develop it further. … We work on the triptych innovation-quality-safety and try to excel in knowledge verticalization – I refer to rice. We do not want to include many products under our brand" (Entrepreneur of FCo6)

Corporate KIE seemed to pay back; FCo4 owns five awards on quality and taste so far, FCo6 was rewarded several times among which for innovation and commercial success in SIAL international fair in 2002, quality in 2009, entrepreneurial excellence and innovation in 2013. FCo8 won the Golden Award in Famous Brands 2013 while FCo10 has received an impressive number of relevant quality awards[303]. FCo6 and FCo7 have further patented innovative process technologies and all of the companies have patented brand names.

c) Two cases (FCo2 and FCo3) innovate by novel production technologies which result in differentiated products. In both cases, products and technologies are more or less known (outside Greece) and results are quite expected, although there were certain difficulties in implementation. We assume, it is not irrelevant that these are the two weak cases of the F&B group. These two cases are further the only ones to have developed the third type of knowledge-intensive venturing; i.e. they are new-to-the-world and have focused on only the technical dimension of innovation relying on only external knowledge (TEK, i.e. Technical-External -Knowledge).

Six cases show a more balanced emphasis on different dimensions of knowledge and develop a equally in-house knowledge and mechanisms of external knowledge seeking (BKD, i.e. Balanced Knowledge Dimensions). These cases are the ones with strong DECs. The remaining two cases develop only the technical dimension of

[302] The company was the first in Greece and among the three on Europe to buy and use a novel packaging technology

[303] The latest known is the Gold Award in the international "Best olive oils contest" in New York (April, 2014)

innovation, combining both internal and external knowledge development (TIEK, i.e. Technical – Internal-External - Knowledge). These are the cases of moderate DECs.

53**Table 7.21: Main venture targets of F&B KIE**

a/a	Main Activity	Type of KI	Main Type of Initial Innovation	Main functional parameter	Patents	Involve supplied innovative material
FCo1	Antipasti,staffed olives spreads	BKD	products (Process)	Reciprocal interdependence		no
FCo2	cucubers	TEK	Process	Innovative production method elsewhere produced		no
FCo3	whole egg, yolk, , albumin	TEK	Product-Process	Innovative production method elsewhere produced		no
FCo4	organic and quasi pharmaceutical chocolate superfoods	TIEK	Product, (Process)	Reciprocal interdependence		no
FCo5	conventional and biological wheat flour and semolina, gluten-free wheat flour, biofunctional flour and relevant foods (5%)	BKD	product (Process)	Reciprocal interdependence	yes	no
FCo6	parboiled rice exotic rice specialities and HO.RE.CA. products (20%)	BKD	Process (product)	quality	yes	no
FCo7	Gourmet dairy products and traditional cheese	TIEK	Process (product)	Reciprocal interdependence	yes	no
FCo8	Milk, juices,yogourts cheese 20%	BKD	Process (Product)	quality /Technology	yes	no
FCo9	Gluten-free snacks, cheese ups	BKD	Product/ (Process)	Reciprocal interdependence	yes	no
FCo10	Oil, olives, spreads-dips "Greek gourmet products"	BKD	Business model	Together with product /process innovation		no

Contrary to the W&F sector (mainly the cases of WCo1, WCo5 and WCo9), it seems that innovative raw material or semi-finished supplies do not constitute sources of innovative business ideas. However, packaging material and innovative packaging methods are important contributors to the physical implementation of all of the cases as evident in Table 7.22.

At a first sight, Table 7.23 evolves certain questions if compared to the relevant Table 7.20 of the W&F group; the number of technical knowledge providers seems to be relatively short in comparison to W&F cases. This is probably due to the fact that W&F interviewees focused mainly on the combination of technical knowledge to create processes and present novel products or methods; as a consequence, they stressed the emphasis in listing contributors in their undertaking[304]. On the other hand, entrepreneurs of this second group are more excited narrating their novel ideas on innovative products and processes than list contributors. They are more abstract and mention plural for manufacturing companies, consultants and other sources. Therefore, they would say - for example - that companies from Greece, Italy and Germany were involved but they do not mention the number. Furthermore they refer to names only when the manufacturers are world leaders, omitting the other smaller contributors.

Indicatively, the entrepreneur of **FCo6** mentioned the co-operation with "many consultants (academic or not)", "several University departments", "highly qualified Greek design companies or departments of foreign ones in Greece[305]", "Greek automation companies" and "several machine manufacturers from Germany, Spain, Italy, Sweden and England". He refers specifically to Schule, the German technology provider that co-operated with the rest manufacturers to build the plant. More precisely, Mother Company developed a four-year research project together with Schule to end up with the novel technology[306]. *"I think we went rather fast. It took us 3-4 years to formalize the initial idea, experiment, make the plant and improve the product. It was quite an adventure!"*

[304] Another reason is the fact that the author was actively involved in the sector, being familiar to names and with inside knowledge of the industry. This made this narration much easier, which did not happen in the F&B group.

[305] The company considers design a very important factor in delivering the company's concept to consumers.

[306] In 1997, they started investigating the new method with Mrs NK, the chemical engineer as scientific champion and later entered PAVET 97 (Programme for the Development of Industrial Research and Technology for new Enterprises) financed by the General Secretariat for Research and Technology for the development of new rice products using extrusion methodology. In 1999 they further entered the EPET II program (Operational Program for Research and Technology), the Investment Law 2601/1998 and an operational programme for energy (biomass and electric energy) funded by the Ministry of Development. They also enterer PEPER 2000 Promotion of Demonstration Projects and Innovation) for the improvements needed in the method (approved budget 1.400.000 €) in cooperation with the TEI of Larissa (2000-2002), followed by a second and a third PEPER 2000 (2002-2004, 2003-20006 TEI of Athens).

Most parts of the innovative plant are pilot-made and there is much knowledge transfer among machine suppliers and customer. Certain parts are designed by the entrepreneurs, themselves and constructed by local companies. A special reference was also made to a specific Greek manufacturing company which seems to have assisted in a number of modifications and took over the project of maintaining the whole installation. Due to the innovativeness of the processes there were many problems arising from theory to practice. Most of them were solved in cooperation with this Greek manufacturing company. This process resulted to new knowledge for all parties involved. Their contributions are described as vital by the entrepreneur

> "Theory and especially new theory were well imprinted on papers and designs but reality posed inconsistencies and failures. That's where this Greek manufacturing company went further and solved many problems. Yes, this small Greek company was flexible and could provide solutions to implementation problems. This co-operation gave birth to many ideas which were adapted by the Germans and were applied in other installations of theirs too."

The packaging industry is also an important supplier which adds further to the innovative concept of the new venture. The entrepreneur makes special mention to the packaging company; together they developed new packaging in terms of safety, transparency, easiness to handle etc. Some of the innovative projects were the triple packaging of the exotic series based on new material and process technology without any cut or gluing. The Group invested significantly in packaging which according to the entrepreneur "*it ensures our innovative picture and quality. Caesar's wife doesn't need* to be *only honest*; *she has* to *look honest as well.*"

In parallel, at the stage of the erection, the new plant is further equipped with modern technology quality equipment while through a research self-funded program with a professor of the Food Technology Department of Athens TEI (Technological Educational Institute) they developed new control methods (e.g. aflatoxines HPLC). At the same time another self-funded research is carried out on kinetics of rice and artificial aging. The plant is further equipped with a pilot laboratory, air and water pollution control systems, improved energy efficiency systems of parboiling and drying with heat recovery equipment, product protection systems including magnets, metal detectors, checkweighers and cleaning systems etc. By the end of 2000 the new state of the art plant is ready, fully equipped, and innovative while a strong scientific basis has been created for further innovation.

The exciting KIE- story of FCo6 cannot be eliminating in numbers of stakeholders. The new venture focused on high-quality products with high nutritional value in the peak of Research and Technology aiming at differentiation and innovative product and concept leadership. It is the first company in Europe to produce parboiled rice while further introducing the innovative process of continuous cooking. It is also the first private company that was certified with P.G.E. (Protected Geographic Clue) in Europe. **KIE was translated into a radical innovative production method, patented for ten years in Greece and seven years in Europe and several patented brand names and package types:**

> "We developed an innovative technology, an innovative process, an innovative production method and our very own know-how. […]. This resulted in many innovations (the entrepreneur names some). We are still the only ones in Europe. […]The whole project engaged much knowledge both for the cultivation and the production flow management"

Table 7.22: Technology knowledge-based sources mentioned during venturing

Cases / Knowledge source	FCo1	FCo2	FCo3	FCo4	FCo5	FCo6	FCo7	FCo8	FCo9	FCo10
Customers					5min	yes				
Suppliers of raw materials & intermediate products			1		1	yes				
Suppliers of machinery, packaging	3	3	2	3	N/A	yes	6	6	2 min	2
Competitors *										
Other firms**	2	3		1	N/A	yes		1	1	N/A
Academia		1	1	1	1	yes		1		1
Consultants	1	4		1		yes			2 min	
Other actors / organizations			2	1	1	yes	1	3	1	1
Total (min)	**6**	**11**	**6**	**6**	**5**	**yes**	**7**	**11**	**6**	**4**

* firms from the same sub-sector
**firms such as ICT providers, electrical machinery, special electronic equipment
*** quality controls or other parallel activity knowledge providers
N/A : no relevant information supplied by the interviewees although there are certain indications of the active involvement of the relevant sources. E.g. ICT has certainly played a role in the installation of FCo10's and FCo3's production lines; however it has been mentioned that the production line was modified with a closed circuit of 4 points to secure the desired temperature and be recorded in the PLC.

Once again and as expected, machine manufacturers play the most important role, while the role of raw material providers seems to be rather negligible. In the same

vein with W&F cases, they develop linkages which go beyond traditional buyer-supplier relations being more interactive and inventive. In most cases, they co-operate with machine manufacturers to develop extremely specialized equipment to fit specific requirements. Almost all F&B interviewees narrated stories of machine co-development or even in-built machinery:

> "Our production lines are mostly customized. There is only a 20% of conventional machinery. All the rest bear our own design and have been manufactured exclusively for us, for our requirements and our needs. […] The refrigerating equipment is of significant importance for the production line. It is our own patent. The rolling machine was also a co-development project. When it started working we had many problems. Now we have solved almost all of them. Actually we have further noted certain improvement tips now that we watch it at every-day work. You see, there are no commercial equipment to satisfy our requirements."
>
> (Entrepreneur of FCo4)

Appropriability regarding specific pieces of machinery (result of co-development) does not seem important. Manufacturers must be able to cover the requirements of the entrepreneurs, are sought mainly abroad and mostly in Europe and are supported by Greek manufacturing and ICT and automation companies. In most cases the sizes and complexity are such that manufacturers do not deny the challenge, even if it is unique.

> "We were a special case and we demanded special interest and effort by them, but the size of the project was that big that they would benefit. Such companies have dedicated departments and develop the required technology. We had a written contract that the developed machinery could not be elsewhere sold but we are not really interested. You see, it is not only the machine and equipment you use but the whole know-how."
>
> (Entrepeneur of FCo9)

> "We often modify the designed machinery ourselves and some of these modifications are adapted by the manufacturers and are incorporated into their commercial products" (Entreprenur of FCo5)

Yet, the F&B group presented **the highest potential of trans-sectoral knowledge combinations**. Besides the variety of food-and-plant – science related areas, entrepreneurs extended to completely different sciences and technologies such as biotechnology, chemistry, biochemistry, environmental engineering and packaging technology. The most important issue is perhaps the fact that they did not participate as passive adapters but they played active roles in innovations even in the packaging industry (e.g. FCo1 and FCo6). The contribution of high-tech sectors, mainly ICT,

automation and electronics is also evident in all cases; this is quite normal since food industry is mainly continuous process production and automation, and advanced safety systems are part of all relevant processes. The extant knowledge and experience of all entrepreneurs (as seen in the relevant chapter) plays a significant role in production technologies too. The entreprenur of **FCo7** is the main actor of the patented technology. The entrepreneur of **FCo5** has even created a new production line benchmarking his own (previous) plant of tomato processing. We remind that he had studied chemistry, specialized in chemistry –industry related electronics and had taken courses in food technology.

The mediocre involvement of Academia was actually not expected for the specific sector: all cases seem to use only one academic institute (University or TEI) when starting the KI-venture. The three cases that appear in Table 4.5 with no such co-operations have used specialized consultants (CCN) and have turned to private control labs. This can be due to a number of reasons: inability to reach the academic world, especially in the cases of nascent KIE, the length of time involved in university research in comparison to foreign private research organizations, the hesitance of the exact type of research the new KI-idea needs, perceptions on the role of Universities such as that they do not integrate the real world or that they are not really interested for the industry world but just for their own projects and research.

> "They usually want to take advantage of your name. They do research just for themselves. They tell us to put our signature –just do it! Then you don't need to do anything at all!" (Entrepreneur of FCo5)

Accordingly, it appears that factors such as mistrust, time and cultural distance played a significant role at least in the first stages of F&B KIE. This is in line with relevant literature on University-industry relationships (e.g. Caloghirou et al., 2004; Caloghirou et al., 2001; Carayannis et al., 2000). However, this obstacle seems to be easy surpassed as the specific firms grow; almost all cases developed significant co-operations with University and TEI departments in their lifespan.

Interestingly enough there are almost no co-operations with customers while there is literally no co-operation with any competitor contrasting W&F sector where such activities were present. FCo5 and FCo6 appear as the only two cases that use customers as knowledge sources. Actually, FCo5 uses two types of customers:

a) business customers who accept to use the innovative wheat flour as raw material, such as bread industries, bakeries and confectionaries

b) the celiac disease and the cancer patient associations; members accept to taste the products and report their observations such as taste preferences, symptoms etc.

FCo6 referred only to business customers such as hotels, catering and restaurants.

Table 7.23 indicates quite clearly that the two cases of weak DECs (and weak DCs as well) lag behind regarding production technologies and consequently technological capabilities too as the respective weak W&F cases . Yet, in contrast to the W&F group, five out of ten cases clearly stated that they have developed in-built machinery. With the exception of the weak cases all others have also mentioned co-development and customization which was also common in the W&F group.

Table 7.23:Dimensions of technological capabilities according to Lall's matrix

Cases / **Investment and production dimension**	**FCo1**	**FCo2**	**FCo3**	**FCo4**	**FCo5**	**FCo6**	**FCo7**	**FCo8**	**FCo9**	**FCo10**
technology search	√	√	√	√	√	√		√	√	√
process design	√			√	√		√		√	
new product design	√			√	√	√	√	√	√	√
adaptation of technologies to new venture's requirements	√	√	√	√	√	√	√	√	√	√
Linkages[307]										
Co-development*	√			√	√	√	√		N/A	N/A
Customization*	√	√		√	√	√	√	√	√	√
In-built*	√			√	√	N/A	√		√	N/A
Intention for NPD Dpt	√		√	√	√	√	√	√	√	√

* regarding machinery, equipment, methods, processes, material

N/A not specifically mentioned but it can be included in general sayings such as "a combination of fixed constructions (ιδιοκατασκευές) and general purpose machinery" of FCo9's or related expressions of FCo10's interviewees.

[307] Other than Knowledge sources which are presented in Table 4.2.

All six cases of corporate venturing present again certain advantages compared to the new-to-the-world ventures. Resource availability (both tangible as financial capital and intangible as social and human capital) appears to be a major determinant for the development of production technologies. Entrepreneurs revealed an easiness and comfort in attracting world's leading machine makers or in contacting academia departments. They can devote more resources for more complex and large-scale production lines.

Mother company of **FCo6** had long invested in technology and technological innovation (since the early 70s). They would buy cutting edge technology regarding production, safety and traceability. Long lasting relationships opened the way for the advanced research-based co-operation for the innovative technology process.

Parent company of **FCo8** was one of the strongest in its sector in 1999. With a turnover of 35 million Euros and several large-scale investments in technology, the entrepreneurs encountered no difficulty in working with European leaders and provide innovative and cutting edge technology for the new venture.

> "If you own a company of a critical size and you have long lasting and credible relationships with the leaders abroad […] then a [production technology development] project contract is not a significant problem, even these companies are not in Greece". (Entrepreneur of FCo8)

The new venture invested from the very beginning and goes on investing on mostly technological and process innovations, at global level and in cooperation with the largest manufacturers, and University departments. This impacts significantly its NPD processes regarding both dairy and fruit juice products. Indicatively, after the significant initial plant investment, it invested in the innovative pet technology (among the three first companies in Europe) and the only one in Greece.

In **2002** they bought the innovative pasteurization technology incorporating an innovative anti-bacterial cleaner which ended up with a novel milk–product (and several problems with the information and the name on the bottle and no relevant norms and legislation).

In **2004** they invest significant amounts on fruit juice cutting edge technology which according to the entrepreneur was innovative at world-level. This investment led to the creation of new production technology-based capabilities for the company, much technology transfer and significant knowledge exchange.

> "The technology provider presented its world-patented technology[308] in the Frankfurt international show and I was interested in it. We chose to be the first to install it and it was a fine decision. It was the first worldwide! It cost around 1.5 million. But we had to specify many things since it was the first application and there was no former experience. For example the problem of taste: number of fruit to use per liter, humility and temperature, time … These could not be provided by the manufacturer. Our engineers had many problems to solve, indeed!"

Several other investments in technology and innovation blend each other to enhance production, quality, innovativeness and image efficiency of FCo8 such as a novel yogurt production method based on a co-operative research project with a Swiss research institute and benchmarking which resulted in a new production line, the incorporation of novelties in production lines, micro-filters, and high-quality and very expensive novelties regarding control systems. According to the entrepreneur the amount of technological investments surpasses the amount of seventy million Euros during the decade 2000-2010. The company goes on investing in energy and water saving. Indicatively, it has recently completed a 10 million investment on a pioneering biogas production process in Europe.

Easier access to stakeholders all along the value chain (e.g. manufacturers, consultants and other types of knowledge providers) is also observed in the two cases of new-to-the-world firms (**FCo1** and **FCo9**) due to the strong family business background which can support financial and organizational demands as well. FCo9's entrepreneur actually argues that it was easier to find foreign specialists than Greeks. For this venture the difficulty laid in the design of industrial scale production in terms of quantity, constant quality, repeatability and successful transfer of texture and taste at mass production.

> "We have used food technologists, operation engineers for the production line design and the improvements after installation and pilot production and chemical engineers […] Even if you have make several tests with the manufacturers and you think that you are ready, you do have problems when transferring the production from the laboratory to mass production. So, there were some quite difficult issues and we brought specialists from abroad – a highly specialized company which develops food technology. We found them in internet. We had no Greek company in mind then. Now we decided to co-operate with Universities." (Entrepreneur of FCo9)

[308] Some technical description is provided in the report

Both FCo1 and FCo9 have contacted Italian manufacturers for the majority of their machinery, have made modifications and combinations and added several controls.

On the other hand, FCo2, FCo3 and FCo4 with limited resources encountered major difficulties in production technologies development including waste of valuable time and money in order to find solutions, contacts and/or face arising and non-expected problems. They further are much more conscious in investing in new technology and further technological novelties. A common attitude of these three companies - but observed in other as well - is the inclusion of local manufacturers, machine shops, ICT and automation firms during installation for several purposes and more precisely

a) To undertake several supplementary construction which would be too expensive to be made abroad
b) To be trained and undertake maintenance
c) To compliment in-built machinery construction together with the entrepreneurs.

The entrepreneur of **FCo3** narrates regarding technical malfunctions and maintenance

> "We had to improvise… trying all day long. The cost to bring someone from Italy was too high since there was no similar production line in Greece to share expenses."

Fco4's production lines are almost 90% manufactured in Greece.

> "It would be too expensive if we tried to co-operate with a foreign company and there is no direct technical support. Think on the easiness regarding such machine co-development for Germans. They do whatever they wish."

The entrepreneur of **FCo7** has admitted that general purpose machinery is bought by Italian, German and Greek companies. However, when coming to the innovative processes

> "the existing equipment does not fit our plans since we want to create some other unique characteristics. Furthermore, it is extremely difficult to explain what exactly you need duw to lack of prior experience. We have constructed many parts of our production line by ourselves with Greek machine shops".

The above discussion reveals the importance of **bricolage** in the F&B sector regarding production technologies; technology developers, sometimes well out of the sectoral boarders such as the pioneering technology of climate neutral oil (environmental engineering) of FCo10, the innovative packaging for most cases mechanical engineering by manufacturers and machine shops, automation, ICT and

applied chemistry. Regarding the cases of radical innovation, production technologies were developed in regards to other high-tech sciences such as biotechnology, human pathology (e.g. celiac disease, diabetes etc) and biochemistry.

Indicatively, as seen above, **FCo6** engaged a network of local constructors (both of region of Macedonia and of West Greece) for plant manufacturing. Due to the mother company there was significant networking with the leading plant manufacturing constructors as well as with plant installation constructors for pipelining, electrical installations, transportation lines, automations and so on, as well as some machine shops on custom-made or self-made, in-built machinery.

> "We used the leaders. We knew them. We had worked with them. And we trusted them. We were clear in our expectations. They knew from the very beginning that they were chosen because they were the best and because they would assist us when the next innovative idea would come. Of course they knew that this would happen soon after they finished with this project".

CCN is then a quite significant dimension as explained in detail in the relevant section; in some cases actors even choose to stay within known cycles since stakeholders are considered to be global leaders. **Interactive learning** appears to be a main sub-dimension of the "technical part" of repertoire building. Some cases that extent well outside their sector searching for other –usually more advanced- knowledge bases present a high level of learning capability. Scientific or technical knowledge has to be assimilated in practice mainly in a fast mode. These are mainly the cases of FCo5, FCo6 and FCo9. **FCo6** invests in novel technological knowledge to intervene in innovative ways to known processes offering new products while increasing productivity and focusing on ecological aspects, energy savings and recycling. In all cases learning comes besides conscious knowledge generation, through trial and error and experimentation. Knowledge flows appear also when malfunctions and problems occur in the whole process starting from the design phase till the pilot production. On the other side, the ***two weak DEC-cases, FCo2 and FCo3***, show certain weaknesses regarding learning as well as in adding knowledge further. ***FCo7, a case of moderate DECs***, presents a reluctance to develop research-based networks in order to expand knowledge limits.

Problem making is evident in most efforts of implementing the idea in practice and more precisely to industrial production. All F&B entrepreneurs have posed such implementation questions, searched for technologies and got actively involved in

finding solutions to arising technical problems. However, the strong bricolage cases reveal a dynamic problem creation since they address radical challenges. Cases of moderate bricolage capabilities seem to be inspired by similar products using benchmarking or reverse engineering and follow more conscious steps. The weak ones address problems that have been dealt by others at global level, and are more of the adaptation-to-local-conditions type.

Production technologies are affected by **the improvisational capabilities** of the entrepreneurs / entrepreneurial teams. Almost all cases have reported modifications of ordered machinery, complementary equipment and new equipment to solve arising problems when using the new machinery for real production (FCo2, FCo3, FCo4, FCo5, FCo6, FCo9) or to new arising requirements of customers or the market (FCo1 and FCo8). Certain parts of machienry are even designed by the entrepreneurs themselves and constructed by local machine shops. Cross-functional activities and associated investments take place concurrently, rather than sequentially, in order the newly launched products to cut time-to-market.

T**he cases of strong improvisational capabilities** are more flexible in causing and adapting changes and advance further the initial project; **FCo5** displays a full spectrum of improvisational prowess enabling creative solutions around the main challenge such as creative ways of solving the mass production without the need of totally changing production lines, industrialization of new opportunities by testers and a significant advance from the initial idea (gluten free wheat flour) to other food products with far more advanced properties. Under the words of the interviewee, improvisational capability appears to affect even the final form of ordered machinery and the reaction to malfunctions producing new knowledge.

> "There is always the equipment supplier's power. They give you a machine and say "This is it!" Then it is a matter of networking, it depends on the supplier you have chosen and his will to maintain the relationship with you. [….] You must know exactly what you want then. But even at the stage of erection we learn and then problems emerge again and we have to find the solutions. […] The main problem is that innovative equipment is unique."

An indicative example of this is the following: the new wheat needed somewhere in the process to enter the next step more clean and fluffy that the designed system could offer. That caused a major problem as the pilot production started which was solved due to the improvisational capability of FCo5's technical department: the technical solution required some additional parts to the machinery of the new product line

department which were manufactured by a foreign company. The foreign manufacturer later engaged the new solution in a new type of manufactured production lines under the permission of FCo5.

Improvisational capability appears to be significantly strong in the case of **FCo9**: Production process has to be reshaped many times during the transfer from the manufacturer to plant and every-day production. There is much flexibility and experimentation observed, as well as a constant interaction with the manufacturers, and changes of a great number of different parameters as the idea is evolving.

The two cases of **weak improvisational capabilities** appear quite slow in finding solutions and quite inflexible in adapting changes. **FCo2** lost two-years production due to its poor improvisational capabilities and the inability to cope with the arising technical problems from theory to practice. **FCo3** appears to hesitate in devoting resources to interact to new information and avoids robust experimentation.

In the same line with the ten W&F cases, improvisational capabilities allowed modifications, novelties and new insights, tangling scientific with practical knowledge and mixing bricolage with new resources of all kind. Such deviations have led to innovative machinery too or improvements and modifications which are adapted by the machine manufacturers. The entrepreneurs start again with a vague idea on innovative products or a novel concept, by sometimes posing questions or listening to questions, such as:

"How should the company be reinvented in order to suit to the new entrepreneurial international landscape?" (FCo6)

"Why tsalafouti cannot be produced in winter?" (FCo7)

"Why should we follow existing standards for milk quality?" (FCo8)

"Who said that gluten-free products are medicine food? (FCo9)

These questions gradually turn to "flesh and bones" due to the transcendental capabilities of actors that surpass sectoral and national borders and technology limits. As in the W&F group, in the majority of the cases, there is not ready to buy machinery and equipment for the innovative products or processes. Sometimes it appears even difficult to explain to manufacturers the purpose of the required technology. In such cases transcedental synthesis seems to be applied even at the stage of technology creation (by the F&B entepreneurs); high receptivity and

judgmental ability enable the design and construction of non-ever-thought pieces of machinery or technology in a more general sense. We assume it is not irrelevant that the two weak cases are the only ones that present no cases of co-developed or in-built machinery and equipment. FCo2 used customized solutions for packaging and micro-climatic conditions automation engagin local and national companies. On the other hand, **FCo7** of moderate DECs presents only customization and **FCo4** encountered many difficulties in arriving to technological solutions.

The two "weak" cases developed and focused on only technical dimensions of innovative concepts relying only on external knowledge. This was due to a mediocre sense of PEA and spaciousness which were combined with rather weak bricolage and improvisational capabilities. Thus, **FCo3** rested on sources offered by the Italian process technology manufacturer and **FCo2** in the use of hydroponics without further exploiting the pioneering method.

However, the level of sense of speciousness (and transcendental conditions in general) seems to be partly responsible for the direction actors look for solutions to the problems they create:

- The "cosmopolitans" (Cs) i.e. the agents of FCo10, and FCo1 and partly FCo9 do not talk extensively on production technologies. **FCo10** is the most extreme case. KIE turns equally around all three axes of a new venture and namely the technological, marketing and organizational one. They focus on trans-national innovative marketing approaches; technology plays an important role in realizing their innovative ideas but they do not seem to have a passion for it; providers and all stakeholders needed seem to be rather easy to approach while solutions are found by selected experts.
- The "science approacher" (SA) is mainly **FCo5.** It is the only case that bases its initial competitive advantage in science-based R&D well outside its own area and develops in parallel the technology needed to turn lab tests to products. **FCo9** stands somewhere in the middle; both the characteristics of the cosmopolitan and the science approacher seem to be present: the entrepreneurs transcend national and sectoral borders to meet technology providers while they engage scientists to excel their initial innovative idea. Backgrounds of the entrepreneurs appear again to play a significant role.

- The outstanding "industry masters" (IMs) are **FCo6** and **FCo8.** They actually seem to play with cutting edge technology, innovative machinery and developing technology building bridges for becoming clearly and highly innovative. FCo6 started with a clear technological innovation and has indeed turned into an extremely innovative company, a "science approacher" which has transcended its sectoral limits by co-operating in research projects that connect its main raw material and products with areas such as biotechnology, pharmaceuticals and chemical industry. On the other hand, FCo8 remains a clear industry master, based on technology to implement novel ideas and present new products.

It should also be mentioned that some of the interviewees mentioned benchmarking practices and technologies to solve technical problems and to develop their own machinery and technology. FCo1 narrates benchmarking a nuts packaging company for the co-development of an innovative packaging process with an Italian relevant manufacturer. FCo5 used tomato processing technology to solve a problem of flour fluffiness (see above). FCo8 reported several similar cases.

Discussing the three categories above a little more, we can observe that "cosmopolitans" FCo10 and FCo9 do not share technology understanding at the same level with the other two categories. The same happens in the case of FCo8 but for a different reason; the entrepreneurs do not have the capabilities to do so (resembling the entrepreneurs of WCo2[309]). However, in contrast to the two weak F&B cases, they have the "luxury" of doing so; they engage people of significant relevant experience as employees and as external consultants to cover this weakness. On the other hand, this is not feasible in the cases of FCo2 and FCo3.

All F&B cases are to date knowledge-intensive and more or less innovative. Further development of novel processes together with innovative products have been mentioned in the chapter regarding innovativeness (i.e. *Dynamic entrepreneurial capabilities and innovativeness)* and the relevant descriptions of the cases. Some of the new firms seem to continually push the boundaries of innovation in several areas; FCo5 and FCo6 are probing more advanced markets. FCo1, FCo4, FCo7, FCo8, FCo9 and FCo10 focus their efforts on novel products, tastes and food concepts attempting some stretch to semi-medical food gourmet trends and exclusive combinations

[309] For more details please refer to pages

transcending national borders. They try innovative marketing methods, and complementarities regarding technological and promotional aspects.

Almost all ten firms appear to be very inventive and active; they seem to use their capabilities in detecting, selecting and creative combining knowledge bases of a great variety of areas to provide novel and almost always knowledge-based ideas. In many cases, novelties are tightly related to process modifications, additions, improvements or even new developments. The entrepreneurs interact with a wide range of stakeholders all along the value chain and at global level. Machine manufacturers, packaging manufacturing industry, ICT and automation providers appear to be the most important links, followed by consultants and technology experts. Control laboratories appear also of great significance to test, experiment and approve findings since F&B industry is a very sensitive one. All ten ventures have survived the usually used five years criterion (Ensley et al., 2006) and seem to be unaffected by the Greek severe crisis.

The results strengthen further our assumption on the role of production technologies for LT-KIE. They also support the contradiction of the common belief that low-tech companies are just "buyers of embodied technologies". As seen, in most cases, entrepreneurs co-operate with machine manufacturers to produce novel machines and equipment or even to develop novel processes. The cases present the new image of the F&B industry in Greece; small and medium new firms are flexible, extrovert, with advanced technology and strong innovation potential[310]. Some companies produce disruptive innovation as FCo5's spectacular entrance to bio-functional foods with patents on several products; others create new niche markets or introduce technology-based innovations, patenting innovative technologies for existing products which add to properties and other characteristics such as FCo1, FCo6 and FCo7. These companies have also contributed to the technological advancement of other tradditional sectors or even the creation of new businesses. The demand of FCo1 for ready-to-use vegitable staff created a new agri-business sub-sector fro vegitable preparation and relevant developed technology. FCo6's advances requirements of the basic raw material created a group of highly advances farmers:

[310] Such firms used to be highly introvert, traditional processing ones, using conventional technology to offer low-value products at low prices, characterized by a lack of awareness of new technologies and innovative culture (for more please refer to F&B industry review). However, there were large companies, usually joint ventures or takeovers by foreign groups that were technically advanced.

> "We have set the bar high; till then there was a rather commercial attitude I would say. Our farmers are now entreprenurs with their lap-tops and high investments in electronic machinery, huge tractors with lazer that cost almost a million Euros". (Entrepreneur of FCo6)

The analysis also maintain our assumptions on the role of DECs on production technologies. Transcedental capabilities seem to hold the strategic role creating strategic problems in order to match the novel ideas to implementation and physical creation. Bricolage and improvisational capabilities encourage extended networking with actors of different fields and disciplines and creative flexible co-opearations under a wide scope of potential opportunities.

Differences have again been traced among corporate and new-to-the-world ventures. Established organizations seem to have the potential, capital and capabilities to develop far more advanced innovative production technology innovations than the newly established companies as evidenced in W&F cases too. Furthermore, entrepreneurs of no technology-based capabilities cover this weakness by adding the needed resources which is too difficult – considering time and money as well as respective knowledge and acquaintances needed – for new-comers.

III. TEXTILES AND CLOTHING SECTOR

Production technologies have always been important for the textiles and clothing industry. However, they were provided by big international manufacturing organizations targeting higher productivity capacities and quality at least during the two last decades of the prior millenium. This status would create a rather homogeneity regarding competitve advantages which would be more affected by the devotion of financial resources in order to invest on cutting edge technology together with low labour costs (as labour intensive industries). Differentiation was achieved mainly by design and a race to aquire emerging techniques and methods. This was a global phenomenon, evidenced also in Greece. Almost all interviewees naratted how they would attend all international trades regarding machinery and automation innovaton and how they had devoted hugh amounts of millions of Euros to replace technology quite often.

After the massive transition to Asia, all the above efforts seemed fruitless. Cost leadership was not easily achievable due to cheap textiles and clothing from China (as a production country) and Turkey causing the obsollence of mass production as well.

Competitve advantages should emerge by different ways. However, once again it was quite difficult for Greek T&C companies to develop R&D and innovation alone. On the other hand, the number of the new ventures of the sector was becoming smaller and smaller since it was quite difficult to find promising niche markets.

T&C group is represented mainly by corporate KIE; in all cases production technologies continue to dominate but from a different point of view: they are co-developed with T&C entrepreneurs in order to fulfill unique business ideas that can offer competitive advantage even in this far-too-saturated business ecosystem. Process innovation is then significant in all cases either to produce new products and services or even to assist the innovative reconstruction of the existing conventional organizations (Table 7.24).

Table 7.24:Main venture targets of T&C KIE

a/a	Main Activity	Type of KI	Main Type of Initial Innovation	Main function. parameter	Patents	Involve supplied innovative material
TCo1	Cloth Dyeing –finishing	BKD	Process* (products)	Exploit innovation elsewhere produced		yes
TCo2	Special-use and high-performance fabrics, garments and protective systems, for armed forces, public services, fire brigade and industry.	BKD	Process (products)	Exploit innovation elsewhere produced- more to advanced markets	yes	yes
TCo3	Apparel one-piece dyeing	BKD	Process	Exploit innovation elsewhere produced		no
TCo4	Tricot	TIEK	Process (Product)	Exploit innovation elsewhere produced	yes	no
TCo5	Branded children clothes	BKD	Process	Organizational innovation & fashion		no
TCo6	Spinning mill	BKD	Process (Product)	Exploit innovation elsewhere produced		yes
TCo7	Denim clothes	BKD	Process (product)	Exploit innovation elsewhere produced		no
TCo8	Fashion lingherie	BKD	Restructure (Process)	combination		yes
TCo9	Indigo denim production	BKD	Restructure (Process)	combination	yes	no
TCo10	High-fashion	CD	Business Model**	creativity		N/A

* this means that the initial innovation was process-based but it produced also novel services / products
** among the few cases where the designer becomes a producer and an entreprenur as well

CD: creative design
Combination: complete restructure of the business model including exploitation of innovations elsewhere produced, novel business models and methods of promotion together with product innovation and fashion creativity.

This group presents no case of sole technical innovation using only external knowledge which seemed to characterize the weak new-to-the world cases of the other two sectors. In all ten cases there appears to exist a balanced use of maany types of mainly inter-sectoral knowledge combining in-house efforts to organized and well-structured external knowledge seeking. TCo4 is perhaps the only cases that focuses on the technical dimensions neglecting the organizational and markeitng axes.

Six out of the ten cases appear to use outcomes of other research fields such as material or chemical technology science for the development of core technological advantages such as the novel dyeing of special features (TCo1), products of high-tech (TCo2) and new types of bio- and synthetic fibres (TCo6). Therefore, it appears that innovative raw material and semi-finished intermediate products constitute sources of innovative business ideas as in the W&F cases and contrasting F&B sector. On the contrary, packaging is not deemed that important although it is always an issue when concernig logistics and transportation (as in the W&F sector again). Yet, knowledge sources transcend sectoral borders in general; besides advancements in ginning – spinning - finishing - dyeing - knitting –sewing and all types of sectoral knowledge, all of the cases seem to exchange knowledge with machine makers and technology providers; they invested on process technologies, intelligent production lines, ICT, logistics and automation to apply new production methods such as TCo8 and TCo9 (mass customization), or to develop new technological capabilities in order to meet the processing requirements of new textiles and innovative composite material. They further seem to co-operate mainly with the chemical industry, while some cases go even further deriving knowledge from biotechnology and nanotechnology (TCo6) or antiballistic and plastic deformation technology.

Comparing the three tables (7.21, 7.23 and 7.25) it appears that T&C and F&B groups have used around the same number of knowledge providers, constrasting the W&F cases. The reasons are the same as above. Sometimes it was even difficult for entrepreneurs to recall all firms engaged during venturing. However, once again companies of several areas are mentioned mainly when they are world leaders or national companies of significant contribution to the project. Machinery suppliers and

suppliers of raw and intermediate products play again (as in W&F) the most important role followed by knowledge coming from high-tech sectors such as ICT, automation and chemical industry. Other knowledge sources (denoted as consultants and other organizations) are also involved confirming further the view of relevant literature (e.g. Bender, 2004; Hirsch-Kreinsen and Schwinge, 2011).

57**Table 7.25: Knowledge sources used during venturing**

Cases / **Knowledge source**	TCo1	TCo2	TCo3	TCo4	TCo5	TCo6	TCo7	TCo8	TCo9	TCo10
Customers			2				2		1	
Suppliers of raw materials & intermediate products	2	3		3		2	2	2	4	
Suppliers of machinery, packaging	3	1	3	4	1	3	3	2	yes	
Competitors *	2									yes
Other firms**	2	N/A		N/A	2	N/A	N/A	2	1	
Universities, Technical Colleges			2		2	1				
Consultants	1	1								
Other actors / organizations***	2	N/A	1	1	1	N/A	2	2		yes
Total (min)	**12**	**5**	**8**	**8**	**6**	**6**	**9**	**8**	**6+**	

* firms from the same sub-sector
**firms such as ICT providers, electrical machinery, special electronic equipment
*** quality controls or other parallel activity knowledge providers
N/A : no relevant information supplied by the interviewees although there are certain indications of the active involvement of the relevant sources. E.g. ICT has certainly played a role in the installation of TCo4's and TCo6's production lines.

TCo1 is a representative case. Networking with machinery manufacturers and automation providers enables the choice and construction of original high-tech machinery and its combination in innovative ways. The company benchmarks two of the best relevant plants abroad in order to locate weaknesses, requirements and potential of innovation. A mixture of novel ideas and potential novel applications are located and knowledge and co-operations are sought for the implementation.

Search for technical knowledge involves relevant production technologies literature research, patent searching and a rough design of required machinery. Search

transcends national limits: besides Greece, entrepreneurs turn to Germany, Austria, Switzerland and even USA to discuss the above requirements. The entrepreneurs invested on exploitation of cutting edge technology some parts of which would be developed by their own ideas. These investments would constitute the basis of working with innovative yarns, fabrics and innovative dyeing – finishing and treating elements. They further invested in an impressive *debut* with an innovative process for finishing and treating textiles with skin-care oils and emulsifiers, patented a year before. «*It was pure luck. In USA there were similar patents based on oils and such ingredients tried in relevant plants. This patent was new – it was registered a year before- not yet out and we were the first to express our interest*."

The main production line was a result of cooperation with foreign manufacturers. However, the main innovation was a result of cooperation with a Greek manufacturing company[311], specialized in the design and manufacturing of fabric dyeing machines: automatic settings adjustments and variable loading features, launched at ITMA after two years. Furthermore, TCo1's engineers developed in-house an innovative technology referring to the colour-enzymes-and-chemicals' preparation for automatic mixture and feed, which they named "*chemicolour kitchen*". This would soon become a strong competitive advantage for the new company, since all relevant companies (local and European) would refer to it for special high-demand orders. Interestingly enough, the entrepreneurs were was not interested in patenting either technology.

TCo1 was also pioneer in adaptation of several new technologies such as a system for energy saving, a full-scale recovery of effluents for reuse in production, waste water treatment mechanisms for feasible tailor-made solutions and special effects and further automation equipment to achieve high level repeatability – safety and flexibility. The installation endured about ten months. The patented material based on skin-care oils and emulsifiers, was then applied in the brand new plant. Yet, it required several try and error loops and constant knowledge exchange with the relevant multinational chemical company to transfer it from lab to mass production[312]:

[311] In the early 60's the company started making innovative fabric dyeing machines, i.e. the first stainless steel winches. It launches innovative products at every ITMA[311] trade show

[312] Indicatively, there was not any former suggestion regarding the process stage of new material entrance. TCo1's engineers tried two cases: in the fular (intermediate process stage) and the dyeing machine (final stage).

experiments would refer to environmental conditions, water requirements, mixture phases, material quantities, time and speed of the processes and so on resulting in equipment and process modifications. The controls needed for the whole process would be carried out by a private quality control laboratory in Thessaloniki under a formal contract. The new finishing and dyeing plant of TCo1 was one of the 3 most innovative ones in Greece and among the 7 ones in Europe.

Therefore, the development of the required production technologies was deeply knowledge-based: textile processing and fiber manufacturing, study of chemistry and chemical processing encompassing application of various kinds of chemicals, dyes, thickeners, enzymes and finishing. They further involved knowledge of green chemistry and biotechnology together with recycling and green engineering for supplementary installation.

TCo1 can be clearly considered an active "carrier" of high tech R&D, active user of ICT and automation technologies and active machine co-developer.

The entrepreneurs ensured the development of constant collaboration with most of the companies that participated in TCo1's "physical creation" they strengthened the collaboration with the big chemical company (Clarient) extended the formal cooperation with the Greek laboratory for controls that exceed the control range of the company's labs contacting further some other highly specialized laboratories in Switzerland and Germany. They have established trust and respect with suppliers. The entrepreneur makes a special reference in the Greek manufacturer, the co-developer of the innovative machine:

> "We have worked hard with [name of the Greek manufacturer]'s engineers and that paid us back all these years. I mean when we need some modification, we can have it in really good time. We enjoy it that the company is here in Greece. We had nothing to do with patents. We did not need them!" (Mr R)

All cases present more or less impressive stories of active involvement in production technologies underlining the significance of production technologies for new LT venturing and the consequent significance of knowledge for the development of KIE production technologies.

> "Starting with erections we sent "signals" in Europe for novel technologies. The German LG approached us to co-operate on the production technology of some innovative fiber. The next 2-3 years we will experiment together in a place where new buildings are added, machines are erected, and pilot productions of the innovative machinery and compact technology bought at ITMA take place.

> Germans had to stay all these years in our town. You see they had to be with us every day. It was a beautiful confusion of priorities and decisions which would create the final concept. We should constantly, learn, discover and …search…"
>
> (Entrepreneur of TCo6)

The contribution of high-tech sectors, mainly ICT, automation and electronics is also evident in all cases either as enablers of production flows or as major contributors to innovation such as in the cases of the new distribution model of TCo5 and the application of mass customization in the cases of TCo8 and TCo9. The extant knowledge and experience of all entrepreneurs (as seen in the relevant chapter) plays a significant role in production technologies too. The entrepreneur of **TCo1** is the main actor of the combines technology. *"As a mechanical engineer and a former customer of similar plants knew very well what exactly he wanted to create" (Technical Director of TCo1).*

With a Bachelor in Chemistry and a Master in Manufacturing System Engineering the entrepreneur of **TCo2** builds the new technological capabilities creating a cutting edge technology flexible plant, an advanced R&D department and strong collaborations with high-tech companies. *"We chose to collaborate with the leaders – I mean the technological leaders" (Entrepreneur of TCo4)*

It appears that KIE caused significant knowledge flows and changes in all T&C cases. Interestingly enough, there is no case with products as initial innovations (Table 4.7): they all target processes or a total restructuring of the existing business models with production technologies to hold a key role:

> "This decision led to a total, in-depth restructure of a traditional company. By then the classical search for raw material and new technology ready by suppliers was enough. Then we invested in new knowledge regarding unknown sectors: design, technical material well beyond the familiar cotton and synthetic ones which required knowledge on chemistry and a shift to mass customization which was in its infant stage for the sector; this was painful. It required significant changes in production technologies, modernization of the administrative and the commercial parts a change of the company's image in the market; thus completely new skills and capabilities"
>
> (Entrepreneur of TCo8)

However, in many cases innovative products are results of the above activities strengthening the argument on the reciprocal process-product relationships. Once again, appropriability is not deemed important. Manufacturers must be able to cover

the requirements of the entrepreneurs, are sought mainly abroad and mostly in Europe and are supported by Greek manufacturing and ICT and automation companies.

A quite significant difference with mainly the F&B sector and partly the W&F one is the fact that there is no tendency of cooperation with Academia for KIE (Table 7.25). The entrepreneurs prefer to co-operate mainly with machine and raw material suppliers or at least with research institutes, private experts and consultants.

Indicatively, TCo1 focused on chemical and equipment industry for new knowledge and innovation, According to the entrepreneur there are no serious proposals for their sector till now by universities and other research institutes.

> "The only innovation that was proposed to us was the magnetic strips with the barcode which were known to us. Actually we have been using them for almost a decade." (Entrepreneur of TCo1)

It appears indeed that, according to entrepreneurs, there are no R&D novelties by academia that may lure them[313]. University or Technological Institutes are used in extremely specific cases, well outside the normal sectoral activities: TCo3 used two Academia Units to create the innovative combination of one-piece dyeing using biodiesel technology to produce the necessary energy and steam needed. The same entrepreneur of TCo1 and one of the two creators of TCo3 admits:

> "Of course we have cooperated [i.e. with Academia] for our new plant for bioenergy with the University of Thessaly and the University of Thessaly. We are not against that kind of research but it has to be accurate and serious research"

The second case is TCo5; it is the only case that started KIE due to academic consultancy. We should also mention that besides TCo3 and TCo5, the only company to later develop some types of collaboration with academia was TCo2 supporting further the argument of TCo1's entrepreneur. Furthermore, TCo1 and TCo2 are the only cases to have admitted the use of consultants as knowledge providers during the development of the initially used production technologies.

Table 7.26 presents the developed technological capabilities according to Lall. At a first sight it seems that the case of weak DECs does not follow the general rule and present quite significant technological capabilities. The fact is that the technology axe

[313] This may be attributed to the lack of a relevant Department in Greece. The only Technological Department in Northern Greece has rather an administrative direction than a technological one. A comparison is inevitable here with the existence of WFTD department and its relationship to W&F KIE.

is well-developed due to the experience and the involvement (at this stage of the two co-entrepreneurs). However, as already mentioned in previous sections, the other two axes i.e. organizational and marketing were rather neglected due to reasons such as the already significant market that could absorb the 50% of the production. According to our suggestions, strong DECs regard all three axes in cases of LT-KIE venturing.

Table 7.26: Dimensions of technological capabilities according to Lall's matrix

Cases / Investment and production dimension	TCo1	TCo2	TCo3	TCo4	TCo5	TCo6	TCo7	TCo8	TCo9	TCo10
technology search	√	√	√	√	√	√	√	√	√	N/A
process design	√				√	√	√	√	√	N/A
new product design	√	√	√	√		√	√	√	√	
adaptation of technologies to new venture's requirements	√	√	√	√		√	√	N/A	√	N/A
Linkages[314]										
Co-development*	√			√	√	√	√	N/A		N/A
Customization*	√	√	√	√		√	√	N/A	√	N/A
In-built*	√		√					N/A		N/A
Intention for NPD Dpt	√	√	√	√	√	√	√	√	√	√

* regarding machinery, equipment, methods, processes, materials, technologies
N/A not specifically mentioned but it can be included in general sayings

In line with W&F sector in-built machinery is very rare. However, almost all cases have reported co-development or customization (or both) of new machinery, equipment and even processes. Furthermore, all entrepreneurs (except TCo10) revealed an easiness and comfort in attracting world's leading machine makers or in contacting academia departments. They devote huge resources for complex and large-scale production lines. The parent companies had developed a precise culture around the importance of technology and automation which was tightly connected to high

[314] Other than Knowledge sources which are presented in Table 4.2.

performances. Now, they seem to move more or less easily to more advanced relationships to technology and advanced-knowledge providers. This is the distinctive feature of this group.

Distance did not appear as a significant problem in any case although it could be "disturbing" sometimes. Almost all parent companies enjoyed a good reputation in Europe and had good and long-lasting relationships with a critical number of machine and technology providers. Even in cases of complicated projects, entrepreneurs can afford to have big teams at their place for long periods. Most times even after installation there would be local service personnel to represent the machine vendor.

However, all cases have used Greek companies for mostly custom-made ICT programs, ERP and other logistics solutions as well as Greek electronics for automation system and safety valves. Most cases have used Greek manufacturers and workshops for machine co-development and almost all of them for supplementary equipment and installation. We remind the innovative machine of TCo1 introduced later by the Greek manufacturer at international level. TCo7 has used two Greek manufacturing companies. A number of workshops were used by TCo4 to assist the building of the novel machinery. TCo5 had to develop a special semi-automated machine to respond to the requirements set by the two academia departments:

> "We could not actually manage our inventories with the new method. We found ourselves trapped into huge trouble with extremely high costs of return. Then the solution came of the University of Piraeus. We developed a semi-automated machine that receives the returned pieces, checks barcodes – we had traced a 3-4% wrong codes and wanted to solve that too – and restructures returns to orders. The machine was developed with a Greek manufacturer. We had already had good relationships. Another Greek, local company took over the necessary computerization". (Entrepreneur of TCo5)

In general, T&C cases do not present the same intensity of investing in production technologies after KIE as found in the other two groups**.** This can be mainly due to the severe declining of the sector mostly after 2005 which was accompanied with the transfer of their bigger customers in Asia and the severe socioeconomic crisis in Greece. Furthermore, these companies had already invested huge amounts in machinery and production lines by turning to KIE. Of course, they go on developing innovations and strong DCs as seen in the relevant sections. For example, TCo2 systematically obtains technological knowledge and know-how by reverse engineering and in cooperation with technical consultants and advanced material

suppliers to creatively combine knowledge and build new vertical manufacture capabilities. KIE created the need for further investments in the case of TCo9 too. KIE process was completed in 2000. However the company invested more that 60 million Euros in new machinery and further machinery replacements in the period 2000-2005.

Most cases combine production technologies with novel products and services as a means to survive; yet, some insist in investing in technologies although this appears quite useless today if not combined to flexible business models and fresh new ideas:

> "Just consider the fact that even in 2008 we invested 1,5 million Euros followed by a further investment of 2 million in 2009. Such investments in our sector constitute a continuous process. Trying to become "greener", we replaced some finishing and dyeing machinery with innovative one with dicrease of the dyeing-finishing production cycle and lower energy consumption" (Entrepeneur of TCo4)

The discussion above together with Tables 7.25 and 7.26 indicate that knowledge-intensive T&C entrepreneurs **use bricolage capabilities** and succeed in mastering technology and/or technical standards; Bricolage engages mainly technology developers, which belong to all links of the value chain; i.e. they stretch from machine manufacturers and raw material producers (TCo1, TCo2, TCO3, TCo4, TCo6) to ICT and process technologies to fit their novel ideas (TCo5, TCo7, TCo9). Sometimes they even develop collaborations well out of the sectoral boarders such as the involvement of chemistry, biotechnology, enzyme technology and nanotechnology (TCo1, TCO4, TCo6), antiballistic, composite material and plastic deformation technology for TCo2, biodiesel science, organic waste treatment and technology in the framework of environmental engineering (TCo3, TCo6, TCo7). Various sub-sectors of T&C industry are well engaged such as Textile Processing, and manufacture of fibers, denim production technology, washing-prewashing processes, design and garment finishing to name a few. Moreover, mechanical /electronic engineering, ICT and design, fabric and yarn quality control were areas to search in and develop CCN and repertoire building in most cases.

Almost all cases disregard the manufacturer's dominance and find new production ways to fit their novel business concepts. This constitutes a significant part of their specific ***problem making*** dimension while CCN capability enables its solution: technology developers, sometimes well out of the sectoral boarders such as the pioneering technology of bio- fuel (environmental engineering) of TCo3, the active

participation in R&D with the chemical industry and material engineering for many cases, the active collaboration with manufacturers and machine shops (mechanical engineering), and the extensive use of automation and ICT for the majority.

Indicatively, as seen above, **TCo1** engaged a network of foreign manufacturers and local constructors for plant manufacturing. Due to the mother company there was significant networking with the leading plant manufacturing constructors as well as with plant installation constructors for pipelining, electrical installations, transportation lines, automations and so on, as well as some machine shops on custom-made or self-made, in-built machinery.

> "As a mechanical engineer I knew the production part well and I knew precisely what I wanted. […] I had good partnerships and I had collaborated successfully with them in the past. Good networking enables choices and the best implementation – I mean you may choose the technologies you need, which may be pioneering, you may combine them with modern ICT and other innovative sectoral techniques and there you are! You solve your technical problems! This is how we managed to have the machinery we wanted. The Greek [name of the company] for example with a leading position globally. We co-operated, we worked together, with its engineers but this came back to up. What I mean: we can have them again for new changes – there is a direct support. […] We patented nothing. We did not need to do so!". (Entrepreneur of TCo1)

Almost all cases have engaged a significant part of human, social and financial capital in reaching various technological knowledge bases and translate combinations in novel production technologies. Actually, it appears that physical implementation of innovative ideas does not find practical difficulties; this is mainly due to the strong parent companies of most cases; path dependencies secure easier and faster co-operations, more trust and advanced planning instead of the rigidities they entail. Abuntant resources foster the search out of national limits and the collaboration with the best.

However, the strong bricolage cases reveal a dynamic problem creation. Owning strong DCs, they develop further significant CCN and repertoire building in far easier ways that new-to-the-world cases. They extend to new contacts and forms of collaboration while moderate cases stay trapped in their existing cycle: for example **TCo7** gets out of usual contacts to unknown areas of bleeching, finishing, treating and so on reaching R&D in this area. **TCo2** seeks knowledge developing CCN with firms of high-tech sectors and technical consultants well out of the textiles sector and the Greek borders. **TCo8** presents strong bricolage capabilities; the analysis indicated

strong CCN capability and repertoire building with equally strong sub-dimensions such as resourcefulness, creative combination and interactive learning.

On the other hand**, TCo9** tries to do the same by turning to flexible production and the implementaion of the novel mass customization concept. It extends collaborations but somehow does not actually get out of its shell; machinery is ordered and the incorporation of R&D follows existing techniques and practices. The same goes for **TCo4** too[315]. The company seems caged in its former culture although the entrepreneur had decided to create some "completely different". We cannot deny that there was a deep pool of knowledge and strong networks mainly with suppliers but perhaps this was perhaps the core rigidity of TCo4. Thus, **CCN** appears to be a quite significant dimension also in the building of production technologies in T&C cases as in the other two sectoral groups.

Interactive learning appears again to be a main sub-dimension of the "technical part" of repertoire building. It supports a constant bidirectional knowledge flow of both embodied and disembodied knowledge among all stakeholders. The cases that extent well outside their sector or sub-sector searching for other –usually more advanced - knowledge bases, present a high level of learning capability. Scientific or technical knowledge has to be assimilated in practice mainly in a fast and dynamic mode. These are mainly the cases of strong DECs; i.e. TCo1, TCo2 and TCo7. As seen above, **TCo1** invests in novel technological knowledge to intervene in innovative ways to known processes offering new products while increasing productivity and focusing on ecological aspects, energy savings and recycling. Technological knowledge seeking is also supported by individual studies, technology literature research, patent searching and trade shows of different industry sectors (e.g. chemical, fiber, fabric and equipment). Some employees get trained by the manufacturers' technical staff on maintenance and problem solving techniques during the erection phase. **TCo2** collects, combines and generates knowledge while embedding a relative culture of constant learning in order to build its novel processes. In all cases learning comes besides conscious knowledge generation, through trial and error and experimentation. **TCo7's** interactive learning is gained by frequent and repeated visits to Italy, training within Italian plants, but mainly with the successful move of engaging the Italian

[315] Please refer to the relevant section (bricolage T&C sector) for more details

specialists. **TCo6** develops strong interactive learning especially among the company and leading European manufacturers ending up with innovations for all stakeholders.
On the other side, the weak DEC-case, **TCo3**, shows certain weaknesses regarding learning as well as in adding knowledge further. This was also observed in the weak cases of the other two sectors.

Production technologies are also affected by the **improvisational capabilities** of the entrepreneurs / entrepreneurial teams. In the same line with the other two groups, almost all cases have reported modifications of ordered machinery, complementary equipment and new equipment to solve arising problems when using the new machinery for real production or to new arising requirements of customers or the market such as the cases of TCo8 and TCo9. Certain parts of machienry are even designed by the entrepreneurs themselves and constructed by local machine shops.

TCo1 is a wonderful case proving the significance of this DEC on production technologies. Indicatively, during the whole design-to-erect process of the novel production lines alternative methods and uses of the new lines manufacturing knowledge are developed and arising problems find novel solutions due to improvisation capabilities; for example, the incompatibility of innovative material with the conventional dyeing production lines led to the innovative "*chemicolour kitchen*". A need that emerged by a three-piece order at **TCo2** during the erection phase led to the addition of a special customization line and subsequent changes, modifications and additions[316]. **TCo7** seeks for and takes advantage of all information around denim treatment and improvises no matter the costs by experimenting and many try-and-error loops.

The cases of strong improvisational capabilities are more flexible in causing and adapting changes and advance further the initial project. **TCo6** accepts the challenge of a high-quality man-made cellulose fibers' producer to develop together innovative product and the subsequent technology in the under-erection new plant.

> "Experimentaion lasted 2-3 years in a place where buildings are built, huge air-condition systems and machinery is erected, the first compact production is directed. The whole process offers significant knowledge exchange for us as well as the other companies which are also using the whole machinery for the very first time. […] We should always learn and then search again. There were frequent meetings for modifications." (Entreprenur of TCo6)

[316] Please refer to the relevant section (improvisational T&C sector) for more details

According to the analysis of the ten T&C cases, improvisational capability allowed modifications, novelties and new insights, tangling research with practical knowledge and mixing bricolage with new resources of all kind. Long-planned arrangements were blended with inspirations of the moment (e.g in the case of TCo1), past experience and good practice resulted ininnovative technical solutions (e.g. in the cases of TCo4, TCo6, TCo7 and TCo9). In almost all cases, incremental or even radical deviations from initial discussions with machine manufacturers were observed. However, improvisational capabilities of T&C sector seem rather weak compared to the improvisational capabilities of the other two sectoral groups. This issue has been discussed in the relevant section; it is mainly attributed to the inability of the well-established parent companies to escape their normal way of behavior.

The same goes for transcendental capabilities; they are the weakest at inter-sectoral level. We have claimed that a major characteristic of LT-KIE is the fact that innovative concepts lie partly in product/ process innovation and partly in the business model and the market axis and are produced by the interaction of these aspects. This was evident in most cases of strong DECs and all three groups. However, in this group they seemed to be responsible mainly for the *repositioning* of the new venture within the existing or a newly created business ecosystem. Thus, novelties are mainly answers to already –more or less – formed needs of existing markets, while KIE happens for maintaining shares of the market instead of creating new markets. Consequently, transcendental capabilities are not that strong as in the cases of F&B innovative challenges.

No matter how strong or weak, transcendental capability is needed in the physical implementation of the novel business concepts: as seen in the majority of the cases, innovative products or processes are translated in heavy investment in novel machinery; the difference in this sector lies in the fact that the main part of machinery is again developed by the relevant manufacturers. We assume it is not irrelevant that in-built machinery is not that common in these ten cases. However, significant parts and necessary modification together with innovative adjustments, or combinations of existing manufacturing technologies belong to T&C entreprenurs. Their business concepts stress an “unconventional production technologies issue” from the

beginning. Most cases used customized solutions, made recommendations during machine design or participated in modifications.

The strong transcendental capabilities of TCo1, TCo2, TCo7 and TCo8 are reflected in the novel combinations of technologies too as seen both above and in the relevant section. The **corporate ventures** of moderate transcendental capabilities are moving on a more secure road. They all want to challenge their eco-systems but mainly by excelling in technology-based solutions challenging existing relevant capabilities and by creating even patented technologies and products (**TCo4, TCo6** and **TCo9**). Actually, KIE in TCo4 and TCo6 seems to be only based on technology lagging behind in the other two axes.

This is mainly due to the transcendental conditions as shaped by TCo4's and TCo6's former DCs (managerial side) together with the personal views and perceptions of the entrepreneurs / entrepreneurial teams (entrepreneurial side). Thus, TCo4 and TCo6 belong to "the industry masters"; they develop a high-level PEA dimension but only within the industry, focusing on mainly technical knowledge-intensive innovation. They actually seem to play with cutting edge technology, innovative machinery and developing technology building bridges for becoming clearly and highly innovative.

The *"cosmopolitans"* such as the agents of TCo1, TCo2, TCo7, TCo8, TCo9 and TCo10 seem to be open to every chance offered independently of origins and initial relevancy. For them technology is the media to realize their concepts and not the core of their novel ideas.

However, in all ten cases, entrepreneurs appear to be well aware of the technologies used and the ones required. TCo10's entrepreneur admits that he was not aware of the production stages and had to learn all about it. Yet, **only the cases of strong transcendental capabilities –mainly the cosmopolitans - benchmarked best practices** as in the F&B group with the difference that it was within sectoral borders. TCo1's entrepreneur visits the leading relevant plants in Europe and gets inspired for both cases (i.e. TCo1 and TCo3). TCo2's entrepreneur invests on reverse engineering. In the same vein, the entrepreneur of TCo7 visits many plants all along the value chain (i.e. denim producers, fabric makers, finishing and dyeing plants etc) in Italy, the heart of jeans culture. TCo8 benchmarks the leading lingerie group in Europe.

All T&C cases are to date knowledge-intensive and more or less innovative. Further development of novel processes together with innovative products have been mentioned in the chapter regarding innovativeness (i.e. *Dynamic entrepreneurial capabilities and innovativeness)* and the relevant descriptions of the cases. An observation could be the fact that the following innovations in the lifespan of most cases are rather incremental and regard mostly product improvements, new product developments, new design and applications of novel raw material. Process modifications are also reported; still not at the scale of the initial innovation, while they attend issues such as energy saving, envirmental protection or efficiency and productivity increase and quality.

In line with the wood and furniture cases, new T&C firms prefer to invest on production technology innovation in order to secure their position in their volatile markets. The entrepreneurs interact with a wide range of stakeholders all along the value chain and at global level. Yet, machine manufacturers and raw material providers are again the most important links; this was rather expected since we refer to production technologies. The results strengthen our assumption on the role of production technologies for LT-KIE and the active role of low-tech companies are "carriers of technologies" and "technology co-developers". As seen, in most cases, entrepreneurs co-operate with machine manufacturers to produce novel machines and equipment or even to develop novel processes.

The analysis further supported our assumptions on the role of DECs on production technologies as also delineated in the relevant discussion of the other two sectoral groups. Transcedental capabilities seem again to hold the strategic role creating strategic problems in order to match the novel ideas to implementation and physical creation. However, they appear to be weaker that the ones of the two other sectors. Consequently they result in limited bricolage regarding both repertoire building and networking while improvisational capabilities appear to be even weaker due to existing core rigidities of the parent organizations. Yet, almost all ten firms appear to have the potential and the capabilities to develop far more advanced innovative production technology innovations than the conventional ones of the industry; they seem to use their capabilities in detecting, selecting and creative combining knowledge bases of a great variety of areas to provide knowledge-based novelties in order to survive.

Chapter 8

Discussion

Chapter Objectives

- To discuss the findings in relation to the research objectives as presented and analyzed in chapters 6 and 7.

8.1 Introduction

This thesis has endeavored to explore the "black box" of low-tech knowledge-intensive entrepreneurship. It actually attempted to "decode" the way KI entrepreneurs/teams create novel knowledge-intensive business concepts which lead to the establishment of sustainable low-tech ventures down to the operation level. Thus, the main research question as initially stated was:

> ***How* and *why* certain low-tech but knowledge-intensive ventures survive early death and prosper within mature ecosystems?**

According to Autio et al. (2000) a firm's knowledge intensity is defined as the extent to which a firm depends on the knowledge inherent in its activities and outputs as a source of competitive advantage. The present thesis suggested a conceptual framework for the field of low-tech knowledge-intensive entrepreneurship (Fig. 7.9) which purported to offer a comprehensive picture of the specific entrepreneurial phenomenon explaining how the knowledge-intensive venture idea and the new KI business evolve. The domain of LT-KIE is therefore about analysing the whole *entrepreneurial process* – from the *venture idea* to its physical implementation and the new firm's survival and growth. The actions associated with these dimensions are complex and challenging. As many times repeated, it is quite difficult for new low-tech ventures to obtain and manage resources strategically merely *within their mature industries and established value chains,* in order to establish and sustain a competitive advantage. They have to find ways to establish a foothold in the existing markets or even create niches in order to compete. Established firms may take even greater risks when engaging in KI corporate venturing; for example, they may lose their market or disorientate, since KIE is not a friendly or familiar condition for the majority of existing low-tech companies.

Under this lens, the dynamic entrepreneurial capabilities concept is an effort to explain how successful LT-KIE evolves. The suggested framework reflects views at the broad nexus of the entrepreneurship and the strategic management literature, focusing on the area of LT-KIE. Previous work[317] has examined LMT sectors in regard of mainly four topics: a) the relative importance of LMT sectors and their place in modern industrialised economies (partly contrasting high-tech sectors); b) the roles

[317] A literature review is presented in section 2.5

played by LMT firms and industries in adapting new technologies to fit into existing technological frameworks; c) the role of innovation to LMT firms; and lately d) the role of knowledge in LMT industries. However, there seemed to be a hesitation to focus research on *purely low-tech industries*. Indicatively, in their introduction, von Tunzelmann and Acha (2005) make it clear that besides the chapter title, i.e. "Innovation in low-tech industries" they refer to LMT ones. The same tendency was featured in a series of empirical research and perhaps the first European research project on the issue; researchers examined LMT cases. Therefore, it appears that the present study is **among the very first to advance our knowledge on the KIE phenomenon, shifting focus to the rather neglected area of low tech industries.**

Regarding entrepreneurial capabilities, to our knowledge, scholars have not yet turned to a more focused exploration of any specific ones within the new socio-economic phenomenon called Knowledge-based or knowledge-intensive Entrepreneurship. Even among the scarce work on the topic, research turns to high-tech cases; Burger-Helmchen (2009), for example, tried to evaluate the innovative/entrepreneurial capabilities of small firms based on a longitudinal case study of a high tech start-up. To our best of knowledge, no other framework purports to offer a comprehensive empirical research-based perspective **on key entrepreneurial challenges or to operationalize entrepreneurial capabilities or reveal the impact of such capabilities to survival, growth and innovation performances.**

Furthermore, the present thesis adds also to the Dynamic capabilities literature by **throwing some light on the origins of DCs and the debate on their existence at the outset of new firms**, confirming, in parallel, **their applicability in low-tech industries or otherwise areas of less environmental dynamism.** Up to date, a very small stream of empirical research has been slowly emerging, trying to capture the DCs impact in low and medium-tech sectors (e.g. Protogerou and Karagouni, 2012). In addition, regardless the technology level, there is a quite new but increasing debate on whether DCs exist, assist or are absent during venture creation, while the relation between dynamic and entrepreneurial capabilities is far from clear (e.g. Arthurs and Busenitz, 2006). However, we can assume that the increasing interest in the issue and the plurality of directions and intentions of researchers trying to capture the nature and role of dynamic capabilities in low-tech sectors indicates that the potential to

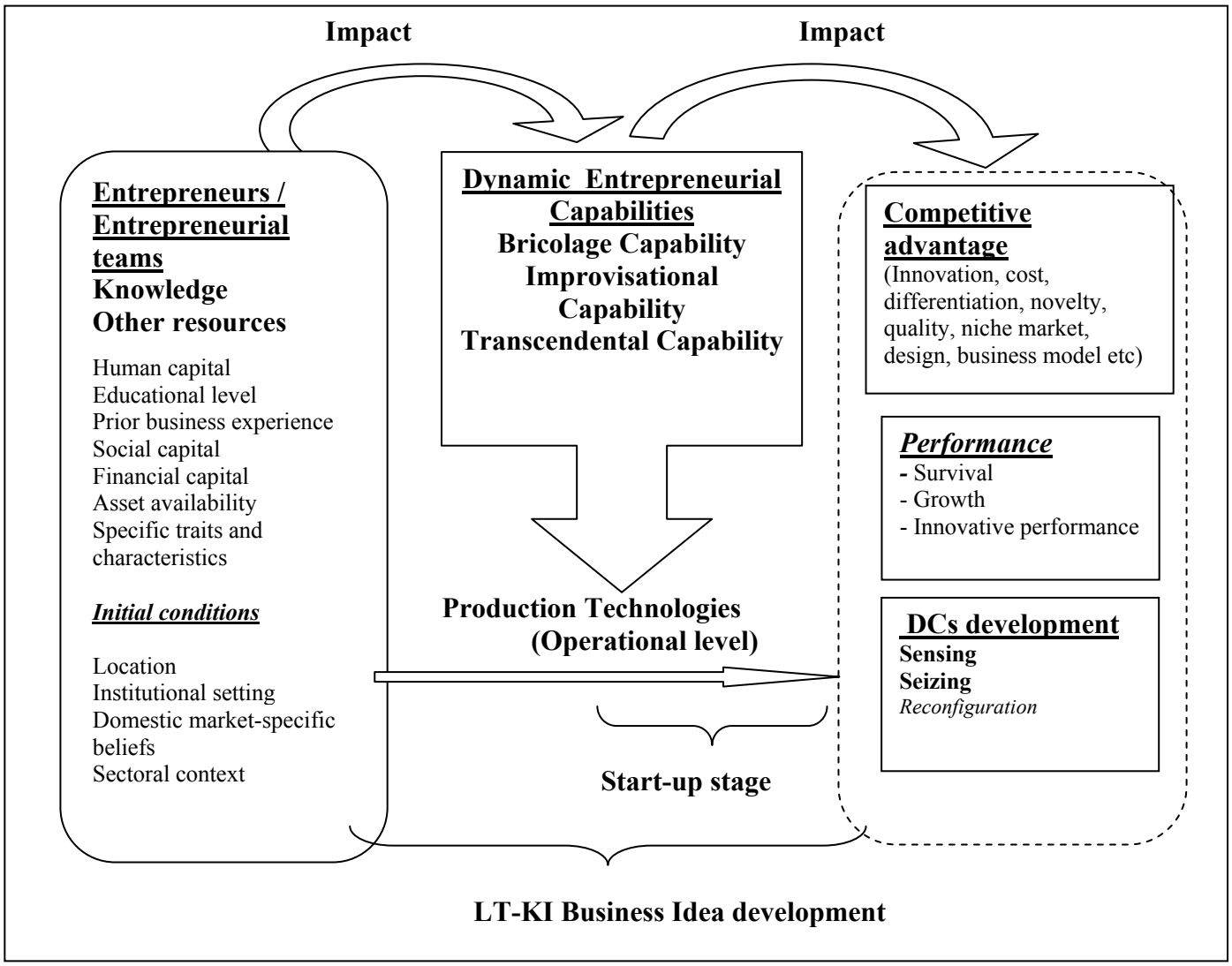
examine low-tech through the lens of the dynamic capabilities approach remained largely unexplored.

The term **"dynamic entrepreneurial capabilities"** was not adopted from literature but it was suggested by the author's supervisors in 2011; in a quite thorough research that followed the adaption of the term, it has been found in some papers where it was used in a rather indifferent way (e.g. Chirico and Nordqvist, 2010; Kearny and Morris, 2015; Lee and Shlater, 2007). Lanza and Passarelli (2013, 2014) view DECs as peculiar higher-order capabilities in small business settings, which enable product innovation and technological change. However, they do not describe or operationalize their DECs. Corner and Wu (2012) try to define DECs considering venture creation as a number of phases but within a high-tech context. Both efforts - developed in parallel with the present research - are based on limited empirical research (one case study) and reflect very specific cases. Furthermore, in both works, DECs lack precise definitions and measures. However, they are to our knowledge, the very first efforts to connect entrepreneurial to dynamic capabilities and explain their genesis and impact on venturing.

Last but not least, there is a surprising shortage of studies that investigate how low-tech ventures build up their operational environment, although it is widely accepted that the commitment to physical creation is a significant transition point in venture creation, in general. Similarily, there are only a handful of studies that probe the role of production technologies within a low-tech but knowledge-intensive context mainly at a sectoral basis. **The present thesis is among the first to link entrepreneurial capabilities to production technologies.** It actualy indicates that DECs can be the capabilities that offer to entrepreneurs the potential to build up operational and technological capabilities by seeking, acquiring and creatively combining knowledge and tradable resources.

The analysis of the thirty case studies confirmed the suggested general conceptual framework (Figure 6.1), provided evidence on the nature and the dimensions of the suggested Dynamic Entrepreneurial Capabilities and specified relationships among the entrepreneurial content (knowledge, resources and initial conditions), DECs, production technologies, competitive advantage, performance and DCs. The final conceptual framework is presented in Figure 8.1.

Figure 8.1: Conceptual framework of LT-KIE



The rest of the chapter presents some discussion on the findings of this study which are related to the knowledge gaps discussed above. The chapter is structured as follows:

8.2 The dynamic entrepreneurial capabilities framework

8.3 The Role of production technologies and relation to DECs

8.4 The DEC-DC relations and new LT-KI firm's sustainability

8.2 The Dynamic Entrepreneurial Capabilities Framework

The present thesis indicated a gap in the understanding of the *entrepreneurial approach* of the LT- KIE phenomenon regarding the mechanisms by which new founders and founding teams will accumulate the bundle of resources, knowledge, skills and other inputs which have been quite expensively investigated in KIE literature in order to establish successful LT-KI ventures. More precisely, the first research objective of this study was to explore and examine *how low-tech knowledge-intensive entrepreneurs/teams create innovative knowledge-intensive business concepts and how they locate, access and use knowledge in order to produce innovation* (Table 4.4. a and guiding research questions). For that purpose, the study:

a) Adapted the view that the entrepreneurial process is "the process that takes place between the intention to start a business and making the first sale" (Gatewood, Shaver, and Gartner 1995; Newbert, 2005) or as "the process, from the venture idea to the newly formed business's strategic success, in terms of the development of knowledge", (Ihrig et al., 2006)
b) used an entrepreneurial-capability and dynamic-capabilities influenced perspective

to examine this objective and provided evidence to verify the first hypothesis that:

KIE in low-tech sectors can be related to specific dynamic entrepreneurial capabilities (DECs).

Findings indicated the existence of a comprehensive set of dynamic entrepreneurial capabilities which suggests a potential ecology between entrepreneurial capabilities, DCs and long-term survival and growth. The proposed set of capabilities can lead, according to our arguments and evidence, to the creation of significant initial competitive advantages which can provide a sustainable entrance of a low-tech but knowledge-intensive new venture into mature and saturated business ecosystems. Therefore, the development of the DECs concept purported to fill the relevant literature and research gap on a capabilities perspective regarding low-tech knowledge-intensive entrepreneurship.

The characteristics of founding new ventures have been of great interest in the entrepreneurial literature. It is also commonly accepted that the capabilities of a founding team are important in shaping the idea or the business plan when examining

factors for entrepreneurial success (Eisenhardt & Shoonhoven, 1990; Taylor, 2007). However, if capabilities are embedded in the tacit knowledge and skills of individuals (Barney, 1992; Henderson and Cockburn, 1994), then it is important to understand capabilities as inputs to the venture. Helfat and Lieberman (2002) showed that firms with pre-entry capabilities that are needed in a new market are more likely to enter that market. Additionally, they also found that firms that had the pre-entry capabilities were more likely to outperform firms without these pre-entry capabilities.

Specifically, regarding KIE, scholars have discussed the nature and role of knowledge resources as main drivers for enhancing performance and innovativeness (e.g. Hirsch-Kreinsen and Schwinge, 2011; McKelvey and Lassen, 2013); however, inadequate attention has been paid on the emergence of capabilities needed to start viable KI ventures or the explanation of how individual-level competencies are transformed into higher-order capabilities necessary to new ventures.

In the present research, we observed patterned variation in our thirty LT-KI cases in terms of the development of useful capabilities. We actually noted that these patterns seemed to have some identifiable antecedents, exhibit "commonalities in key features, idiosyncrasy in details" (Eisenhardt & Martin, 2000; p. 1108), and cause important consequences in terms of venture creation, survival and growth. The observation of specific visible attributes led us impute the nature and the dimensions of the underlying new LT-KI venture creation capabilities, which we named Dynamic Entrepreneurial Capabilities.

Certain dimensions of these capabilities can be characterized as processes, thus as systematic series of actions directed by the entrepreneurs towards the targeted creation of the new venture. Most regard knowledge management and resource management processes and are mainly informal and highly flexible while all dimensions entail intent and are human-centric. This is in line with the entrepreneurial character of these dynamic capabilities which constitute "non-routine activities and leadership skills" (quoting Teece, 2012).

DECs have been then defined as the dynamic entrepreneurial capabilities to engage in non-routine activities, improvisation and a flexible and paradox way of collecting and establishing knowledge assets and asset combinations in order to realize transcendent business ideas and address complex entrepreneurial environment through

new LT-KI ventures. They have been treated **as higher-order dynamic entrepreneurial capabilities** that influence the location, selection and the ways of selection of resources and skills and use a priori knowledge in order to capture existing knowledge from various domains and create initial competitive advantages to new ventures.

DECs leverage the relationship between the limited resources and the capabilities under development in the new-to-the-world cases, while allow established firms to escape their well organized and perfect routines in cases of corporate venturing. They can be conceptualized at the individual as well as at the entrepreneurial firm level. While entrepreneurs and managers are the key agents of change, DECs are later embedded in organizational routines becoming precursors of DC dimensions (as will be later discussed) and remain in this form till the very next venture of an organization.

Within our case studies there was an exceptional case of an established company which had developed strong DCs but failed to enact DECs when trying to apply KIE. As a consequence, the new corporate KIventure did not survive dragging down the mother company as well. On the contrary established organizations that put aside their routines activating DECs presented survival and significant sales increase of the new venture even during the crisis years 2008–2012 in Greece. Therefore, it seems that one of DECs' roles is to activate the 'entrepreneurial' and cognitive component of the dynamic capabilities and provide their flexible shaping and use, as well as the flexible transitions from individuals to processes.

According to our findings, DECs do not appear to be static. As experiences occur, the new information is used to modify, add to, or change previously existing patterns and processes and thus reform capabilities and behaviors such as ways of knowledge seeking, technological competences and production methods, markets and business model formation. This behavior gave us the faith to believe that DECs can be deliberately cultivated, developed and influenced (according to Aviram 2010).

DECs are characterized by the interplay of LT-KI entrepreneurs' abilities to envision cognize and mobilize action. New knowledge (productive or reproductive) derives by combinations of knowledge ranging from out-sectoral novel science to codified knowledge and practical knowledge (e.g. Napolitano,, 1991, Pavitt, 1984, Chesbrough, 2006 in Lichtenthaler, 2009, Robertson and Patel, 2007, Hirsch-Kreinsen

et al. 2005), Böheim 2008, PILOT project (2003-2008)). They are responsible for the shaping of emergent conditions by creating and not simply discovering opportunities. They engage in exploration out of the boundaries of the firm and usually even of the industry they belong which is a vital role of DECs in building initial competitive advantages in low-tech sectors. When a new LT-KI venture is established, DECs are more individual-centric, while later they are embedded in the organization.

According to the findings of the present study, DECs incorporate the search for novelty through improvisation and bricolage, and creativity through transcendental thinking in order to build a competitive advantage at the early stages of a firm. Actually, across all thirty case studies, findings pointed to a rich fabric of processes and competencies, many of which matched descriptions of bricolage and improvisation, while others formed the introduced concept of "transcendental capability". These formed the three dynamic entrepreneurial capabilities (bricolage, improvisational and transcendental) with a number of dimensions each.

The following paragraphs depict these capabilities in short, illuminating the 'how' of LT-KI new venture creation.

Bricolage Capability: According to our findings, knowledge-intensive entrepreneurship in low-tech sectors seems to presuppose the existence of a *bricolage capability* that is strongly shaped and affected by knowledge and scientific areas, physical and financial resources, bases and networks transcending sectoral and national limits. The capability enables entrepreneurs both explore and exploit new opportunities that might otherwise be too expensive to investigate by more traditional means (Baker and Nelson, 2005; Miner et al, 2001; Witt et al., 2008).

In all cases the capability to transform and absorb external knowledge proved to be of utmost importance. This presupposed the ability to discern and appreciate the value on loosely pieces of information, knowledge and technology, novel or not, dispersed in several industrial sectors. This is in line with KIE literature; knowledge-base expansion regarding trans-sectoral knowledge about technological, market and institutional opportunities seems to be a condition *sine qua non* for low-tech KIE (Hirsch-Kreinsen and Schwinge, 2011) while "distributed knowledge bases" are significant for low-tech innovativeness (Robertson and Smith, 2008). Firms and individual entrepreneurs cannot rest on their specific sectoral knowledge; instead they

have to create and nourish linkages with actors out of the sector and out of their nation as well.

In this perspective, resource constraints regarded mainly knowledge issues besides the rather normal shortage of basic resources (e.g. finance) a new venture confronts. Most times in order to create novel ideas, agents had to "tap distributed competence and knowledge, reemploy, reframe them, and recombine them creatively" (Bender, 2004). This capability to "…create new forms with current resources" has been defined as 'bricolage' (Lévi-Strauss, 1967). Bricolage capability has been treated as a form of inter-organisational dynamics (Garud and Karnøe, 2003) enclosing a conscious refusal to limitations defined by knowledge, institutional or cultural settings (Baker and Nelson, 2005).

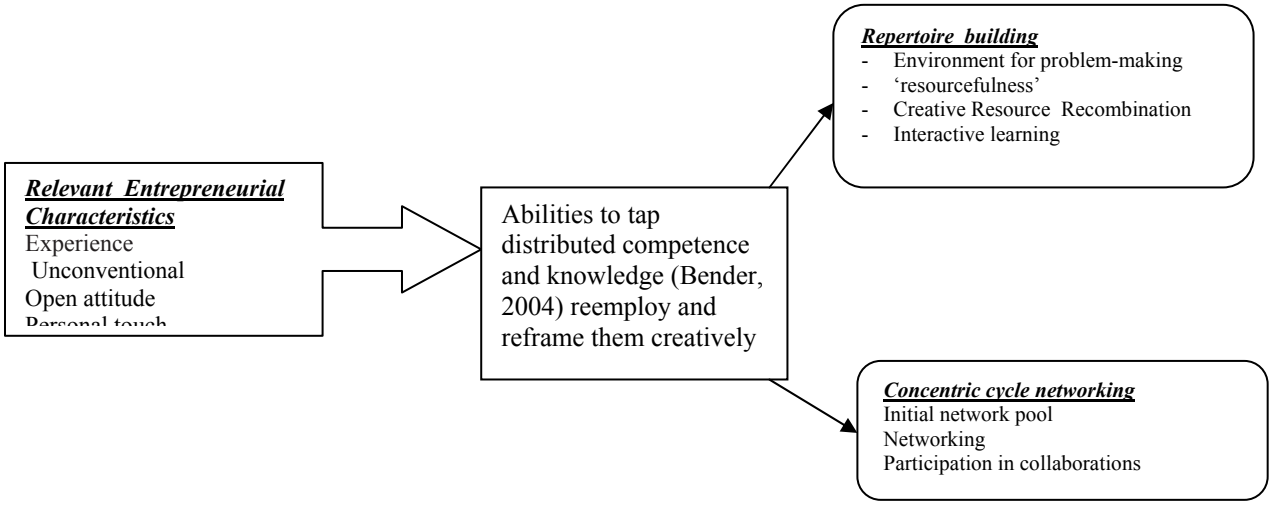
Knowledge-intensive entrepreneurs of the research developed indeed bricolage capabilities in order to successfully sense and capture both tacit and explicit knowledge and distributed competence. This could be scientific, technological, technical or practical knowledge, design competence, or expertise; it referred to codified or knowledge incorporated in humans and/or technical artifacts. Based on the case-study analysis, we formed two bricolage dimensions with their sub-dimensions as analyzed in Chapter 7. Findings of the research verified the first proposition:

> P1: Bricolage can constitute the basis of a distinct type of dynamic entrepreneurial capability in knowledge-intensive low-tech ventures and namely *bricolage capability.*

Bricolage capability can be clearly assigned to entrepreneurial capabilities, since the strong interpersonal dimension is evident and it is directly related to the successful creation of resource bases. The dimensions of the bricolage capability enact the mechanisms of alignment and realignment of resources which in the case of KIE refer mainly to knowledge syntheses together with other resources. However, it constitutes a dynamic entrepreneurial capability, too, since:

- its dimensions can be applied in all cases, are difficult-to-imitate combinations of individual, organizational, functional and technological skills,
- it encloses the potential to continuously reform these skills and competencies at the founding stage as well as the early phase of the new venture, matching the demands of the new and often ambiguous environment.
- It contributes to the creation of initial competitive advantage

Figure 8.2: Bricolage capability



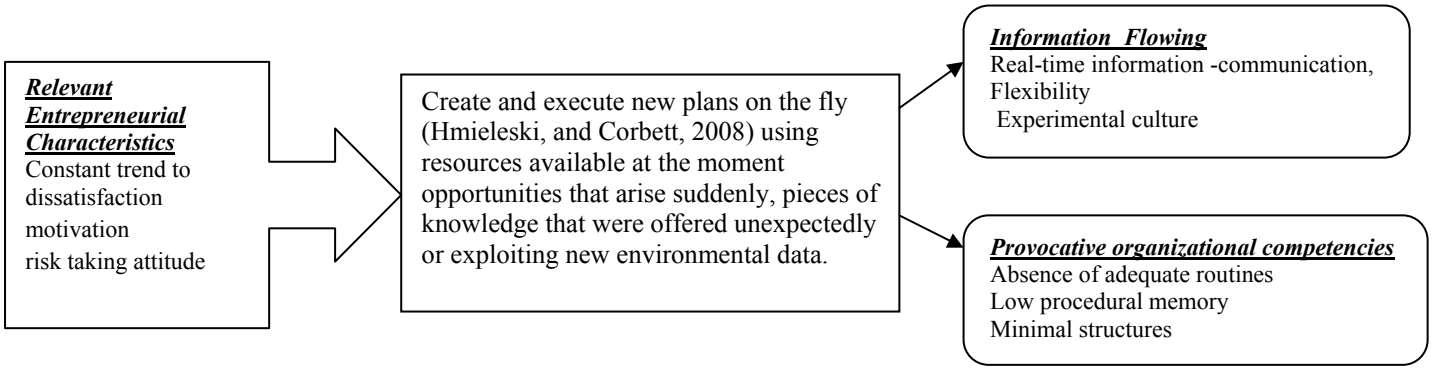
Improvisational Capability: Back in 2002, Ciborra (2002) suggested that 'people improvise when they are overwhelmed by the world, and thus, are forced to read the world in a different way'. Low-tech firms are actually forced to read markets and systems in different ways, since today neither cost-leadership nor quality alone can assure safe entrances to newcomers. Quite astonishingly none of the cases seemed to follow the "design-plan-execute" linear model. On the contrary, it was quite evident that design and execution converged substantively. Yet, this is the actual definition of improvisation (e.g. Baker et al., 2003). *"We presented our innovative products in ANUGA and orders started. We actually did not know how to reach mass production*" (FCo9). Literally, founders "seem[ed] to plunge into the start-up process, designing the firm as they create[d] it" (Baker et al., 2003).

Improvisational capabilities were found to exist even in cases of corporate venturing where the new activity was quite pre-planned (e.g. in the cases of WCo2, FCo6, FCo8 and most of the T&C cases). Unexpected problems, crises or even new ideas that would come up the very last minute (e.g. the innovative process of hardboards by WCo2) and new opportunities were confronted as "points of departure" (Docherty and Marking, 1997) due to the improvisational capability. Thus, improvisation does not refer to the absolute negation of design–execution (Baker et al., 2003). A major aspect of the capability is the provision of retrospective interpretation and creation of new patterns regarding products, processes, targeted markets, models etc (Miner et al., 2000; Preston, 1991). Therefore, entrepreneurs appeared to shape an ongoing activity.

Findings of the research verified the second proposition:

P2: The concept of improvisation can constitute the basis of a distinct type of dynamic entrepreneurial capability in knowledge-intensive low-tech ventures and namely the *improvisational capability*

Figure 8.3: Improvisational capability



Transcendental Capability: "The best way to predict the future is to create it". The famous quote of Peter Drucker is more popular than ever; in today's competitive environment new ventures can survive and grow only if they manage to challenge existing business ecosystems or create new ones. This holds especially true for low-tech firms with well-established technologies and highly standardized processes, which share to a greater or lesser extent markets on mature products (Hirsch-Kreinsen and Schwinge, 2011).

LT-KI actors of the thirty cases appered to be in the need of constructing novel knowledge-based concepts that would permit consumers to amass a great number of concepts allowing them to interpret their needs in different ways. Actors of all cases challenged the very nature of their low-tech industries and their strong path-dependencies. FCo6's CEO, known for his new firm's strong innovative image, specifies this in a very clear way: *"while no-one would argue that rice is really rice, knowledge-intensive innovative concepts can argue about nutritional exception, novel mixtures, waste and by-products genius exploitation, eco-innovation or whatever. Of course, all these presuppose knowledge, scientific involvement and experimentation. Still, ideas are a priori; nothing exists before you imagine and invent them!"*

In general, there is a common acceptance that entrepreneurs own the ability to see behind symptomatic solutions (Senge, 1990) and come up with an innovative opportunity, beyond the simplistic combination of pieces of knowledge. In the attempt to "decode" the way KI-LT entrepreneurs/teams created novel knowledge-intensive business concepts and outline "principles that underlie and guide choices of the entrepreneurial acts" (Teece, 2012) we introduced the notion of Transcendental Capability, inspired by Kant's Critique of Pure Reason[318] (please refer to the relevant section in Chapter 7). Transcendental Capability is a totally novel concept, a purely dynamic entrepreneurial capability of strategic nature, which explains 'how' innovative knowledge-intensive concepts are built. It regards mainly the process of intangible assets' creation, such as novel knowledge and know-how which according to Teece (2011) constitute the new, hard to "build" and difficult to manage "natural resources". We claim that innovative business concepts are results of a priori knowledge generation processes.

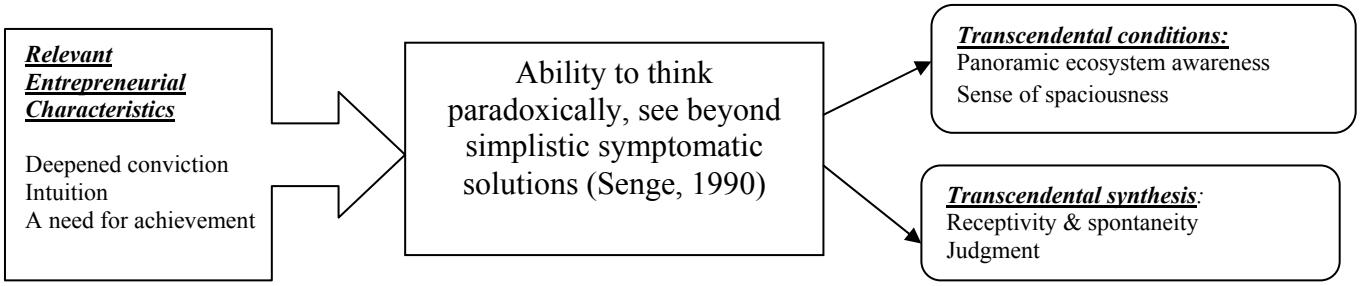
Transcendental capabilities (TCs) are the key drivers of shaping unorthodox ideas and orchestrating the other two DECs to realize these ideas. Entrepreneurs form by anticipation genuine concepts based on cognitive capabilities derived from TCs, which determine the origins, the extent, and the objective validity of knowledge, facilitating a path carving within the KI "beginner's" chaos. Such an enactment of mechanisms needed to allow unexplored knowledge paths and produce innovative business ideas constitutes the specific difference between KIE and plain entrepreneurship. The fruits of TCs seem to be able to permit a newcomer be accepted in an already established and seemingly saturated market environment, entice customers, deliver value to them and persuade them to pay for value.

Transcendental capabilities in the examined cases seem to define the depth, the impact and the degree of novelty of knowledge-intensive business concepts; that is the core of the initial competitive advantage, the positioning of the new venture within the existing or the newly created business ecosystem and the new venture's dynamism. **Although bricolage capability allows for the hunt of knowledge and**

[318] In short and but for extreme simplification: Kantian philosophy regards transcendental knowledge as knowledge of *how* it is possible for us to experience a priori objects as objects. The core question of the Critique of Pure Reason regards the relationship between knowledge and "things- in-themselves"; the core idea was then transferred to the research question on the relationship between knowledge and the novel LT-KI entrepreneurial idea itself.

improvisational capability for the convergence of design and execution, it is the transcendental capability that rules and curves the directions towards novelty and knowledge seeking, indicating solutions to limitation refusals. Thus, transcendental capabilities guide and direct the other two dynamic entrepreneurial capabilities. Bricolage and improvisational capabilities perform executive functions while transcendental capabilities are strategic directional capabilities.

Figure 8.4: The Transcendental Capability



Findings of the research verified the third proposition:

P3: Transcendental capabilities constitute a novel distinct type of dynamic entrepreneurial capabilities in LT-KIE in order to describe the genesis of challenging concepts by mismatches of common and transcendent ideas.

Dimensions of the transcendental capability are novel (introduced by the author), inspired by the Kantian Critique of Pure Reason and based mainly on the entrepreneurship literature. More precisely,

Transcendental conditions are necessary in order to produce concrete business ideas of the opportunity in question (paraphrasing Kant). *Sense of spaciousness* regards the constant sensation of where the agents are and where they want to go; it actually describes the conscious excess of the limited 'known' because of the existence of the unlimited 'unknown'. Spaciousness and crowding are antithetical; although traditional markets are usually considered as "crowded", the sense of spaciousness allows for these markets to generate opportunities instead of imposing limitations. The sense of spaciousness seems to be related to the openness of the entrepreneurs to novelty

depending on their attitudes, experiences and knowledge but it extends also to the level of search they do for novel ideas; i.e. the areas (sectors, sciences, perspectives) they search, the agents they envelop, the markets they explore, mechanisms and channels they use, networks they build and visions they develop in order to build subjective expectations of an unknowable future.

Still, the ability to realize intra-industry space in saturated markets seems to be strongly dependant on the ability to view global markets *in a panoramic way* being in the position to estimate value chains, intra- and inter-sectoral industry potential. Thus, sense of spaciousness seems to be related to an ability of viewing a given phenomenon from various points simultaneously. Actually PEA launches the interaction with the environment; actors want to acknowledge the environment, be able to look at it from outside and reshape it through knowledge creation.

Transcedental synthesis is more related to Kant's way of thinking and regards the process of receiving data and stimuli, a spontaneous reaction, and a repetitive action of judgment.

The dimension of TS actually rules and harnesses the act of unifying and combining the manifold information, data and stimuli into one idea which will be further developed into a knowledge-intensive innovative business concept. No matter how preconscious and well structured or tacit it may be, each synthetic act of processing information is not merely an operation of converting raw elements of information into higher level, newly ordered complexes of knowledge. Within Transcendental Capability it's an act of intelligent unification which triggers bricolage and improvisation in order to realize the initial "entrepreneurs' subjective acts of the imagination" (Chiles et al., 2009).

TS can be productive or reproductive that is either exhibiting and producing an original concept prior to experience (*exhibitio originaria*) referring to radical innovations, or producing it on a derivative way by bringing back an empirical intuitive business idea (*exhibitio derivata*) and then we refer to adaptive or relevant types of innovation.

Transcendental synthesis entails bottom-up and up-down information processing capabilities, depending on the cognitive properties and perceptions of the agents, their knowledge on ways to locate, retrieve and store data, their mechanisms to process them as valuable information and combine them with relevant resources in order to

prepare the manifold. While transcendental conditions provide a structured coordination of getting to know the external environment (micro and macro environment, industries and markets) and work on the internal environment of the entrepreneurial team or the company (cognitive properties, capabilities, resources etc), TS enables the creative adaptation and exploitation of all input with the judgment dimension to bring together understanding and sensibility, hence concepts and ideas by making difficult decisions in a short time frame with imperfect data.

Taking into account his own assurance that Critique of pure reason is "ultimately a book on method" (B xxii), we made the parallelisms that drove to the development of the Transcedental Capability as a conceptualized capability that is composed of both entrepreneur-based elements and constructed methods that may constitute processes.

All three DECs go well beyond "…vivid imagination, good insights, and self-confidence. They also involve organization" (adapting the phrase of Penrose, 1959, p.41 for entrepreneurial judgment) and processes in order to produce KIE.

8.2 a) Common in all three industries

The research indicated that in all cases, DECs can be developed and harnessed to create unique asset bases and to challenge existing or shape new business ecosystems through novelties in products, processes and business models. Thus, DECs framework may be able to partly explain the sources of initial competitive advantage in cases of low-tech KIE. Quoting Teece (2007)

> "A framework, like a model, abstracts from reality. It endeavors to identify classes of relevant variables and their interrelationships. A framework is less rigorous than a model as it is sometimes agnostic about the particular form of the theoretical relationships that may exist".

More precisely, findings indicate that for all three low-tech industries:

- Knowledge-intensive entrepreneurs develop *bricolage capabilities* to disregard the limitations of commonly accepted definitions mainly of technology and standards, insisting on trying out solutions, collecting knowledge from diverse areas and combining resources for new purposes to fit their business concepts. Bricolage capabilities seem to affect innovativeness and the underpinnings of new product development and performance in low-tech industries. The entrepreneurs are the creators, the animating spirits and the main actors for the business idea realization.

- Differences in prior business experience seem to influence bricolage capabilities and moderate the relationship between them and the likelihood of a strong initial competitive advantage and consequential path creation.
- Bricolage capability is affected by the pre-existence of resources, while the level of the entrepreneurial human capital and the initial knowledge assets impacts it together with prior business experience of the entrepreneurs. A limited and specialized knowledge base may constrain the search zone reducing the ability to gain and use knowledge developed elsewhere.
- Among the sub-dimensions of bricolage capability, concentric cycle networking is deemed important for facilitating access to strands of technology that are alien to firms such as R&D on bio-functional food, use of innovative fibers in fabric production, innovative dyeing processes or patented processes of innovative material production (such as WPC), stretch to new markets, excel in design or develop new business models (especially in apparel section). It appears in the forms of joint ventures, exclusive partnerships and contracts for the purpose of creating value. New firms start with informal CCN based on personal contacts and former relationships, developing flexible types of co-operations. Established companies use more formal ways of CCN. In all three industries, suppliers and other stakeholders "gather" easier around an existing and known company while there are core difficulties to trust and be close to a new one.

- Knowledge-intensive entrepreneurs develop *improvisational capabilities* which enable the constant refinement of the initial business idea in pursuit of more novelty and differentiation, due to restrictions and limitations or due to a strongly embedded improvisational culture but without really knowing where one's queries will lead or how action will unfold
- Strong improvisational capability appears to be irrelevant of former condition.
  - The level of human capital of the entrepreneurial team will moderate the relationship between improvisational capabilities and the likelihood of a strong initial competitive advantage. While flexibility is quite natural (and expected) in new-to-the world ventures, together with the other provocative competencies, they all have to be clearly defined and specified in the cases of

corporate venturing. In all cases of corporate venturing enthusiasm for innovation, entrepreneurs' attitude towards knowledge and novelty, their commitment to flexibility and extroversion and their creative and provocative dissatisfaction affect improvisational capabilities.

- The amount and quality of existing resources affects improvisational capabilities and moderates the likelihood of a strong initial competitive advantage and the relationship between it and the consequential path creation. Yet, resources are not alone sufficient to create strong improvisational capabilities.
- Strong improvisational capabilities seem to be irrelevant of company's size and from type of venture to be created (new-to-the-world or corporate). However, in cases of corporate venturing, established organizations were observed to deliberately activate provocative competencies as well as the other dimensions of improvisational capabilities.

Knowledge-intensive entrepreneurs develop *transcendental capabilities* which define the depth, the impact and the degree of novelty of knowledge-intensive business concepts; that is the initial competitive advantage, the position of the new venture within the existing or the newly created business ecosystem and the new venture's dynamism. Furthermore, in all cases we detect the capacity of the knower. Agents are "knowledge operators" who work at the intersection between science, technology, innovation and markets in order to develop high quality transcendental synthesis. More precisely:

- Transcendental capabilities guide and direct the other two DECs. Bricolage and improvisational capabilities perform executive functions while the transcendental are strategic directional capabilities.
- More precisely, the width and the quality of sources to seek, resources, ways and combinations are defined by *the sense of spaciousness* (dimension of the transcendental capability) realized mainly through the bricolage capability and further developed through the improvisational capability. Bricolage and improvisational capabilities can further support the initial idea. They help entrepreneurs anticipate their market entry, beware of experts and refine their strategy to counter possible imitators of the idea (which for example the cases

of WCo5, WCo7, FCo3 and TCo3 failed to do). This is in accordance with the relevant literature (e.g. Moorman, 2001; Faltin, 1999). Still, the ability to realize intra-industry space in saturated markets is tightly dependant on the ability to view global markets in a panoramic way and be in the position to estimate value chains, intra- and inter-sectoral industry potential. Thus, entrepreneurs need to question or purposefully develop a higher level of PEA for concept-building. A limited picture of the sector which revolves around local markets and certain knowledge limits affects negatively transcendental capabilities and especially transcendental conditions.

- Limiting PEA into specialized technological bases may constrain the search zone, reducing ability to obtain and use the knowledge developed elsewhere. This danger is higher for new-to-the-world ventures, while it can be a choice in corporate venturing. This aspect indicates that development and focus on only technical dimensions of innovative concepts relying only on external knowledge may deprive newcomers from market leadership advantages.
- The dimension of transcendental synthesis seems to affect significantly the business concept formation in all of these cases. It is the capability actually responsible for the capture of the novel but initially vague idea which will build the new business opportunity.
- The level of Transcendental Synthesis seems to depend on the level of the Transcendental Conditions and affects significantly the other two DECs. Strong transcendental synthesis supports the production of strong business concepts that cover the whole new entrepreneurial activity and not only the novel product/process/service concept. Consequently it is not only innovation but the whole entrepreneurial schema around it that judges the produced advantages as competitive or not (from supplier approach to communication of the new concept to the market and its further support). Weak transcendental synthesis supports the production of business concepts that are not able to equally cover the whole new entrepreneurial activity resting only upon product/process or service novelties.
- Reproductive transcendental synthesis is more common than productive in knowledge-intensive but low-tech new ventures.

- A limited picture of the sector which revolves around local markets and certain knowledge limits affects negatively transcendental capabilities and especially transcendental conditions.
- The *sub-dimension of deepened conviction* is partly a trait of entrepreneurs but it also depends on previous experiences and successes, strong networks or a strong starting knowledge pool that secures the idea support. It seems to have an impact on the degree of novelty of the business concept. Deepened Conviction enhances entrepreneurial novelty and creativity in low-tech knowledge-intensive ventures. When the agents receive favourable attention for their initial vague ideas a further gradual development and increase of deepened conviction is observed. On the contrary, low level of conviction hinders entrepreneurial novelty and creativity of ventures.
- The level of human capital of the entrepreneurial team will moderate the relationship between transcendental capabilities and the building of a strong initial competitive advantage.
- Former agents' condition (i.e. cases of corporate or new-to-the-world venture) affects the quality of transcendental capabilities which in turn defines the type of KIE development.
- Established companies present more organized and well–built mechanisms of transcendental capabilities in corporate venturing than new-to-the-world ventures. This can be due to the fact that they have already developed routines, their own dynamic capabilities, they are richer in experience and structured ways of operational efficiency and can devote more resources (either tangible or intangible) in order to get creative answers.

Another interesting observation which cannot however be generalized is the fact that almost all agents (in our corporate cases) **had been pioneers** (not necessarily innovators) at least at local level in the past, before the knowledge-intensive venture.

DECs' development seems to depend on origins i.e. the existing organization in cases of corporate venturing or the entrepreneurial team in cases of nascent companies. Initial knowledge stock, as reflected in founders' average educational attainment, can be regarded exceptional for the specific low-tech sectors; twenty-five out of the thirty

cases report founders with graduate degrees or even higher ones (Master of PhDs), with F&B group to retain the lead; in nine out of ten cases agents hold a higher degree diploma. Notable is that the ages of the entrepreneurs follow the dynamism of the sector as discussed above; new ventures of the mostly dynamic F&B industry are founded by agents in the 4th decade of their life (31 to 41), new W&F entrepreneurs – a prospering sector until 2007 in Greece – are in their forties (34 to 42) while the T&C sector present mainly corporate venturing with the entrepreneurs to be between 40 to 60.

In all three sectors there are cases where the entrepreneurs do not hold a graduate degree but they have an exceptionally rich professional and more precisely entrepreneurial experience to compensate with this weakness. In cases of corporate venturing, usually a team of well educated staff will undertake the realization of the idea. This does not resist the existing literature. For example, Wennberg et al. (2011) argue that the commercial knowledge gained by industry experience is potentially more valuable for entrepreneurial performance compared to the academic knowledge gained by additional research experience at a university.

8.2. b) Sector-specific and type-specific differences

However, the findings indicate that **KIE types and the development of DECs for low-tech KIE are partly industry-specific** and justify the selection of three specific low-tech industries which allowed for the control of environmental variation. Differences have been also traced **between new-to-the-world ventures and corporate venturing.**

Firstly, KIE development follows different ways due to path dependency and the different context of each of the three sectors:

W&F sector used to be a strong and prospering industry with no need to get out of national and sectoral borders. Firms would rely more on practical skills than knowledge. Thus, KIE means a complete shift to knowledge, innovation and extroversion. The general prosperity of the early 2000s combined with the abundance of subsidies and easy access to finance as well as the perspective of the Olympics 2004 supported significantly the W&F KIE entrepreneurs. Yet, the industry does not really allow for breakthrough innovations, while the nature of products makes exports somewhat more difficult compared to the other two sectors. KIE then seems to be an

issue mainly (but not only) for established firms which have realized that KIE may be the only strategic choice in the future.

F&B industry used to be mainly a packaging industry, introvert and traditional. It used to be less organized and knowledge oriented it. Now, within KIE, it becomes more technology and science oriented with highly educated management and R&D indexes to surpass the ones of high-tech industries. Scientific developments in multiple areas allow for radical innovation while globalization has favored extroversion. The transcendence of sectoral boards is achieved mainly due to the approach of academia and research and the convergence of stakeholders of the whole value chain on innovation. A further impact of prosperity was the willingness of Greek consumers to taste new flavours of high price (such as gourmet products) or even new suggestions for healthier life such as biological and semi-pharmaceutical chocolate.

T&C was more organized and used to have a more international perspective than the other two industries. Actually it was the most extrovert industry till late 90s. In the more capital intensive textiles industry, firms would invest on new machinery and equipment while in the manufacture of clothing organization, professionalism and licensing from abroad predominated. KIE came mainly as an answer to global threats and it actually permitted entrepreneurs to become active players in technology development and R&D. On the other hand, clothing industry had to turn to design which was rather neglected in Greece since "there is not too much space for technological innovation" according to the entrepreneur of TCo7 and the relevant literature. Besides the favourable environment regarding financial support, the sector itself as well as a certain level of conservatism and teleology did not allow for radical innovation.

Therefore, it seems that **KIE regards the creation of opportunities for F&B, the confrontation of threats for T&C and the exploitation of opportunities for W&F industry.**

Knowledge is deemed important in all cases and all sectors. However, there are quite different ways to seek it, combine it and produce innovation. Research revealed **significant sectoral differences in the way firms approach knowledge creation.** Depending on the type of competitive advantage they want to develop, firms invest on R&D or open innovation and co-operations. Food companies usually establish well

organized, dedicated R&D departments (8 firms out of 10), charge relevant expenditures and develop strong linkages with academic and other research institutes. They are followed by the established large textiles companies (4 out of 10). On the other hand most wood and furniture and apparel firms invest on design (whether creative or imitative) and build information and knowledge diffusion networks.

Secondly, **certain sector specific differences were evident in regard of the nature and development of DECs**:

Bricolage capability development is differentiated on the basis of knowledge seeking activities, knowledge assets and performance. Across our case studies, founders engaged in bricolage with regard to knowledge providers, suppliers, customers and consultants in equally formal or informal ways. In all three industries there are cases where collaborations extended to areas well outside the sector and the market of the companies (e.g. WCo10, FCo5, and TCo2). However, F&B sector seems to be the only group that extends to sciences other than food technology with a far broader repertoire building and stronger CCN, transcending sectoral and national limits. The industry seems to be more active in collaborations with research institutes, universities or specialized consultants. In direct contrast, T&C cases stay caged in their initial network pool although they are very good at collaborations. They transcend national but not sectoral limits. The cooperation with customers or potential customers and even competitors in textiles and clothing seems to be more significant while the co-operation with both machine and raw material suppliers is important in the W&F sector. Furthermore, it seems that it is only the T&C sector that engages formal partnerships. Across all groups, knowledge is purchased in terms of human capital (highly and relatively educated personnel), patents, technologies and co-operations.

Respectively, the *hunt of knowledge* on relevant W&F sub-sectors, regards mainly familiar areas than chasing radical innovation. Innovations of the field, although knowledge-intensive, target in their major percentage local/national markets, are mainly incremental but not mere improvements of products and processes and they *do bring* considerable benefits which are noticed more by B2B customers (e.g. the furniture sector in the case of wood processing) and less by the final consumer.

On the other hand, F&B cases present radical innovation engaging mostly high-tech sciences such as biotechnology, pharmaceutics, human pathology and biochemistry.

In parallel, bricolage includes many other fields such as mechanical engineering, automatization, marketing and design. The *hunt of knowledge* on both relevant and irrelevant sub-sectors still regards more the "new in the shape of the familiar"; it is this paradox combination of innovating on traditional products. The actual target is to ***produce novel products*** at least in nine out of ten cases. Innovations of the field are all knowledge-intensive, target in their major percentage global new niche markets, cannot be characterized incremental and some of them are patented.

However, while in F&B sector, the actual target is to ***produce novel products*** at least in nine out of ten cases, it is not the same with T&C. Actually, there are only two cases (TCo2 and TCo6) which target to the competitive advantage of novel products. Most cases target the production of novel methods of production, processes, novel techniques, or novel combinations in order to create initial competitive advantages. Yet, innovations of the field are all knowledge-intensive, target in their major percentage global new niche markets, cannot be characterized incremental and some of them are patented.

It is worth mentioning that not all T&C agents are engaged in ***real problem making*** but they actually engage bricolage in an effort to solve problems due to the need of survival. Therefore this limited the knowledge bases required for KIE.

Improvisational capability is quite weak in the T&C industry but this is mainly attributed to the fact that almost all cases are cases of corporate venturing. Parent companies were all well-organized with well developed dynamic capabilities and other routines and processes. In the same vein, experience in the W&F sector appears to be a drawback for well established cases. On the other hand, in F&D cases it seems to follow literature findings and thus it leads to better improvisation and consequently better performance (Arshad, 2011). Experience and past similar actions engagement encouraged spontaneity and immediate responses (Hambrick et al., 1993; Geletkanycz and Black, 2001) in many cases (e.g. FCo1, FCo5, and FCo9). In all three industries, improvisational capabilities are far better developed by new entrants than by corporate venturers.

The analysis of the DECs at sectoral level indicated stronger ***transcendental capabilities*** for the F&B new-to-the-world cases. However, W&F established

organizations manage to develop ***transcendental capabilities*** of high levels easier than the CV cases of the other two sectors; they also apply them in more controlled ways than most new entrants realizing KIE through LT corporate ventures. In contrast to W&F sector, the F&D cases do not reveal any supremacy of established organizations in stronger transcendental capabilities development regarding corporate venturing. Yet, there are significant indications that former condition of the agents *really* matters; that is, former condition affects the formation of transcendental capabilities, which in turn affect the other two DECs.

In the case of W&F start-ups, the agents usually have a limited picture of the sector which revolves around local markets and certain knowledge limits and affects negatively transcendental capabilities and especially transcendental conditions. On the other hand, transcendental conditions seem to be quite strong in all T&C and F&B cases. More precisely, no F&B weak case presented weak transcendental conditions. Sense of spaciousness in crucial in all cases; however, spaciousness is sought in differenct areas depending on the sector. For example, spaciousness in the F&B industry considers mostly radical innovation and invention instead of exploiting innovations produced in other links of the industrial value chain in contrast to the other two groups, while W&F cases seek spaciousness mainly within national borders while the other two industries adapt a global view.

Reproductive Synthesis is more common in all three industries. Yet, the F&B sector included cases of productive Transcendental Synthesis (TS) which is quite expected; productive TS[319] (appearing mainly in the form of radical innovation) is somewhat easier to be developed in F&B industry than in the W&F industry. Contrasting the other two sectors, F&B KI-ventures develop very strong TS no matter if they are new-to-the-world or corporate. Actually in our cases there is an analogy of 50%-50% between the two types regarding an excellent exploitation of a totally novel business concept. No differences were observed regarding the development of weak TS; in all three sectors weak DECs are developed by new-to-the-world ventures. Additionally, their initial innovations appear unable to create a strong initial competitive advantage, although they can ensure the opening of a niche market or open a new business

[319] We remind that Productive TS is the power of exhibiting and producing an original concept prior to experience (*exhibitio originaria*) and Reproductive TS the power of producing it on a derivative way by bringing back an empirical intuition (business idea) previously held by the organization (*exhibitio derivata*) and then we refer to adaptive or similar types of innovation. It is also partly conceptual as it connects directly with the determination of the form of a sensing opportunity.

activity. However, this is not enough to guarantee first mover's benefits or even survival.

Transcendental synthesis seems also to be quite strongly affected by *institutional and contextual factors at national level*. By definition, the analysis regards ventures established within the same national context and namely Greece. However, besides the general prosperity and the abundance of subsidies, the three sectoral groups present quite different reaction as already seen above. Globalization supported the extension of transcendental conditions and the development of high-level TS. Threats turn to opportunities; global energy crisis gives birth to carbon-free olive oil and novel wood-based material, water shortage to novel cultivation methods, limitation of cultivated area and price drop to innovative production methods.[320] University-industry collaboration is gradually increasing during the years of the case studies creation and not only in high-tech sectors (Caloghirou et al., 2001). This trend towards science was mostly exploited by F&B knowledge-intensive ventures, where agents invest in such co-operations to extend knowledge pool, organize R&D and surpass limitations of traditional industries. The F&B cases create strong links with universities and Departments of Biotechnology, Food Technology, Pharmaceutics, Chemical engineering, Plant Engineering[321] etc. Besides science, there is also a closer contact to flourishing industries of technology production and a plethora of technological innovations.

In terms of the national context, it should be highlighted that the Greek state does not seem to support KIE efforts: Subsidies are not paid accreting to textiles entrepreneurs; legislation is not actually imposed regarding environmental issues according to W&F agents. In all Greek food cases, bureaucracy and the "unfriendly state" were mentioned as major obstacles. *"We had to collect a thousand signatures for each action*" says FCo6's agent. *"The state was never side by side with the entrepreneurs*" states FCo5's agent who narrates long stories of inappropriate public services' behavour[322]. FCo9's agent details how the new-to-the-world venture lost money and

[320] E.G. in the case of FCo6: at the time of the decision for the new establishment, the regulations of E.U. had influenced sharply the rice market in Greece. The cultivated area should be decreased and standardized at an area of 25,000 ha. In parallel, producers' prices had been subjected to a gradual decrease which was to be continued until the end of year 2000 (from 351 EURO/MT in 1997 to 298,35 EURO/MT in 2000).

[321] Plant engineering : design and building of greenhouses and hydroponics systems

[322] E.g.: although the product was registered by the General Chemical State Laboratory of Greece and the company was assured that no other license was required, there were claims for not having a license

valuable time just to gain a license for gluten-free products. *"We were between NAO (National Organization for Medicines) and the prefecture, "from pillar to post", for a whole year. They could not sort it out among themselves. A whole year of meaningless trouble… "* . Innovative products could not be categorized or get a license in order to be exported.

> "At first they gave us a number for cheese processing but they took it back and asked for more details. They had also certain doubts on what to control for. We actually teach them since everything is too new for all of them… You know, these problems lasted over a year and hindered exports. Of course all this issue to move forward needed further financial support. Yes, the state malfunction cost us money and time" (FCo9)

> "That was really nasty. It was entered as pickles but that categorization actually ruined our product since it has nothing to do with pickles' (FCo1)

The existing mechanisms rather hinder than enable co-operations or innovative efforts.

Regarding **patents and intellectual property protection,** it seems that T&C sector stands in the middle of the other two groups; W&F sectors is not particularly interested in appropriability issues, while F&B seems to care a lot. Actually, the more science-based and the more "trans-sectoral knowledge-based", the novel business idea, the more important the appropriability issue for the agents. *Still, the patented idea is the end and not the beginning of the low-tech, knowledge-intensive business creation journey.* Lead time (first mover advantages) and trademarks were the mechanisms deemed by far the most effective, both for product as well as for process innovations, followed by secrecy and design complexity. However, in accordance to the other two sectors (with some exceptions in F&B), there is respectively low interest in patents and intellectual property protection regarding the developed machinery and production technologies.

Differences were also traced in regard of new versus corporate KI venturing. Perhaps the most important one is the fact that founders of new-to-the-world KI low-tech firms develop more human-centric and less organized DECs than in cases of corporate venturing. Other differences observed regard mainly the role of resources and the improvisational capability.

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from the National Organization for Medicines (although it is not a medicine). The company had to pay a fine of 3000 Euros and request the license which was a time-consuming process.

In all three sectors, resource availability is a major determinant for the DECs development; DECs presuppose certain levels of tangible and intangible resources. Financial, social and human capital affects DECs and their development and subsequently their impact on new venture performance. In cases of corporate venturing, however, the development of DECs should be handled with care avoiding the danger of core rigidities and teleology due to the usually rich pool of social and human capital or the reassurance that abundant financial resources inevitably cause. Notable are the obvious differences between the resources of cases with limited private capital background. This is more intense when comparing nascent to corporate venturing cases. On the other hand, subsidies, which can potentially solve certain capital problems, are confronted with suspiciousness by W&F agents and are actually avoided by the majority. On the contrary all ten F&B cases and half of the T&C cases apply and get subsidized irrespectively of size and status (nascent or corporate venturing). However, subsidies proved to be a trap at least for the T&C companies; according to narrations, they were never paid causing a series of significant finance trouble for the new ventures.

Resource availability was not the only difference between the two big categories of nascent and corporate venturing. While bricolage capabilities seem to be easier developed by established parent organizations due to an already existing and significant initial pool, this advantage may turn to disadvantage; the analysis indicated cases that stayed trapped in their existing strong networks and avoided CCN or limited repertoire building. On the other hand, transcendental conditions were far better developed by existing organizations; yet, in many cases transcendental synthesis would be caged in the wishes and the existing ecosystem of the entrepreneurs while judgment would be confused with teleology.

The most difficult DEC to be well developed was according to our opinion the improvisational capability. Established companies could not “de-learn” their organized way of functioning producing rather weak provocative organizational competencies. This was more evident in the T&C cases which were well-organized with strong routines and processes and had enjoyed success at global level. This is in line with literature; new ventures do not include highly standardized organizational routines, nor have they been institutionalized (Chrisman and Bauerschmidt, 1998) and thus improvisational capabilities are easier to be developed.

Corporate knowledge-intensive venturing appears to be more suitable for the W&F regarding the transformation of existing non-KI firms to knowledge-intensive and innovative ones, and T&C industries mainly due to need than due to choice. In corporate KIE, bricolage, which is tightly connected to knowledge "hunting" and networking, is easier due to the richer pool of resources, social and human capital**.** In addition, resources are richer and abundant, and transcendental conditions are superior. However, in cases of corporate venturing local proximity increases the danger of core rigidities. On the other hand, there is no supremacy of corporate knowledge-intensive venturing in the F&B industry.

Furthermore the existence of DCs (traced in the cases of corporate KIE) cannot guarantee the success of a new corporate venture; Ireland, Hitt and Sirmon (2003) have stated that start-up ventures have been relatively skilled in identifying entrepreneurial opportunities while more established organizations have demonstrated relatively superior skills in terms of developing and sustaining competitive advantages but have been less effective in recognizing entrepreneurial opportunities. Therefore, opportunity-seeking behavior and advantage-seeking behavior are quite different and require different capabilities; while DCs are significant for the development of sustainable competitive advantage, DECs are needed for fundamentally new opportunities to be created or found. Following Ireland et al., (2003) LT firms pursuing KIE through corporate venturing "seek opportunities (i.e., opportunity-seeking behavior) either to disrupt an industry's existing competitive conditions or to create new market spaces (i.e., advantage-seeking behavior)".

Barney (1986) has also suggested that one of the few periods in which it might be possible for an organization to develop a culture is in its early stages of growth due to its characteristic flexibility which is further imperfectly imitable. In the same line, extensive literature has proposed a variety of reasons why established firms find it difficult to develop radical innovation if they do not depart from their routines (e.g. Czarnitzki, Dick and Hussinger, 2011). Successful corporate ventures presuppose autonomy from the daily business operations of the parent firms (e.g. von Hippel 1977, Burgelman 1983a, 1983b, 1985, Siegel, Siegel and MacMillan, 1988) and conscious recognitions of the need for autonomy. According to findings, cases of

W&F had concentrated on achieving this type of "freedom", while, on the other hand, T&C cases did not manage even to consider it.

8.2. c) DECs'impact on new LT-KI venture performance

The proposed dynamic entrepreneurial capabilities framework introduced the bricolage, the improvisational and the transcendental capability and their operationalization as derived by the in-deapth exploration of the thirty low-tech cases and based on the study of a wide range of fields including the ones of entrepreneurship, innovation, KIE and dynamic capabilities. However, the answer to the first research objective would be incomplete without the examination of the impact of these observed capabilities on the performance of the examined cases.

In accordance, section 2 (7.4) explored the performance of the new LT-KI ventures looking at the significance of their initial competitive advantage and through the parameters of survival, growth, and innovativeness in their life-course as new firms.

The analysis provided evidence that DECs were developed at different levels at the examined cases; however they were always significant across cases and sectoral groups impacting the creation of the initial competitive advantage, as well as the survival and partly the growth of the new ventures. Results indicated that, in all three traditional low-tech sectors,

*LT-KI entrepreneurs need to develop the **whole set of DECs,** which are actually interacting among them, to start viable and successful ventures with strong initial competitive advantages regarding survival, growth and innovativeness.*

The findings indicated again that the impact of DECs for low-tech KIE is partly industry-specific justifing further the selection of three specific low-tech industries which allowed for the control of environmental variation as mentioned above. Sectoral characteristics such a technology life cycle and standards, types of competitive advantage, technological and R&D opportunities, factor endowments (such as human and physical capital intensities), market size and degree of openness to foreign competition or the export orientation of the sector seem to affect the development of DECs and consequently the new venture idea creation and the realization of this idea. However, similarities have been found as well, and this supports the generalizability of the DECs' framework. And more precisely:

In all three traditional low-tech sectors successful knowledge-intensive entrepreneurship is characterized by a balanced emphasis on different dimensions of innovation combining harmonically external knowledge seeking to in-house R&D. On the other hand, the focus on only the technical dimension of innovation relying on only external knowledge affects mainly the new-to-the-world knowledge-intensive ventures rather negatively.

This is in line with former findings regarding KIE. Prototegou and Karagouni (2012) have found a similar group in the Aegis Project survey which was named "All-around innovators"; its members were distinguished by their balanced emphasis on knowledge seeking activities (both in-house and from external sources), on new-to-market product innovation, and on process *and* administrative innovation.

However, the different periods in the three industries' evolution, the relevant markets and the different competitive environments seem to play a significant role in LT-KIE and the development of DECs and mainly the development of the two dimensions of the transcendental capability; transcendental conditions and transcendental synthesis. In addition, the analysis has indicated that besides human social and economic resources, DECs' development is also related to a variety of environmental trends which are also sector-specific. And more precisely:

- Being a completely non-knowledge-based and extremely fragmented sector, the Greek *W&F industry* enjoyed large markets being quite well protected by imports (at least till the beginning of the new millennium). LT-KIE in W&F industry appeared in a time of prosperity which offered the "luxury" to ambitious and forward looking enntrepreneurs to try for more. Thus, LT-KIE seems to target a strategic will to "restart the (sectoral) cycle" ((Tushman and Anderson, 1986) at least at national borders, mainly by becoming more sophisticated entities within an entirely traditional craft-based sector. **This group seems to favourite the transformation of non-KIE existing firms to KIE ones**.
- *F&B group* seems to develop KIE in order to establish dynamic and innovative export-oriented companies. Entrepreneurs of the group grasp the opportunities of globalization, the advances in other sciences and the technological discontinuities of their own sector to build on knowledge and develop radical innovation. **KIE seems to stem from a new generation of young people with strong educational**

profiles, experience and former -close or not- relations to the industry, who have transcended national and sectoral borders.

- On the other hand, *T&C* KIE regards mainly complete firm reconstructions of already strong and well-established groups which lose power due to globalization, trade liberalization, WTO decisions, the international monetary system and the shift of production to Asia**. KIE seems to be rather a reaction** and DECs are developed in more organized ways in order to interrupt the declining process of the industry. It regards mostly corporate venturing; most of the entrepreneurs were already aware of the role of knowledge but they were mainly adopters than creators untill their shift to knowledge intensiveness. In order to react to sectoral crisis, KIE turns around the creation of new needs and advanced differentiation through complex combinations of NPD, more focused R&D, novel technologies and business models, flexibility, design and customization. **This group's evolution stresses further the importance of sectoral history indicating that path dependencies affect KIE development and performance.**

If we should comment on "space" and opportunities, T&C sector appears to offer the fewest opportunities of all three industries contrary to the F&B sector, while W&F sector stands somewhere in the middle. However, in all cases LT-KIE seems to resist one of the main tenets of how mature industries evolve; i.e. the shift from product innovation to process innovation as the new basis for competition (e.g. Utterback and Abernathy, 1975; Utterback, 1994; Klepper, 1997; Adner and Levinthal, 2001). In most cases product innovation is significant, while sectoral context applies also for the innovation potential. Thus, F&B cases produce mainly product innovation which can be even radical, while both T&C and W&F industries innovate on functional parameters as well as processes and models; yet, they also try to develop some kind of product innovation which is mainly incremental.

Another difference observed regards the markets targeted and accordingly the type of changes entrepreneurs intend to create in order to enter these markets. All examined ventures of all three sectors and especially the strong casess manage to pose significant changes in their ecosystems. However, these changes refer to global relevant business ecosystems for the majority of the strong cases of the F&B and T&C industries, while they are limited within national borders for the W&F group.

This issue has a significant impact on the development of DECs regarding the three axes of product/market/ model triptych. It actually seems to affect all three DECs and their dimensions. For example F&B entrepreneurs get more or less well out of sectoral limits engaging other sciences such as chemistry, biochemistry, biotechnology, environmental and energy engineering, health and wellness science, geoponics, pharmaceutics, etc. This indicates stronger and broader development of the transcendental capability and intense development of bricolage and improvisational capabilities. The entrepreneurs of the other sectors present a more conservative attitude towards trans-sectoral knowledge seeking which is attributed partly to the nature and the context of the specific industries.

The different level of DECs development seems to affect the evolution of the new firms as well. F&B cases present a much more dynamic course and higher performances regarding growth and innovativeness than the other two groups, while new firms starting with strong DECs are not affected by the severe Greec crisis (at least until 2013). Furthermore, F&B cases of moderate DECs seem to be less vulnerable than their counterparts of the other two sectors; they are not seriously affected by the crisis either.

The analysis of the thirty case studies confirmed our hypotheses 2.1, 2.2, 2.3 and 2.4 for all three sectors:

Confirmation of Hypothesis H2.1: DECs appear to have a positive impact on new LT-KI ventures' competitive advantage, affecting the level of changes and challenges that these ventures bring to their business ecosystems. In accordance to our findings:

2.1a: Strong DECs produce strong initial competitive advantages which cause major changes in their business ecosystems

2.1b: Weak DECs produce weak initial competitive advantages which however cause some changes or challenges in their business ecosystems

2.1c: Among DECs, transcendental capabilities are mainly the ones to affect the initial competitive advantages and the changes they cause to new ventures' relative ecosystems in major ways.

However, the level and type of changes seem to differ according to the industry:

W&F new start-ups seek novel niche markets in order to accomplish leadership and appear to achieve it in their majority. Yet, they do not get that much out of sectoral limits and they do not present breakthrough innovation; this seems to constitute a

major characteristic of the group. W&F KIE efforts manage to change or challenge their ecosystems at least at national level and some manage to make the difference worldwide altering the "rules of the game".

All *F&B* ventures managed to pose significant changes in their ecosystem; changes refer to global relevant business ecosystems for companies with strong DECs and at national level for new ventures with moderate ones. This category presents much better performance in almost all parameters than the relevant cases of the other two groups regarding the changed to business ecosystem and innovativeness.

The major purpose of *T&C* KIE venturing is to maintain share in the market or replace existing with new niche markets. KIE corporate venturing is a reaction to sectoral crisis by posing major or minor changes in the ecosystem at national and European level. In contrast to the other two sectors, all new ventures *targeted rather survival* by creating new needs and advanced differentiation though complex combinations of NPD, technologies, flexibility, design and customization. In their past, they were pioneers at national level and among the leaders at global level. Half of them were among the strongest Greek companies in Europe's textile industry. Thus, KIE in T&C sector was related mainly with differentiation in functional parameters and processes. *Strong DECs* allow agents to get out of the strict national and sectoral limits, cause changes to the existing (by the time of venturing) business ecosystems and create novelty all along the three axes (technology-market-business model). They are all cases of corporate venturing; two targeting radical internal renewal and one spin-off and all targeting new markets.

This indicates that sectoral context matters and therefore, that the level of DECs' development has quite different impact on ventures in relation to the low-tech sector they belong to.

Confirmation of Hypotheses 2.2 and 2.3: New knowledge-intensive low-tech ventures with DECs are more likely to survive and grow

2.2-2.3a: Strong DECs have a positive impact on survival and growth

2.2-2.3b: Weak DECs have a negative impact on survival and growth

Once again we observe that sectoral context matters since F&B industry presents much better performance regarding survival and growth. Major differences are the following:

a) F&B ventures of moderate DECs are not necessarily lagging behind ventures of strong DECs in economic indicators (as in the case of the other two industries)
b) F&B ventures of moderate DECs were not affected by the severe crisis while two out of 3 relevant W&F ventures did and most of the T&C cases did, with not a single one to avoid turnover decrease.
c) Food ventures with weak DECs are less sensitive to the severe crisis than the ones of the other two sectors. They were affected mainly in 2011 and 2012 but "death" is not yet a threat. On the contrary, survival is questioned for W&F companies of weak DECs while a major impact of the crisis can be detected in almost all companies with moderate or weak DECs of the two sectors in 2011 to 2013.
d) There are no cases of brand new ventures besides TCo10[323] and none with an entrepreneur not relevant to the industry. That can be attributed to the fact that according to our knowledge there were hardly any (really) new ventures established after 2000 and according to experts' sayings and our personal research none knowledge-intensive.
e) ***Strong DECs*** allowed F&B agents to present increasing sales until 2012, contrasting T&C agents (at least till 2006) and W&F ones (at least till 2012). The same regards the rates of innovation and NPD performance.

It appears that not only the secotr but its course as well has a significant impact on the survival and growth of knowledge-intensive low-tech ventures.

Confirmation of Hypothesis 2.4: New knowledge-intensive low-tech ventures with DECs are more likely to innovate. Actually, DECs curve the innovative behavior of the new company.

2.4a: Strong DECs have a positive impact on innovative performance both at start-up stage as well as later

[323] Even TCo3 can be considered a spin-off joint venture of TCo1's parent company and TCo7. However it is a new venture.

2.4b: Weak DECs have a negative impact on innovative performance, especially after the initial innovation

Commenting on the innovativeness, in W&F sector almost all following innovations turn around the initial novel concept. Business scope innovations refer to year-to-year investments in technology, R&D, experimentation and new product and market developments. Organizational innovations turn around processes and process improvements activities, business models and firm structure.

On the other hand, in the other two sectors, there appears to be a differentiation of follow-up innovations which seems to depend on the quality of DECs' development. Accordingly, all companies with strong DECs produce various types of innovation such as by-products of R&D exploitation, marketing innovation and even new niche markets. However, ventures with moderate or weak DECs rest again in innovation efforts around the initial novel concept.

A main characteristic of the strong-DEC group in both industries is that novelties do not constitute answers to needs; instead, they are new ways to gain space and share mainly in existing European markets and the virgin (for their products) Greek market.

Especially the food-case ventures present a densification of innovative activity over the years, enriching their internal or external approaches to innovation and knowledge management. NPD is considered the best mechanism for gaining competitive advantage, since the-time-to market for new ideas is set to fall significantly. This is further used as the best appropriability method. This seems also to be a major characteristic of knowledge-intensive low-tech sectors, since even the food and drinks industry appears resistant to external sources of innovation (Hardy, 2009).

A difference between the F&B and T&C industries is the fact that, even the breakthrough innovation cases, such as the patented products of TCo6 (which are supported by significant R&D expenditures), the innovations cannot alter the relative business ecologies since they just add special projects in existing markets with many other innovative ones.

All thirty knowledge-intensive cases developed DECs in order to produce innovation, differentiate and shape strong initial competitive advantage in order to enter already saturated markets. All cases with strong DECs managed to pose changes to the rules of their competitive environment at sectoral, national or even global level, due to innovative products, processes, or novel models. They reaped the benefits of the firs-

mover advantage in accordance with literature (e.g. Urban et al., 1986) while they tried to secure it. T&C and F&B cases seem to emphasize intellectual property protection more than the W&F group; secrecy, use of trademarks and lead-time advantage on competitors are mostly used but several cases present patents as well. All ventures based on strong DECs presented a significant growth in sales and degree of innovativeness, while they were not seriously affected by the severe crisis.

Another interesting finding was the variation of post-entry performance of the new ventures across the three sectors. Actually, the growth rates of new firms tend to be above average and higher than the ones of the corporate ventures. This was particularly evident in the F&B industry which seems to be the most dynamic of the three groups. This is in accordance with general relevant literature (e.g. Evans, 1987a, 1987b; Hall, 1987; Dunne et al., 1989). According to Storey (1996) fast growth is related primarily to small firms that can develop significantly in terms of percentage change across one or more dimensions because of their small size at the outset. Fast growth is mainly due to the fact that firms have to reach a size that enables them to exist in the market (e.g. Carizzoza, 2007; Hall, 1987; Dunne et al., 1989; Gilbert, McDougall, & Audretsch, 2006). The findings indicated that this critical size varies from sector to sector reflecting heterogenous needs for DECs' development. Even though there is some ambiguity in the studies linking growth and survival to firm size and growth, Audretsch et al. (2006) argues that both European and North American younger and smaller enterprises present higher growth rates especially in knowledge-intensive industries and that such variations of critical sizes are present indicating certain other variations too (Carizzosa, 2007).

Some of the cases could be even characterized as high-growth cases or gazelles. According to existing literature they are industry innovators, initiate competitive actions and found in every industry (Nicholls-Nixon, 2005; Upton, Teal and Felan, 2001). Notwithstanding, among these cases, some presented uneven growth trajectories, that is, highs and lows, downturns, and recoveries but this is quite common even in high-tech industries (OECD, 2002; Tan and Smyrnios, 2005). In any case, fast growth is regarded as an indicator of market acceptance and therefore new venture's success.

The analysis indicated certain similarities among the cases of all sectors which were discussed in more details in the relevant sections such as:

- family or personal background and new venture creation: FCo1, FCo9, WCo1, WCo8
- professional experience and focus on well-educated human capital FCo5, FCo6, FCo8, FCo10, WCo2, FCo9, FCo10, TCo4, TCo7, TCo8
- Excellency without a strong technology-based educational background: WCo2, WCo10, TCo7, FCo8
- Irrelevant or non-existent studies and no former experience- features of poor DECs' development: FCo3, TCo3, WCo5 and WCo7

Since we refer to the set-up of new businesses, we should also mention that location of them is also an issue of decision making affected by sectoral context. Actually eight out of ten W&F cases are located in the area the entrepreneurs were born coinciding with their sayings that location does not affect the venture's performance. On the other hand only four out of the ten F&B cases are located in the place where the agents used to live. This is mainly due to several reasons such as the existence of raw materials (FCo6, FCo8, FCo10), the existence of basic facilities (FCo5), proximity to big urban areas (FCo4) or even subsidy reasons (FCo9, FCo10). The findings coincide with the interviews' data and the opinion of the agents too. Seven out of the ten T&C cases are located in the places where the entrepreneurs live, although it is generally known that textiles' firms need to be close to raw material and abundant water and clothing industries close to big urban areas and to transport media and places with good accessibility in general. Actually, the cases that did not choose another place for set up regard entrepreneurs whose place of origins satisfies all above criteria and therefore did not have to move.

This is in line with literature. Michelacci and Silva (2007) found that the fraction of entrepreneurs who set up their businesses in the area where they were born was significantly high. Dahl and Sorenson (2011) found that companies perform better, survive longer and generate higher profits when located in regions in which their founders have lived longer, this effect being similar in size to that associated to previous experience in the same sector.

Of particular interest here is the fact that although knowledge-intensive, no case chose to be located near knowledge sources although in some cases there were complaints about the lack or relevant institute centers in the region. This is quite normal since no cases were set-up by scientists; the relevant and quite long research has showed that such type of proximity happens mainly in cases of set-ups by prior employees of the knowledge-producing organizations (Stam and Garnsey, 2008) who commercialize inventions.

It should be once again mentioned that all cases have differentiated to a large extent than the sectoral average; in all three industries innovativeness and NPD are rare or refer to minor changes, new (imitative) design, conventional IT applications and similar actions. Furthermore, almost at a 100%, low-tech non-KI firms do not risk exports or develop DCs or other routines of strategic management. The examined cases were chosen among the ones that serve a minimum basis of knowledge – intensive tendencies and cultures.

8.2. d) Epilogue to the first research objective

In 2007, Teece stated for high-tech multinationals: *"Improving quality, controlling costs, lowering inventories, and adopting best practices ('technical fitness') will no longer suffice for long-run competitive success. Nor do traditional scale economies in production always have the differentiating power they may once have had. More than scale and scope, advantage is needed"* (Teece, 2007, p 1346*).* His arguments match even more the low-tech industries and more precisely new low tech ventures.

In regard of the mature and saturated business ecosystems, exposed to the aggressive attack and plethora of low-cost products and services, **the proposed dynamic entrepreneurial capabilities framework** highlights entrepreneurial and strategic competencies that can enable low-tech but knowledge-intensive newcomers to create significant initial competitive advantage, survive and grow. Perhaps the major contribution of the study regards DECs operationalization as it provides a multidimensional measure of DECs, indicating that they are more than just vague and fuzzy abstractions guided only by human talent and intuition. As discussed in detail above, the three capabilities are closely interrelated as the transcendental capability actually drives the other two, while improvisational and bricolage capabilities are utilized quite simultaneously.

Low-tech entrepreneurs need to shape the future by the opening of new niche markets, the creation of new needs and the enhancement of value of the existing ones. Our cases indicated that sometimes, low-tech KI entrepreneurs have changed or even have set new "rules of the game" at national, European and global level. In all cases it is quite clear that innovation alone cannot offer leadership or even secure survival, since it regards mainly mature products. It has to further create new needs and novel markets, sometimes to reinvent the relevant ecosystem and underline the new venture's uniqueness.

The suggested framework answers the fist two guinding questions of the thesis by integrating and synthesizing concepts and research findings from the fields of entrepreneurship, knowledge-intensive entrepreneurship, strategic management and the specific area of dynamic capabilities, the innovation studies, the low-tech exploration stream of literature and elsewhere, in combination with the exploration of the thirsty case studies derived by three low-tech industries.

The accidental existence of "couples" of ventures that started from the creation of the same vague and general idea and developed it in extremely different ways seems to be a significant indicator that DECs framework is not entrepreneur-specific but more general and flexible, and can be applied in a wide variety of cases. For example, both FCo1 and FCo10 share the same view of the *lost value of Greek agricultural products* and the need to turn to innovativeness. Still, they have chosen diametrically different ways to shape their business concept.

8.3. The role of production technologies and relation to DECs

Retaining our essential definition of the entrepreneurial process as "the process that takes place between the intention to start a business and making the first sale" (e.g.Newbert, 2005), the next research question regarded the transformation of the LT-KI business idea into production lines and products.

The analysis of all thirty cases indicated the significant importance of production technologies for LT-KIE verifying the first part of the 4th hypothesis. According to the findings, the establishment of all new ventures was tightly connected to new machinery and equipment. After the commitment to physical creation, entrepreneurs garnered resources towards technology set-up to find the best way of transforming the innovative concept into products or processes at an industrial scale.

The analysis confirmed that traditional, so-called low-tech sectors can be intensive in their use of even scientific knowledge; industries such as food production, textiles and wood products seem to have significant indirect science inputs. However, the depth and complexity of the required knowledge bases are linked to a combination of complex, formal or informal, direct or indirect links mainly with supplier companies and then with universities, research institutes and consultants. In many occasions, these are further related to in-house R&D performance or common research projects. In almost all cases, interviews revealed a constant bidirectional knowledge flow of both embodied and disembodied knowledge through skilled personnel, plant and equipment designs and descriptions, and sometimes mentioned consulting and training activities. Knowledge flows were observed in activities such as the design of machinery, co-development or customization, mutual experimenting, erection works and trial production. Many times users decided even to produce their own complex machinery in-house. Knowledge was incorporated into machinery, equipment, methods, techniques and production processes components and materials.

Thus, in all cases, traditional reliance of suppliers of machinery is being overtaken by active co-development projects and a shift to needs for technologies from advanced instrumentation such as lasers, electronics and computing, eco-technology, pharmaceuticals and smart materials supplied by high-tech firms.

The analysis actually seems to challenge the established opinion of common entrepreneurial processes in low-tech sectors according to which low-tech firms follow well trodden paths, complying with market and manufacturing *status quo*; i.e. they act as "technology borrowers" using existing technologies to satisfy and penetrate existing markets, seeking advantages in low prices, productivity increase, and better delivery terms. In almost all cases appropriate production technologies assist the integration of competitive advantages. Traditional machine manufacturers are now asked to design special machinery to suit customer needs acting more as partners than mere technology providers. Besides the very fact that activities such as the installation and preparation of equipment and trial production are knowledge generating activities, KI-LT entrepreneurs have more active roles in the usually long-term, iterative nature of the machine production process, i.e. all three phases of design, installation and debugging modification in regular operation. Sometimes, they even take the risk for in-built machinery and own technology development. Therefore,

machine manufacturers seem to constitute the most important knowledge sources regarding production technologies followed by ICT, electric and electronic equipment providers but with LT-KI entrepreneurs to hold active roles in innovation. Actually, it appears that production technologies provide rather strong links between low-tech and high – tech sectors.

A common attitude of all three sectoral groups is the inclusion of local and national manufacturers, machine shops, ICT and automation firms during installation for several purposes as narrated above. Close relations to the developers and manufacturers of production technologies are crucial for LT-KI industries. This holds better, particularly if technical equipment is custom designed, or if at least certain components and functions are adapted to the particular user needs. However, it should be mentioned that the dependence on suppliers of any kind can be a constraint for LT-KIE for countries with small markets, since firms may have limited leverage on the cost of the equipment, and may even have limited choice among suppliers willing to provide the desired level of service. These factors can make production technology development and upgrades, as well as significant process changes even more daunting when combined with the usual cost, time, and disruption factors.

Furthermore, ***appropriability regarding innovative machinery*** is not deemed important in any of the three sectors.

Repeated patterns let for the observation of a number of differences among the three sectoral groups, which appear to be related to the dynamism and the stage of the industry at national or international level. Thus,

- while ***reciprocal relationships between product and process innovation*** are evident in all cases, F&B sector is the most product-oriented and T&C industry is the most process-oriented attempting mostly a complete recosntruction. W&F sector seems to stand in the middle; process innovations target mainly to novel products development and *vice versa* innovative products require new processs technologies. However, product innovation is the main focus of all, followed by process innovation, service innovations and to a much lower degree organizational or business model innovations These findings are in line with relevant studies (e.g. IMP³rove II Study, 2011[324]).

[324] The study builds upon a large benchmarking dataset on SMEs from different countries, age and size classes. It covers nearly 1500 validated datasets which were collected between spring 2007 and spring 2011

- ***suppliers of raw and intermediate products*** appear to be of great importance for W&F and T&C groups. On the contrary they are rather indifferent in F&B cases where besides machine makers, there seems to be a dominance of the packaging industry in almost all innovative efforts.
- ***In-built machinery*** appears mainly in the F&B sector, while co-development and customization seem to be of the same importance for all three sectors.
- W&F cases ***invest in production technology innovation*** as a means to keep leadership usually within national borders and create sub-niches in oder to secure a position within their saturated markets. On the other hand, F&B cases regard production technology innovation as the media to present product innovation and become leaders in niche markets at global level. Interestingly enough, there is no case with products as initial innovations for the T&C group; all cases target processes or a total restructuring of the existing business models with production technologies to hold a key role and sometimes to produce novel products as well. Thus, besides the production of new products, production technologies seem to target different aims within KIE for the three sectoral groups.
- The F&B group presented **the highest potential of trans-sectoral knowledge combinations**. Besides the variety of food-and-plant – science related areas, entrepreneurs extended to completely different sciences and technologies such as biotechnology, chemistry, biochemistry, environmental engineering and packaging technology. Science was less involved in the other two sectors.
- All three sectoral groups present a low degree of coopearation with academia. However, T&C sector presents no tendency for such co-operations, W&F cases go on with a rather timid interest while F&B cases show a rather dynamic *crescedo* in attempting common research with various Univeristy Departments.
- Benchmarking of best practices and technologies regarding machinery and technology are evident in all three groups. Yet, it is quite interesting to observe that it is related mainly to cases of strong or at least moderate DECs.

We should also notice that export-oriented regimes seem to foster efforts to excel in the development of production technologies targeting at mainly innovativeness (all F&B cases and many cases of the W&F sector), as well as the reduction of production costs (mainly T&C cases), high quality achievement (almost all cases), and often even

the reduction of dependence on (expensive) imported technology (indicatively WCo1, FCo4 and FCo7).

A common problem or "disturbance" in all cases regards the issue of distance among machine and technology developers and LT-KI entrepreneurs. This fact can constitute a constraint in LT-KIE, for countries with small markets like Greece. New ventures and especially the nascent cases, may have limited leverage on the cost of the equipment, and may even have limited choice among suppliers willing to provide the desired level of service. It can be suggested that bricolage capabilities solve partly this problem by combining resources of different places (we remind the case of WCo1 where resources were extremely limited) to co-develop machinery and technology or even create their own machinery assisted by local manufacturing companies and machine shops. Insisting a little bit further on the in-built issue, such activities create a demand for more knowledge in order to keep control over the self-made machinery; indicatively, in such cases, new firms have to prepare their own manuals, define maintenance and find solutions to malfunctions.

However, we should also mention that in cases of research and development on manufacturing processes and relevant machinery distances gete shorter; telephone, fax and computer network links for information flows, plus air, automobile and truck links for transportation of advisory, training and service personnel (as well as for delivery of replacement parts) may offer a reasonable substitute for spatial proximity. Such solutions have been narrated in TCo4, TCo6, WCo2, FCo6 and other cases. These were of course cases where the entrepreneurs represented large and important sources of demand for the machine producing firms (just remind the sayings of FCo9's entrepreneur); therefore producers had strong incentives to interact effectively with the users, even over long intervening distances (remember again the big teams that represented the machine makers in the cases of TCo6 and WCo2).

Another worth-mentioning issue concerns the technology understanding of the entrepreneurs which was referred in all three sectors as a crucial element for the development of production technologies. This has been described as experience in the form of personal involvement and touch, a significant LT-KI entrepreneurial trait in the relevant chapter. The accumulated knowledge and experience of the entrepreneur(s) affects positively the choice and successful installation of the

production technologies needed to realize their innovative ideas. Competent and demanding actors induce producers more strongly to generate innovative machinery and equipment or design processes. Experience and deep involvement in industry activities are core factors for more demanding and sophisticated co-operations on production technology arrangements. As suggested, a major token of experience is business contacts and a strong capability to built new ones, all in order to combine technology and methods and "play" safely by interacting among multiple sectors (e.g. FCo5, WCo8). Such capabilities of entrepreneurs and managers stretch even to administrative duties for the production installation and the subsequent project management in terms of self managing in micro and small companies and as a media of exercising control and arrange the integrated vision and concept realization in bigger organizations. According to our observations, all cases actually bared the personal touch of the entrepreneurs; the scientific direction of FCo5 was due to the main actor's personal interests. FCo6 and WCo2 were the dreams if their "creators". TCo4's entrepreneur admitted that it was his own obsession for cutting edge technology that drove the company into this direction. Diehard green, the businessmen of WCo10, FCo10 and TCo6 have pushed the boundaries of innovation towards relevant directions and leaving their mark on products and processes. They all refused limitations by an open attitude towards technical, scientific and other communities and creativity combined with unconventional ways of their ideas' realization. Technological knowledge later becomes embedded in documents or repositories, organizational routines, processes, practices, and norms. Technology-flows need to be properly managed in order to produce desired results in operations floor and translate them into viable competitive advantage.

Resources (financial, human etc) appear again to play a significant role in the development of production technologies in all three sectors; they make networking easier, facilitate technology research and robust knowledge combination in achieving advanced technological results. Almost all corporate cases revealed an easiness and comfort in attracting world's leading machine makers or in contacting academia departments.

Furthermore, the analysis verified the second part of the 4th hypothesis; i.e. our suggestion on the relation between production technologies and the dynamic entrepreneurial capabilities; DECs are actually the capabilities that offer to

entrepreneurs the potential to build up operational and technological capabilities by seeking, acquiring and creatively combining knowledge and tradable resources. In some cases, the novel and knowledge-based production technologies constituted the core technological capabilities of the new firms such as in the cases of WCo2, FCo6 and TCo1. This is in line with relevant literature on technological capabilities (see for example Leonard-Barton, 1995; Maritan and Peteraf, 2011).

Bricolage capabilities appear to be significant for all sectors regarding the trans-sectoral comparison. However, their development is differentiated on the basis of technological and science knowledge seeking activities, relevant assets and performance. Thus, F&B sector seems to have far more broader repertoire building and stronger and more CCN, transcending sectoral and national limits. In direct contrast, T&C cases stay caged in their initial network pool although they are very good at developing collaborations. They transcend national but not sectoral limits.

Among the sub-dimensions of bricolage capability, networking is deemed significant for facilitating access to strands of technology that are alien to firms such as R&D on bio-functional food, use of innovative fibers in fabric production, innovative dyeing processes or patented processes of innovative material production (such as WPC). It appears in the forms of exclusive partnerships and co-development contracts for the purpose of creating value. New firms start with informal networking based on personal contacts and former relationships, developing flexible types of co-operations. Established companies use more formal ways of networking.

Entrepreneurs seem to create great value by assembling particular constellations of technology or science based knowledge assets to develop novel production technologies and produce highly differentiated and innovative goods and services that customers want. This process of identifying, assembling, and orchestrating constellations of sometimes seemingly complementary or irrelevant assets appears to be a fundamental function of LT-KIE.

Repertoire building regarding the technological dimension of the LT-KI business concept follows the same patterns as observed in the relevant section. Interactive learning appears quite strong in all cases of strong and moderate DECs of all three sectors. It is also evident that knowledge is also accumulated through experience in production and use on what has come to be known as ‘learning by doing’ and

'learning by using' (e.g. Pavitt, 1987). On the other side, all weak DEC-cases present certain weaknesses regarding learning as well as in adding knowledge further.

It should be also mentioned that, in contrast to conventional low-tech entrepreneurship, LT-KIE presupposes also the capability of keeping control over all in-built innovation. Autonomy due to in-built or extremely modified machinery is leveraged by the imperative need to document the new arrangement's functioning (for example with preparation of manuals) and structure (for maintenance and repair reasons); this requires extended knowledge on certain areas – different at sectoral and most times at individual level as well; manuals**,** training, standardized user interfaces and other elements should be developed in order to allow the integration of the arrangement into the working environments. If the above are neglected, only those who have participated in the creation of the novel machinery or equipment would know how to operate it.

Improvisational capabilities allowed modifications, novelties and new insights, tangling scientific with practical knowledge and mixing bricolage with new resources of all kinds. Such deviations have led to innovative machinery or improvements and modifications some of which are adapted by the machine manufacturers, complementary equipment and new equipment to solve arising problems when using the new machinery for real production or to new emerging requirements of customers or the market. They appear quite weak in the T&C industry but this is mainly attributed to the fact that almost all cases are cases of corporate venturing; parent companies were all well-organized with well developed dynamic capabilities and other routines and processes.

Real time information was sometimes formal like a business contact in a trade show that is translated to a modern plant in Greece, such as in the cases of WCo8 and WCo9 or informal (a personal contact with professors which can lead to innovative products or processes – e.g. the case of FCo5) or a combination of both (e.g. TCo8 and TCo9). All cases presented significant persistence on remodeling by try & error and fixing processes, sometimes engaging even customers in testing. New technological developments built upon past experiences of production and innovation and proceeded through sequences of specific problem solving junctures. However,

flexibility was more evident in the nascent cases and small parent companies in cases of corporate KIE.

Transcendental capabilities guide and direct again the other two DECs. Transcendental conditions allow for a wider search for partners for production technologies development and stronger focus on the relevant emerging problems. Many times they define the framework of cooperation with the visionary to be the leader and not the follower of the technology provision project. That allows for bolder experimentation and closer cooperation which are both enhanced where mutual benefits are expected. Transcendental synthesis seems to affect the "boldness" of the technology development. Reasons of low spontaneity (almost all weak cases) or high teleology (e.g. TCo4) appeared to hinder creativity. Actually, transcendental synthesis appears weaker in the T&C sector. This has to do with the observed teleology as well as the core rigidities caused by the former dependence of parent companies from machine and technology providers; a culture not easily abandoned since it had supported success for many years.

Therefore, **DECs seem to support and enhance the value-creating development of manufacturing technologies and consequently, the development of the new LT-KI ventures' technological capabilities**; these, in turn, focus on efforts to "make effective use of technological knowledge in production, investment and innovation (Westphal, Kim and Dahlman, 1985, p. 171)", supporting the new firm's survival, growth and innovative performance.

The relevant section analyzed in more detail the role of production technologies in LT-KIE and the impact of DECs on their development. The analysis has proved that new LT-KI ventures require explicit technological capabilities almost from the entanglement of the areas of research and product development to physical creation; this includes investment in production technologies, in order to identify, prepare, design, set up and commission a new idea to industrial entity. Having developed DECs and building technological competencies, the new LT-KI firms can form systems and processes that will allow them to engage in shared problem-solving (embedding the relevant DEC dimension), implement and develop novelties, and import and absorb technological knowledge from outside the firm (e.g. Leonard-

Barton, 1995; Protogerou et al., 2011). In other words, LT-KIE is built in a co-evolutionary process with technical capacity.

However, technical change and innovation do not take place in isolation as often stated in low-tech literature; it is only possible within effective networks, where the new LT-KI entrepreneurs will be actively involved; this can be achieved with DECs' development. As discussed, the impact of DECs on production technologies as well as the impact of production technologies on LT-KIE is not sector–specific. However, the range and level of development and application can be affected by the maturity and the national and global condition of the sector.

Furthermore, the findings provide empirical evidence of the links between DECs and operational capabilities supporting our definition of DECs as higher-order capabilities. The delineation of their impact on production technologies suggests a shift in both entrepreneurial and strategic perspectives. Production technologies have been defined as "basic capabilities" and therefore operational or second-order ones (e.g. Bell and Pavitt, 1993; Lall, 1992; Protogerou et al., 2011). Therefore, at the stage of venturing they are geared towards the operational functioning of the firm, including staff and line activities such as the arrangements for products and production processes. However, these are enabled through DECs which lead, for example, to the creation of the production technologies, the processes and the necessary human capital (or complete modifications towards new directions in some of LT-KIE corporate cases). The suggested links among entrepreneurial dynamic capabilities and operational capabilities highlight the need to **go beyond individual-centered explanations of entrepreneurial activities** towards the formation of integrated capabilities which can be built and sustained due to pre-existing resources (ranking from personal traits and experience to physical ones) and impact operational level as well, shaping new venture's course and performance.

The verification of the 4th hypothesis strengthens the suggestion that DECs are not vague abstractions used to explain success and failure in low-tech knowledge-intensive new ventures; instead they are very specific, can be managed, act as a catalyst and endue new ventures with technological capabilities, as they relate to product and management development.

Shane (2003) analyzed entrepreneurship as a process of discovering opportunities. But as Zahra (2008) stated "Opportunities discovered or created by entrepreneurs often fall well beyond management's thinking and strategic vision". We have assumed that opportunities are created through the exercise of bricolage, improvisational and transcedental dynamic capabilities. When referring to the technological direction of a business idea realization, LT-KI entrepreneurs should recognize technological patterns connecting seemingly unrelated science and technologies, through bricolage and improvisational capabilities in order to realize the *a priori schemata* of novel business concepts. That means that the ability to relate technologies and processes to concepts and form relevant strategic priorities is not self-evident. A major problem among scientists is the inability to connect science or technology to mass production and firm performance (Krabel et al.,2009).

Bricolage, improvisation and transcendental capability are not idiosyncratic traits, talents and "gifts". Intentional and organized cultivation of DECs supports competitive new LT-KI venture creation through changing the existing, or creating new business ecosystems, and sustainable development of both operational and dynamic capabilities.

8.4 The DEC-DC relation and new LT-KI firm's sustainability

As it has been many times pointed out, low-tech industries are facing different environments and challenges than they had faced some decades ago. In this respect creating new market segments is a crucial strategy for new entrants or for the sustainability of established firms (Kastelli and Caloghirou, 2012). Actually, LT-KI companies appear to develop DCs in order to sustain leadership and their competitive advantages in their new KIE-based business ecosystem (Protogerou and Karagouni, 2012). It seems that the KIE era for low-tech industries emerged with the new millennium; LT-KI firms start creating the new low-tech but more sophisticated markets which seem to advance in quite significant paces. The examined LT-KI cases appear to be extrovert in terms of the mechanisms they use to collect new knowledge and information; perhaps they have the potential to identify more rapidly new product development opportunities compared to conventional firms which rely mainly on technical skills and relevant rather practical competencies as their own resources and are actually trapped in their introversion. LT-KIE then is characterized by a more

intensive networking activity perhaps because of the firms' capability to be effective in external knowledge-seeking and creative knowledge combination. In contrast to conventional firms, knowledge-intensive ones use technology and even science partners as sources of knowledge, they are innovative and sometimes they use even intellectual property protection methods.

It is reminded that the exploration of DCs concept was not intended at the outset of the present research. However, extant discussions with entrepreneurs and the analysis of the transcripts indicated that DCs are present ever since the very first years of the most new LT-KI entities (new-to-the-world or corporate venturing). In all thirty cases, DCs were traced as a natural follow up of DECs to secure viability and growth. Whereas it is rather difficult to specify the transition point from one stage (DECs) to the next (DCs) with precision, as Helfat and Peteraf (2003) clearly state, DCs appear rather informal and loosely structured in its beginning, bearing the personal touch of the entrepreneur/entrepreneurial team. This is in line with theory; in the words of population ecologists (e.g. Hannan & Freeman, 1984), the structure of the new venture is not reproducible because it does not include highly standardized organizational routines.

Summarizing the observed KIE-DCs, ***technological sensing, NPD, networking and collaboration*** capabilities appear to be the most significant entailing processes to acquire knowledge and understand technology developments in a variety of industrial sectors and relevant scientific fields for all three sectors examined.

NPD seems to stem from a combination of transcendental and improvisational capability; certain dimensions regarding trans-sectoral knowledge, such as sense of spaciousness, receptivity and judgment, experimental culture and learning are then embedded in processes, leading to innovation and adaptation to the market for all cases except the ones starting with weak DECs. These firms seem to stay caged in problem-solving with mere improvements and product line extensions (WC5, FC2). Depending on the type of competitive advantage that they want to develop, firms invest in R&D or open innovation and co-operation. Research revealed significant **sectoral differences** in the way firms approach technology sensing and NPD. Food companies usually establish well organized R&D departments (8 firms out of 10), followed by established large textiles companies (4 out of 10) and develop strong linkages with academic and other research institutes. On the other hand, most wood

and furniture and T&C firms invest in design (whether creative or imitative) and build information and knowledge diffusion networks.

However, quite interestingly, the NPD intensity is not directly reflected in the firms' sales performances. Actually, initial innovations of the cases seem to pay back around the third year of entering the market[325]. The cases of weak DCs do not present such peaks in sales, confirming further the fact that NPD and innovation do not follow the same patterns of the other cases with strong DCs.

Another observation is that ***sensing*** seems to be tightly related to the dimensions of NPD capabilities. This is due to the fact that shorter product life cycles and the aggressiveness of global markets intensify strategies of all types of companies towards translating market messages into new products ready to entice customers. Both DCs entail processes to acquire knowledge and understand market and technology shifts and developments in a variety of industrial sectors and relevant scientific fields for all three sectors examined.

A common feature of all sectors is the high importance of networking and collaborations in supporting or supplying R&D as well as for the development of sensing capabilities.

Networking is deemed important for facilitating access to strands of technology that are alien to firms such as R&D on bio-functional food, use of innovative fibers in fabric production, innovative dyeing processes or patented processes of innovative material production (e.g. WPC), stretch to new markets, excel in design or develop new business models (especially in apparel section). It seems to be a pure continuation of bricolage capability embedding real-time information flow of improvisational capability in relevant mechanisms such as collecting information and managing production and exports. CCN appears in the forms of joint projects and collaboration with academia, research institutes and suppliers, exclusive partnerships and contracts, transcending national or sectoral borders. In the cases of new venturing, initial informal networking based on personal contacts and former relationships becomes more organized and formal.

Collaborations appear in the forms of joint ventures, exclusive partnerships and contracts for the purpose of creating value. New firms start with informal networking

[325] This conclusion is derived by the significant sales increase in these years and the narrations of the interviewees for the majority of the cases.

based on personal contacts and former relationships, developing flexible types of co-operations. Established companies use more formal ways of networking. Collaborations seem to assist new firms in gaining knowledge to develop the capabilities needed for NPD and innovation, while it is important for design, R&D projects, novel scientific and technological knowledge, manufacturing, and even technical services in all cases.

Market sensing ranges from simple methods to watch trends such as internet and visits to relevant fairs to more advanced monitoring of consumer changing needs and shifts in markets as well as customer feedback and the capturing of new opportunities. Together with the technology sensing, it may be considered as stemming from the dimensions of repertoire building and interactive learning which turn to relevant organized processes and routines for observing markets, science and technologies through information collection and filtering mechanisms. FC9's CEO admitted that initial problem-making and the capabilities they had developed to cope with difficulties of technical and marketing nature soon turned to fast-response mechanisms and new knowledge-hunting processes. Repertoire building was further embedded in mechanisms and processes of scanning international trends and demand changes (FC4, WC9). On the contrary, our findings indicate that firms with weak DECs are rather unable to translate feedback or respond to challenges and exploit market and technology opportunities.

Seizing regards mainly selection of the physical technologies and tailor made solutions for customers (which seems to be a significant competitive advantage in all three low-tech industries). In T&C sector, it further regards re-designing of the business model which also appears in the cases of FCo10 and WCo10. Nascent companies are striving to earn and keep a piece of the pie by creating or entering markets investing on and developing both market sensing and NPD capabilities. On the other hand, ***reconfiguration capabilities*** are mainly evident in some of the cases of corporate venturing.

The analysis indicated that although DECs entail intent and are in their majority human-centric, their dimensions can be embedded quite soon in routines and processes, even if they are not initially fixed and formal. According to Barney (1986a) the characteristic flexibility of a venture fosters a culture that is both imperfectly

imitable and uniquely suited to the strategic deployment of resources; this may be translated in embeddingthis culture in processes, necessary to achieve success. In accordance with the above and the findings, all companies with strong DECs developed strong DCs as well, presenting growth within their mature business ecosystems and resistance in the present severe Greek economic crisis.

Actually, DCs of the first years appear to depend on a combination of the industry they belong *(sector-specific)* and the type of the venture *(new or corporate)*. More precisely:

Most F&B LT-KI cases are new-to-the-world firms and seem to curve the industry's course at global level, transcending sectoral and national borders. Their DCs serve quite the same target as DECs; they are developed to respond to fast technological and scientific advances, changing market structures and intense global competition with sustainable competitive advantages. T&C cases are mostly established companies which try to respond to fierce market competition in an extremely high unpredictable and ambiguous mature environment due to globalization and trade liberalization. They particularly develop strong strategic competitive response DCs focusing on learning capability to attain strategic renewal and address the shifting environmental requirements of the last decade after the China's accession to the WTO. While these two groups target mainly global markets, both new and established W&F ventures seem to refer mainly to the national market and develop DCs in an effort to differentiate at least within national boarders, to catch up mainly with globalization and confront crisis; once again DCs appear to follow the paths curved by DECs. For example, networking and collaborations do not seem to be very popular among W&F firms in general but neither is the bricolage capability. This can be attributed to their rather limited social capital, their introversion and even the nature of the product in relation to the high potential of the domestic market up to 2007.

According to findings, firms with high levels of DECs and DCs seem to manage to respond successfully to global changes and advances in their environment as well as the ongoing Greek crisis. Going back to the section and in accordance with the relevant tables we can assume that sensing, collaborations and networking affect significantly exports and employee growth; the cases with such strong capabilities are the only ones with significant exports and the biggest employee growth (see Table

4.1a). Furthermore, the cases with all DCs strong present the best performances regarding mean sales percentage since establishment and innovativeness.

As seen in the relevant section, the knowledge intensive low-tech companies of the research generate different kinds of innovations. Actually, all firms appear to develop innovativeness in order to maintain leadership in their new niche markets and DCs seem to play a significant role; F&B cases with strong DCs present radical innovation at global level, while the relevant textile and wood cases build on disruptive but not that radical innovation. Furthermore, companies with all DCs strong present an aggressive production of novelties with an increasing R&D intensity. Cases with mainly moderate DCs develop incremental innovations. Companies of weak DECs and subsequent weak DCs did not manage to produce novelty besides the initial innovation, resting in mere improvements.

Therefore, we can assume that companies present different approaches to DC development and context, depending on the sectoral history and evolution, the range of the scope, specific sectoral pressures and the national and global socio-economic environment. On a second level, more firm-based parameters were observed, such as targeted markets and choices.

Differences were also traced among nascent and corporate LT-KIE. New firms are mainly micro or small companies. In accordance with Stam et al. (2007), attempts to sustain and renew capabilities do not at first take the form of routines, but of trial and error efforts, for instance at R&D and alliances. Younger firms produce more radical innovations but have a weaker or rather one-sided portfolio of dynamic capabilities. They develop strong sensing and seizing capabilities but they seem to lag behind in reconfiguration. This can be attributed to their short life, their size and the focus on the exploitation of initial resources and opportunities. New firms' growth appears to depend on their networks, initial resources and knowledge management where the founder-managers' prior knowledge base and capabilities play a significant role. ***Sectoral context*** is also very important when referring to new firms and internationalization. Three out of ten start-ups in the F&B sector strategically chose to start from foreign markets and then decide whether to turn to Greek market as well. On the other hand, exporting is very limited in the wood and furniture sector, while it is mainly a privilege of the older and well established firms of the T&C sector.

Corporate LT-KIE refers to usually medium or large established companies. Most of them present well developed and organized dynamic capabilities before KI-venturing. Reconfiguration capabilities appear mainly in the T&C cases; they are strong in order to address markets which are very volatile due to globalization and trade liberalization. They particularly focus on learning capability in order to attain strategic renewal and identify new production opportunities (mainly in the textiles and wood processing sector), satisfy niche markets (all three sectors) or create new markets (mainly in the food sector). Large and well established companies of the textiles sector have developed strong strategic competitive response capabilities to address the shifting environmental requirements of the last decade after the China's accession to the World Trade Organization (WTO) in November 2001.

Most companies have presented an annual increase of sales after venture creation. It actually seems that these firms are outperforming even during the period of a serious crisis because of the wider scope of action, the capability to compete with new products or services and their knowledge and technologies exploitation capabilities. This is in line with the findings of Protogerou and Karagouni (2012), according to which DCs are important in traditional mature markets as significant drivers for sustaining growth. It is worth mentioning that especially export oriented companies (exporting volume of production >98%) have not been affected at all by the current crisis. Interviewees comment on strong competitive advantages, investments on knowledge and innovation, nurturing the ability to create new implicit needs for global existing and emerging markets.

The role of local proximity, degree of teleology, former condition of the company and the involvement of the entrepreneurs have been set forward as potential parameters of this inability to escape former routines and processes. However, they are mere observations which deserve further investigation.

According to the discussion of Sub-sections 2 and 3, suggested measurable and patterned DECs are simple, idiosyncratic and iterative and they appear to be related with the new ventures' survival, affecting initial core choices, innovativeness and initial competitive advantage. Furthermore, sub-section 4 discussed the fact that certain of DECs'dimensions may be embedded in DC micro-foundations or may just lay the foundations for DC development as antecedents. That means that DECs have a role to play in the creation and development of DCs impacting thus in an indirect

way a new LT-KI firm's innovativeness and growth. Furthermore, both DECs and the subsequent DCs enable the creation of competitive advantages which will be constructed on a knowledge-creation basis instead of relying on existing structures and knowledge. The described DEC-DC evolution in the new LT-KI venture context may help to explain heterogeneity of new LT-KI ventures survival and development while it can illuminate DCs' genesis (Corner and Wu, 2013; Hart and Dowell, 2011; Maritan and Peteraf, 2011). Links among DECs and DCs have been extensively described in section 7.5.b and are presented on the following Table 8.1.

59**Table 8.1: Links among DECs' and DCs' dimensions**

DECs' dimensions	**DCs' micro-foundations**	**Type of link**
Bricolage Capability		
Repertoire building (problem-making + 'resourcefulness')	sensing	Embedded
Repertoire building (problem-making + creative resource recombination)	seizing	Embedded
CCN	Networking collaborations	Evolving
Repertoire building interactive learning	Learning	Same mechanism underlying DCs or upgrade to the relevant DC*
Improvisational capability		
Information Flowing real-time information and communication	sensing	antecedent and partly embedded
Information Flowing experimental culture	Sensing mainly NPD	Embedded (mainly in NPD and technology adaptation)
Information Flowing Flexibility	sensing	antecedent of DCs
Provocative organizational competencies	----	become idle until the next KI-venture
Transcendental Capability		
Transcendental conditions PEA	sensing	Antecedent and partly embedded
transcendental conditions spaciousness	sensing	Antecedent and partly embedded
transcendental synthesis Receptivity and spontaneity	sensing	antecedent and base of sensing
transcendental synthesis Judgment	seizing	antecedent and base of seizing
Transcendental Capability	reconfiguration	"Provoker"

* in relevance with different approaches on the role of learning in DC theory

The potential links among DECs and DCs (as presented in the above Table 8.1 and discussed in the relevant section) do not seem to be sector specific indicating generalizability in the way DECs get embedded or become antecedents of certain DC

micro-foundations. More precisely, findings of all three groups converge regarding the following:

- Certain dimensions of the dynamic entrepreneurial capabilities can be assumed as antecedents of sensing; bricolage as knowledge and resource hunting, improvisational capability with the constant interaction with the environment and the transcendental capability as a constant reshaping of the transcendental conditions and a constant loop of the mechanisms.
- Certain dimensions of the dynamic entrepreneurial capabilities can be assumed as antecedents of seizing; bricolage as creative resource combination and transcendental synthesis mainly regarding judgmental decisions to received and processed information and knowledge.
- Certain dimensions of all three DECs are soon embedded in DCs while transcendental synthesis provokes the reconfiguration capability. DCs actually seem to appear in the very first steps of the nascent ventures in quite loose and informal forms. In the corporate cases they are sometimes affected by former DCs (i.e. before KIE) but they always bear a knowledge-intensity stamp.

Findings do not contradict existing literature as clearly explained in sub-section 4. According to O Jones et al (2011), for example, "If dynamic capabilities are path dependent, as suggested in the literature (Ambrosini and Bowman, 2009; Teece et al., 1997), developing bricolage as embedded routines will provide processes that can encourage long-term agility and continued renewal". Baker et al., (2003) suggest that improvisation, which occurs in the founding stages of a firm, as a strategic activity.

Another interesting observation regards the interaction among DCs of established low-tech firms before KI-venturing and the emerging DECs during LT-KI corporate venturing; for example, sometimes PEA could emerge as a combination of former strong sensing capability and individual search capabilities of the entrepreneurs themselves or their managers. However, sometimes this impact appeared to be rather negative; some LT-KI corporate cases (especially of the T&C group) did not manage to totally escape their own well-developed organized DCs due to strong path dependencies and success of the past. This seems to hinder their performance regarding the development or the re-vitalization of DECs. Therefore, we could conclude that **strong path dependencies may hinder the shift to KI corporate**

venturing if DECs are not deliberately developed. This may further impact the development of after-KIE DCs as well.

Furthermore, DECs that become idle or partly embedded and "provokers" are expected to emerge again in a new LT-KI effort; for example, the ability of low procedural memory and minimal structures or the avoidance of existing routines are capabilities that seem to stay idle until they are needed again; this can be a case of a new venture or even an R&D project or another type of company or department restructure. In those cases, all DECs appear to become more autonomous and able to deviate from processes and mechanisms. They enact dynamic processes in which both individual transcendental thinking and group coordination challenges are at a constant interaction within the broader context of an uncertain environment.

All thirty cases verify the third hypothesis and more precisely, they indicate that:

- DECs are actually interacting among them to start viable and successful ventures with strong initial competitive advantages and therefore entrepreneurs need to develop a whole set of strong DECs.
- DCs exist and are quite significant in the new LT-KI firms
- DECs are significantly related to DCs in cases of knowledge intensive low-tech companies; however, Dynamic Capabilities in established organizations may hinder the performance of DECs in cases of LT-KI corporate venturing and more specifically, the more the path dependency, the less the effectiveness of the dynamic entrepreneurial capabilities.

Commenting further on the suggesting relationships among DECs and DCs, we should bear to argue that this framework corresponds to Teece's entrepreneurial managerial capitalism (Teece, 2012) which "involves calibrating opportunities and diagnosing threats, directing (and redirecting) resources … reshaping organizational structures and systems so that they create and address technological opportunities and competitive threats". A major conclusion is that technological dynamism is not the only one to determine environmental dynamism; the cases studies make it evident that there are many other types of environmental turbulence.

Chapter 9

Conclusion

Chapter Objectives

- To discuss the theoretical contributions this study made.
- To identify implications for practitioners and policy makers
- To identify limitations and shortcomings
- To make recommendations for further research
- Summary and final conclusions

9.1. Theoretical Contributions

> Theory thus become instruments, not answers to enigmas, in which we can rest. We don't lie back upon them, we move forward, and, on occasion, make nature over again by their aid. (William James, 1907: 46)

> "Knowledge Intensive Entrepreneurship taps into a growing trend of entrepreneurship research which recognises ***that not all start-ups are the same"*** (critical acclaim of Simon C. Parker, The University of Western Ontario, Canada, for the book of Knowledge intensive entreprneurship: The birth, growth and demise of *(high-tech)* entrepreneurial firms, 2010, Delmar and Wennberg (eds) – bold and italics added)

> "Despite their minimal application of research and development, industries such as manufacturing, food, and publishing occupy an important role in production expansion and employment opportunities. The editors of Knowledge-Intensive Entrepreneurship in Low-Tech Industries point out the alarming gap that characterizes today's research in regard to industrial innovation and transformation. The book provides detailed studies that explain KIE activities at multiple levels as it emphasizes the origins, characteristics, strategies, organization, and performance of such activities. ...the book should raise significant interest among researchers, scholars, advisors and policy makers who are interested in the revival of manufacturing sectors int he developing world"
> (critical acclaim of Chaza Fares Abdul, Journal of Applied Management and Entrepreneurship for the book of Knowledge Intensive Entrepreneurship in low-tech industries, 2014, Kirsch-Kreinsen and Schwinge (eds))

Some "history": The present study started in 2009; actually the main research objective emerged due to the beginning of the AEGIS research project (FP7) which would explore KIE, and due to the author's long-time involvement and experience in low-tech industries. By that time, the theoretical and empirical knowledge on KIE was extremely limited while low-tech industries were not *even included* in the knowledge-intensive ones. The widespread assumption was rather that low-tech industries offer limited opportunities for entrepreneurial activity due to their mature traditional character (Hirsch- Kreinsen and Schwinge, 2014) while there was a general acceptance of the tremendous gap between high- and low-tech industries regarding issues of innovation and growth and an almost scrupulous focus on high-tech KIE research. However, there were indications of the KIE-phenomenon in these traditional sectors mainly based on research of innovation in the respective sectors (please refer to Chapters 2 and 3). Therefore, by the time of the author's first approach of the LT-KIE issue, the research of KIE itself was in its very first steps; readers should keep in mind that KIE was not even defined! Thus, endeavoring to explore further and deeper the "black box" of the just (at that time) emerging phenomenon of KIE, the author applied literally Weick's saying; i.e. that "theory development starts with guesses and

speculations and ends with explanations and models" (Weick, 1995). However, as the time evolved, feedback derived from the working packages was of great assistance and importance for the thesis evolvement.

The main purpose of this thesis was to contribute to the comprehensive understanding of KIE as a mechanism for the transfer of multifaceted knowledge into innovative economic entrepreneurial activities in low-tech sectors. The core research queation was then: *How and why certain low-tech but knowledge-intensive ventures survive early death and prosper within mature ecosystems?* In other words, the study purported to fill the theoretical gap in the understanding and conceptualization of LT-KIE which addressed the very LT- KI venture creation from business idea to established low-tech business.

If "the most basic goal of scientific research is deeper understanding through theory development" (Parkhe, 1993) and "explanation building…. encourages reflective dialogue among professionals and researchers, both of whom are engaged in the making of a society" (Numagami, 1998), a significant objective of the present thesis was the effort to take part in this dialogue using a multiple-case study method. Actually, in a period of a rapid growth of the interest for knowledge intensive entreprenurship in general, low-technology industries remained a rather unprivileged research topic in the framework of both strategic entrepreneurship and capabilities' development on the basis of knowledge-seeking activities and performances. In accordance, the dissertation is **among the very first to shift focus to the rather neglected LT-KIE area.** Therefore, it will be a significant contribution of the dissertation if it manages to establish some further dialogue regarding the **limited but gradually growing discussion about the role of knowledge-intensive entrepreneurship in the context of traditional low-technology industrie**s **and more precisely regarding the birth, survival and growth of LT-KI ventures.**

The thesis is also **among the few efforts to try to capture the "how" dimension of the entrepreneurial phenomenon *per se*** (Ihrig et al., 2006) advancing relevant knowledge and providing some explanation for "the ability of some new and established companies to create, define, discover and exploit entrepreneurial opportunities" which is still a very popular issue (Delmar and Wennberg, 2010; Zahra et al., 2006). As discussed in the literature review, although literature on new

ventures and market entry is not new, besides the numerous approaches and views, contributions are sparse and sometime lead to contrasting conclusions. Most definitions and studies have viewed entrepreneurship from a strictly individual level of analysis producing a *panspermy* of properties arbitrarily named 'entrepreneurial capabilities'. On the other hand, there exists this mentioned gap in research on dynamic capabilities in emerging ventures and entrepreneurial settings (e.g. Sapienza et al., 2006) in general and more precisely in low-tech and knowledge-intensive fields. The process of new venture generation and its effects on new venture survival likelihood and performance remains an under-explored theme. Analysing this process, **the study is further among the few ones that provide empirical evidence on its argument on the *creation of opportunities* instead of just the discovery of opportunities**. This assumption was supported by Teece (2010) who described entrepreneurship as the proactive creation of opportunities instead of just searching for them.

The multi-level analysis of the thirty case studies gave birth to "guesses and speculations" (justifying Weick's (1995) view of theory development) indicating the existence of a comprehensive set of *dynamic entrepreneurial capabilities;* this suggested a potential ecology between entrepreneurial capabilities, DCs and long-term survival and growth. It is of high importance to state that there was no initial intent to use the dynamic capabilities approach; indicatively there were no relevant questions included in the interview protocol[326].

To our knowledge, this is **the first effort in KIE literature to conceptualize a capabilities framework in order to explain LT-KI venture creation** within a "flat landscape" (Friedman, 2007), characterized by hyper-competition and maturity. As mentioned in Chapeter 8, the term **"dynamic entrepreneurial capabilities"** was not adopted from literature but it was suggested by the author's supervisors in 2011; its use sofar did not reflect the deapth and meaning of the term; it has been used in a rather indifferent way until 2012 while the first efforts for a more conscious use of DECs lacked precise definitions and measures (after 2012).

Perhaps **the major contribution of the study regards DECs operationalization** as it provides a multidimensional measure of DECs, indicating that they are more than

[326] This, according to our opinion, adds validity to the findings since it proves further that there was no interviewer bias.

just vague and fuzzy abstractions guided only by human talent and intuition and thus deserve further theoretical and empirical exploration.

Using our case studies' analysis and the existing literature on **bricolage** and entrepreneurial bricolage **we advanced the concept to an integrated structured capability** with distinctive dimensions which enables the refusal of limitations and the exploitation of resources at hand or the search of new ones. It is also worth mentioning that the introduced dimension of concentric cycle networking **(CCN) can be regarded as a contribution in extending the notion of networking capability and more precisely the way it evolves in start-ups and small firms.**

The improvisational capability based on the relevant literature review of improvisation in the context of mainstream routines of modern start-ups allows the combination and recombination of knowledge, resources and opportunities in order to refine ideas and question existing business ecosystems.

Therefore, according to our opinion **the DECs approach advanced further the concepts of bricolage and improvisation.** Our view provides additional insight that improvisation and bricolage are not just concepts, mechanisms, media, or just "parts", "marginal activities" and "attitudes" of entrepreneurs and organizations. **Our findings are among the first in literature to confirm their existence in low-tech sectors, and the first ones for knowledge-intensive low-tech sectors** indicating their role in the LT-KI founding process and the company's strategy.

Transcendental Capability is a totally novel concept introduced by the author to explain *'how'* innovative low-tech knowledge-intensive ideas are built. It regards mainly the process of intangible asset needs' creation, such as novel knowledge and know-how which according to Teece (2011) constitute the new, hard to "build" and difficult to manage "natural resources". **Besides its contribution as a dynamic entrepenruial capability, it adds to the entrepreneurship literature;** while there is much research on who and why can undertake entrepreneurial actions (indicating types of possible entrepreneurs and factors influencing founding success) the *how* question is not answered yet.

The dimensions of the dynamic entrepreneurial capabilities include "distinct skills, processes, procedures, decision rules, and disciplines" (as DCs do according to

Teece's (2007) prologue) and even some organizational structures and appear that are quite difficult to develop and deploy.

Another significant contribution is the provided evidence on **the DECs impact on new firm survival, growth and innovative performance.** Central to our contribution is the notion that, at least in LT-KIE cases, DECs contribute to overcome the problems of liabilities of newness and enable the breaking of the barriers of established developmental paths by selecting new knowledge and technologies that stand out from the resources of the existing sectoral systems, such as scientifically-generated knowledge. The ***involvement of three different low-tech industrial sectors*** can be said to contribute to a more general view of the impact of DECs (as well as DCs) on new venture survival and the newly established entity's growth and performance.

As a by-side rather result, the study **broadens and adds to the concept of *initial competitive advantage*** going beyond traditional approaches of entrepreneurship. According to a quite extensive research in literature, although it appeared mainly in case descriptions, the term "initial competitive advantage" was used in an indifferent way while its significance has been neglected till now (contrary to the emphasis given to the notion of sustainable advantage as explained in the relevant literature review).

In accordance, the dynamic entrepreneurial capabilities framework "goes beyond traditional approaches" to understanding entrepreneurship since it does not only emphasize traits and individual-based competencies as usual in the entrepreneurship literature but it also purports to provide decision-making disciplines and prerequisites to ensure successful market entrance. On the other hand, it can also apply as a guiding principle in the the evaluation of the relative success of an LT-KIE effort (at least).

Additionally, to the best of our knowledge, **this thesis is among the first efforts to link dynamic capabilities to venturing and throw some light on their origins, adding to the relevant debate.** The need of further development of the dynamic capabilities framework was already highlighted by Helfat (2000). Researchers keep on discussing the need to modify earlier proposed DC frameworks involving the single entrepreneur as a source of dynamic capabilities (e.g. Bocardelli and

Magnusson, 2006; Augier and Teece, 2009; Maritan and Peteraf, 2011). Teece (2007) also recognizes the power of human beings and that "no all are processes…In regimes of rapid technological innovation, it is clear that making investment choices requires special skills not ubiquitously distributed amongst management teams", while Teece (2012) discusses the differences among dynamic capabilities and "enterprise-level dynamic capabilities". Thus, **the DC view is expanded by providing some first thoughts on the "principles that underlie and guide choices of the entrepreneurial acts" (Teece, 2012).**

The analysis indicated that most DECs' dimensions can be embedded quite soon in routines and processes, suggesting that **DECs might constitute the entrepreneurial side and the antecendents of DCs.** This can be a significant contribution to the relevant debate regarding the explanation of generating DCs, since DC literature has reached no concensus until today (e.g. Barrales – Molina, 2010). More precisely, we suggest that DECs can be the media to transform human-centric skills, entrepreneurial features and entrepreneurial capabilities to firm-based processes which will constitute the core of the new firm's dynamic capabilities. Following the quote of Casson[327] (2000), DECs provide the "rules" (and are therefore "entrepreneurial") while DCs provide their implementation (and are therefore dynamic "routines"). This empirically supported argument, if further supported and proven to be able to apply in other industries besides the low-tech ones, can provide **the basis for a broader discussion regarding the origins of dynamic capabilities** consistent with Teece's (2012) call for studying "entrepreneurial management" to "understand how sensing and seizing opportunities arise".

Findings add further to the on-going discussion on the interrelationships between dynamic capabilities, entrepreneurship, innovation and growth (e.g. Lei-Yu, 2007; Zahra, Sapienza and Davidsson 2006). ***Empirical evidence is also provided regarding the applicability of DCs in newly established firms advancing the relevant understanding***; even in 2015, younger enterprises have been given scant attention regarding the ways they create, scout and exploit opportunities (Protogerou and Caloghirou, 2015).

[327] Casson (2000), "rule making is entrepreneurial, but rule implementation is routine".

However, the present thesis can actually confirm **DC existence and applicability in** newly-established low-tech but knowledge-intensive firms and therefore, **more generally, in low-tech industries or otherwise areas of less environmental dynamism. This can be regarded a further contribution** since, according to literature, it is still highly questionable whether DCs have a role to play in an environment characterized as stable with low levels of innovation (Protogerou and Karagouni, 2013). To date, the empirical studies trying to capture the nature and role of DCs in low-tech sectors are still rather limited, while DCs development is differentiated on the basis of their knowledge-seeking activities, knowledge assets and innovatiove performance (Protogerou and Caloghirou, 2015). Furthermore, findings add to the discussion on **the impact of different industrial sectors (however all belonging to low-tech) on the DC development.**

Results of the thesis further confirmed that dynamic capabilities are not only relevant to multinational enterprises but also to **small and medium firms** in an environment open to international commerce and fully exposed to all changes, technological or not. Thus, findings add to the relevant empirical evidence strengthening the position of the research stream that argues on DC existence in SMEs.

A contribution of the thesis regards evidence of the role of both DECs and DCs within a severe crisis framework. This was not an initial target of the research as it started in the mid and the crisis in late 2009. However, the on-going Greek fiscal and economic crisis, which is admittedly an extreme one, proved to be a significant criterion for the examined cases; as discussed above, cases of strong DCs present better resistance in terms of average sales growth and export activities, indicating the **DCs significance to low-tech but knowledge intensive firms within severe environmental shocks.**

Last but not least, **the present thesis is among the first to link entrepreneurial capabilities and to production technologies advancing discussion on the need of a theory on the interrelationships between technology and entrepreneurship** especially for the pre-firm formation stage (e.g. Tan et al., 2009)**.** It actualy indicates that DECs can be the capabilities that offer to entrepreneurs the potential to build up operational and technological capabilities by seeking, acquiring and creatively

combining knowledge and tradable resources. Even since Schumpeter (1934), the creation of a new firm has been connected to technology and new products' production while it is widely accepted that the commitment to physical creation is a significant transition point in venture creation. However, there is a surprising shortage of studies that investigate how low-tech ventures build up their operational environment. Similarily, there are only a handful of studies that probe the role of production technologies within a low-tech but knowledge-intensive context mainly at a sectoral basis.

It can be also regarded **a contibution to the the literature of industrial dynamics** in general, which focuses on the relationship of plant heterogenity and in particular of production technologies with various economic phenomena.

Furthermore, the suggested impact of DECs on the development of production technologies and subsequently on technological capabilities **supports our conceptualization of DECs as higher-order strategic processes justifying their categorization as dynamic.**

Another important contribution can be considered mainly of **endogenous character**. It regards the very understanding of the phenomenon within the Greek borders highlighting problems, development and policies of low-tech industries which constitute a very important part of the Greek economy and are volatile mainly due to globalization. The coincidence of the Greek depression stresses further the particular value of the evidence.

However, the developed framework is general enough to be applied by LT-KI agents in any other national or economic context; DECs do not bear any nation-specific limitation while – on the other hand - they *do* entail dimensions that take into consideration sector- and nation-specific specificities (e.g. the PEA dimension). Once again, it is reminded that the framework refers only to low tech industries and actually knowldge-intensive cases.

With core theoretical pillars anchored in the emerging knowledge-intensive entrepreneurship theory, the evolutionary organization theory and the entrepreneurship research and supported by the specific theories of innovation, knowledge management, industrial dynamics, dynamic capabilities and low-technology literature, this dissertation presents a detailed investigation of the

successful entrepreneurial processes of LT-KI firm entry, survival and growth which led to the development of the proposed framework. Furthermore, for the needs of the research questions, the areas of bricolage and improvisation (organization and management science) were also engaged to form two of three DECs. The formation of the transcendental capability engaged elements of Kant's theory of Critique of Pure Reason. It should be also mentioned that the resource based theory of the firm formed the basis of the initial case-study analysis, while the distinguished features of the phenomenon evolve as novel ways of knowledge based resource acquisition and distribution in order to create opportunities. Furthermore, due to the fact that this approach emphasized the development of strategic-level dynamic entrepreneurial capabilities, it integratd and drew upon research in several other sub-areas such as product and process development, competitive advantage, manufacturing technology, technological capabilities, intellectual property, human resources, networking and learning.

The above mentioned theoretical contributions appear to regard mainly the areas of strategic management and entrepreneurship and more precisely the theories of corporate / nascent, strategic and knowledge-intensive entrepreneurship within the low-tech context. It further adds to specific areas of low-tech industries' exploration and more specifically to innovation, knowledge, DCs and production technologies. Specifically, low-tech knowledge-intensive entrepreneurship literature is extended regarding the field of capabilities (dynamic entrepreneurial capabilities framework) and new venture creation.

The "hallmark of building from case studies" must be *fresh theory that bridges well from rich qualitative evidence to mainstream deductive research* (Eisenhaedt and Graebner, 2007). However, "theory development is a social process" (Frohmann, 1994, p. 124); real contribution of theory-building studies can ultimately be judged only after they have been exposed, while time plays its role for the acceptance or rejection of new theories.

9.2 Implications for practitioners

> The usefulness of a theory is its ability to predict the consequence of an action (van de Ven, 1989).

In "the science of strategy making", Mitzberg (1967) refers to Drucker's "entrepreneurial manager" as presented in a lecture at the University of Toronto, on March 3, 1965. Considering the definition as rather extreme and overemphasized, Mitzberg concludes that Drucker's definition of the manager as the one who controls his/her own destiny supports his tendency to produce some theory on managerial strategy making.

In the same vein, practical implications of the present thesis are presented as food for thought for all those who engage in managerial decision making and especially "entrepreneurial managers" who get involved in new LT-KI start-ups or corporate ventures. The core contribution of the research, i.e. **the development of the dynamic entrepreneurial capabilities framework endeavors to motivate and provide guidance** to all interested to establish a low-tech but knowledge-intensive venture for avoiding failure that may result when attempting to enter mature, saturated markets within the extremely competitive low-tech context. A*lmost with the dawn of the new millennium* and the evident globalization of the international economy, the market environment of the low-tech sectors has become highly volatile and instable. Under these conditions, **the DEC framework has highlighted specific strategic entrepreneurial / managerial competencies that are needed to be developed for new LT-KI agents to create strong initial competitive advantages and enter mature markets in successful ways.**

The dynamic entrepreneurial capabilities construct and its underlying dimensions are a **set of idiosyncratic in their details but identifiable, measurable and, therefore, managerially amenable options** that can be used to address the changing low-tech environment during the gestation, start-up and early development stages. Entrepreneurs, entrepreneurial teams and entrepreneurial managers should engage actively in the development of a ***DECapabilities portfolio concurrently with the evolution of the raw and vague business idea***. On the other hand, ***they may ask themselves if they have already a minimum of capabilities required and this regards mainly the transcendental capability.*** According to our findings, **certain DEC**

dimensions are quite path-dependant; i.e. they cannot be developed from zero when agents decide on LT-KIE, but pre-work is necessary. Awareness of this process would allow for proper decision making regarding the evolvement of the business idea and the further development of novel knowledge and capabilities in relevant areas. Actors should examine which competences are already in place and which need to be created in order to address the LT-KIE challenge. This exercise will indicate the extent to which specific DECs exist and / or need to be further built. For example:

Transcedental conditions appear to act as signposts for entrepreneurs/managers to position themselves in global business ecosystems and curve new business ways; agents should be keen to connect diverse input, getting out of known limits (national, sectoral or even science-related ones), mobilizing all sources to realize business concepts. Therefore, they this dimension should be already developed up to a certain degree if LT-KI business is to be shortly established. It is widely accepted that "history matters" in cases of a firm's future; it appears that *history matters* for new undertakings too. On the other hand, an existing network pool of certain size can allow for a better development of the bricolage capability while the awareness of its non-existence saves rom the illusion of external support and stimulates efforts to create it.

It should be mentioned that, as derived by the case studies, **strong transcendental capabilities are necessary** in order to develop business concepts with unique characteristics which - in turn - create strong initial competitive advantages.

Furthermore, according to the findings, **entrepreneurs /entrepenurial teams need to develop in deapth all three DECs in order to succeed; however, in cases that they trace weaknesses or deficiencies, they have to find the proper human capital to support the team.** Therefore, this research effort increases the understanding of the different priorities and requirements in the various functional areas of new LT-KI firms. Entreprneruial management teams may acknowledge the importance of knowledge and certain other resources at specific levels of the gestation stage evolution. They can use DECs framework to guide them in regard of the sequence of skill and capabilities development in all LT-KIE phases; i.e. the creation /

identification of the business opportunity, the start-up and the first years in life of the company.

The results of this research suggest that there are some factors which may help LT-KIE actors to build dynamic entrepreneurial capabilities. These can be specific entrepreneurial traits and characteristics or resources types. **LT-KI entrepreneurs /teams and entrepreneurial managers should pay attention to such factors before making significant commitments to LT-KIE.** Indicatively:

Knowledge appears to be the major resource to invest in. Agents should be aware of their strengths and weaknesses regarding levels of knowledge and develop DECs in this very direction; i.e. in order to engage different approaches to search for, discover, select, evaluate, adopt, combine and integrate external knwoeldge in order to create new knowledge. This means the conscious awareness of weaknesses and the engagement of proper human capital, the purchase of relevant knowledge-sources etc. It should be mentioned that knowledge within LT-KIE stands out of the existing sectoral systems, including combinations of practical knowledge. Later, best practices for sharing knowledge (as well as tacit knowledge) within the initial team members or inside the newly formed firm may include various forms but appear to be necessary.

Experience is deemed valuable; this may guarantee, for instance, that actors are already familiar with the characteristics of their chosen industry (at least), they can access their personal networks quite easy and that they may own a certain level of deepened conviction. That means, then, that all three DECs are easier to develop.

Social capital and human capital are equally important. Our research results have indicated that, very often, entrepreneurs of the studied cases belonged to various networks such as associations or supplier networks while many business opportunities may emerge from informal discussions with people who are familiar from the past. Sources for that information can be formal; however, informal information sources (discussions with agents, dealers, clients etc) appeared to play a significant role in the formation of novel business ideas. For example, participation in exhibitions is important because information gathered from these events helps actors to identify changes taking place in the market environment. However, actors should engage an **open attitude** towards other – both intersectoral and intrasectoral – communities, overcoming the established introversion of low-tech sectors.

Furtthermore, it is highly suggested that actors must be **deeply and personaly involved** in the planning of the LT-KIE process and in setting the early goals of the venture business. Personal involvement is also important in the cases of corporate venturing together with the commitment of the parent organization to the goals set for the venture.

Before investing in KIE, **entrepreneurs /teams and entrepreneurial managers should be aware of the significance of creating an initial competitive advantage compared to their potential competitors.** This has been proved to be of great importance, since LT-KIE actors address saturated and mature markets. The results of this study confirmed that in Greek LT-KI ventures strong initial competitive advantages are often identified *tout court* with product / process differentiation, innovation and extremely high levels of existing product or process properties (e.g. the high level of quality, well above specifications). In some cases, however, LT-KI competitive advantage can be related to more complex combinations.

A significant implication is that entrepreneurial managers (both in new and established firms) probably have better keep in mind that **they should not create "once-and-for-all" capabilities for their start-up operations; they should continually re-configure or revise them in order to capture the dynamic evolvement of the first stages of a new entrerprise establishment.** In these phases, the environment is always unpredictable and dynamic, since LT-KI firms create actually the foundation of their usually novel knowledge bases, their development path and core choices; for instance, innovativeness was found to be impacted by the level of DEC's development. Furthermore, this is the time that the foundations of dynamic capabilities are laid: the first moments of the firm's life include the transition of certain DECs' dimensions into DC micro-foundations. This highlights also the emerging need for DECs' succession by DCs; **actors have to take care of the DEC-DC transition and create, in the very early steps of LT-KIE, dynamic capabilities that will enable the manipulation and recombination of their functional competences to secure survival and enhance the new LT-KI firm's performance.**

As the thesis's findings supported the significant role of DCs in low-tech industries (adding to the existing but limited relevant strand of literature), it is quite evident that **possessing dynamic capabilities certainly increases new LT-KI firms' potential to**

survive and sustain growth. Therefore, **entrepreneurs /teams and entrepreneurial managers are strongly encouraged to invest in the further development of dynamic capabilities** in order to maintain and strengthen their new LT-KI firms' fit with their changing environment not only with regard to their current business practices but also in terms of their survival and successful operation in the future. Managers should keep assessing DCs' actual and potential use in relation to their capacity of adding value to the business. This process would allow the developing of new knowledge and capabilities in relevant areas and would also facilitate the renewal of existing resources as a means of responding effectively to the changing conditions prevailing in low-tech sectors.

Another implication of the thesis regards the technological direction of the venture; **LT-KI entrepreneurs/entrepreneurial managers should prioritize the creation of operational capabilities which will allow for the physical realization of the business concept and which are strongly linked with the dynamic entrepreneurial capabilities development** For example, bricolage and improvisational capabilities will enable the recognition of technological patterns connecting seemingly unrelated science and technologies. That means that the ability to relate technologies and processes to concepts and to form relevant strategic priorities is not self-evident. A major problem among scientists is the inability to connect science or technology to mass production and firm performance (Krabel et al.,2009).

Some *directions can be set from the point of view of corporate venture strategists and entrepreneurs as well as the management of corporations that plan the establishment of new LT-KI ventures.* As indicated by the case studies, the relationship between the parent organization and the LT-KI venture itself is of crucial importance. However, while it is commonly accepted that support and commitment of the parent organization are important for the success of the new venture, our findings suggest that new LT-KI ventures should be treated as new start-ups, avoiding routines and established processes of parent organizations. Otherwise, the improvisational capability is highly limited. Therefore, **managers should take care to avoid such dependencies;** for instance, they have to activate provocative competencies as well as the other dimensions of improvisational capabilities deliberately. This need is more

imperative when referring to former DCs of the established parent companies. In such cases, managers **should consciously escape the well-developed DCs of the parent organization. They should re-create DECs** by letting idle or embedded in DCs ones emerge again and fit the emerging circumstances of the new LT-KIE.

The present study also provides **useful practical implications for entrepreneurs / entrepreneurial managers of Greek low-tech industries** who are currently seeking survival and growth opportunities within a severe crisis context by mainly trying to reach international markets. It is expected that the DECs framework will assist all interested in LT-KIE to consider which capabilities they should particularly pay attention to while aiming to create a venture based on knowledge within mature industries. **The empirical part of the study refers actually to both good practices and practices to avoid, within the Greek context.** Especially those interested in the three examined industries can derive much knowledge regarding the path dependences and contexts of the Greek sectors as well as specific trends, strategies and capabilities of the presented cases.

Besides, according to our knowledge, the general outiline of the sectors are quite similar within a number of other national contexts. This means that the thesis can assist entrepreneurs / entrepreneurial managers of other countries with similar business ecosystems, too. However, the DEC framework, as well as the suggested theory on DCE-DC relations and the role of DCs and production technologies in LT-KIE are general enough and are proposed to be applied in other low-tech industries and national contexts as well. This is due to the fact that, in general, low-tech business environments are more turbulent than thought to be, as it has been explained in detail before, irrespectively of country or type of turbulence (e.g. economic crisis).

The core message to all low-tech but knowledge – intensive entrepreneurs and entrepreneurial managers is that in order to succeed, they have to shape the future by the opening of new niche markets, the creation of new needs and the enhancement of value of the existing ones. The dynamic entrepreneurial framework can support such efforts and can lay the foundation for sustainable growth.

9.3 Implications for policy makers

"Individuals must be lured by incentives to undertake the socially desirable activities."
(North and Thomas, 1973)
" If policy makers get it wrong, whole nations can be destroyed"
(Joseph Stiglitz)

This thesis endeavors to contribute to the ongoing political debate on relevant policy measures to sustain and promote future industrial growth. It supports the view that low-tech industries are still very important for future economic and societal development. While, the core research objective focuses on successful low-tech but knowledge intensive venturing, typical patterns, prerequisites and impacts of knowledge-intensive entrepreneurship are identified, as well as the distribution of entrepreneurial activities in low-tech sectors and sector-specific issues.

As business cycles tend to become more correlated and macro-level policies are increasingly sterilized due to the ongoing globalization, policy-makers should resort to microeconomic measures in order to propel and sustain growth. A set of such measures should include policies to promote favorable conditions for the foundation of new low-tech firms, and their support in the later stages of growth (Malerba and Vonortas, 2010).

More specifically, policy makers **should consider knowledge-intensive entrepreneurship as a major mechanism to translate knowledge into innovation (and consequently growth) in low-tech industries** and thus pay more attention on the role of knowledge creation and capability development as a way to foster their competitiveness and strengthen their role in international highly competitive markets. Therefore, a real challenge is to combine the entrepreneurship education with the commercialization of the knowledge produced in universities and other research institutes (Caloghirou et al., 2013). On the other hand, policy measures should also consider ***incentives to change the traditional management methods of most Greek low-tech firms*** (micro and SMEs in their majority) which create a really hostile environment for even personnel with a higher educational background. This can refer to training, finance of consultation and support of the implementation of modern management tools.

As suggested in recent studies on the commercialization of new knowledge, an appropriate environment for entrepreneurs is important in order to exploit opportunities within new ventures (e.g. Shane and Venkataraman, 2003). Thus, besides the usually proposed deregulated labor markets and favorable tax-systems, policies should embrace a wide set of instruments which would support **easy access to intra-sectoral knowledge enabling knowledge flows among a variety of sources;** as evident from the analysis, LT-KI agents sometimes seek knowledge well outside their domains. While such "knowledge networks" appear to work in high-tech cases due to the particular emphasis that was and still is given to this category of industries by policy makers and a plead of relevant research projects, low-tech actors continue to be rather "isolated" in their innovative efforts. However, research findings indicate that networks seem to play a pivotal role for successful LT-KI venturing. On the other hand, the mix and organization of private and governmental actors is almost non-existent and, in cases of such efforts, it is badly understood.

Policy measures may include the creation or upgrading of institutions that would bridge low-tech actors (individuals or firms) to required resources such as science and technology providers, machine manufacturers or even other apparently irrelevant ones. According to our research, such institutions in Greece are mainly sectoral ones; they are rather under-resourced regarding human capital, interoperability and infrastructure in general, while they were not even established to provide the wide range of services and consulting we proposed above. **Policy makers should take into consideration that such organizations must be designed to exceed both national and sectoral borders and at the same time be extremely local; i.e. must be able to reach every single entrepreneurial effort.**

Besides networking for knowledge, the thesis suggests that low-tech knowledge-intensive enterprises need to develop capabilities but as seen *not in isolation.* Actors are active within dense networks of formal and informal relationships with suppliers, customers, competitors, consultants, and technology, research and educational institutions forming complex, usually long lasting relations. A recommendation for policy makers might be **the empowerment of such linkages at least within EU if this suggestion applies for the EU countries** in order to help individuals and new firms to deal with each other, to gain access to expensive information and facilities

and to create the necessary dynamic entrepreneurial capabilities. Such linkages can enable transcendental conditions, cultivate further the transcendental synthesis while are quite fundamental for the bricolage capability.

Policies therefore need to adopt a firm-level focus, and must target the building and strengthening of the dynamic entrepreneurial capabilities by agents that wish to establish low-tech knowledge intensive ventures. Besides the development of well corresponding channels of communication and gateways, policy makers may reconsider the supply of andvanced management to all those interested. For instance, many of the DEC dimensions can be better organized after relevant training or information sharing. ***The tendency towards knowledge*** indicates further the need to intensify efforts for more skilled personnel as well as a more professional approach of issues which are even today regarded as purely "craft-based" (e.g. the W&F industry) or "practical" by the majority of the business and the institutional environment. In this vein, **relevant education, at least at third-grade level, may be of crucial importance.** Human capital remains still a scarce resource in low-technology industries. On the other hand, **policy makers should consider the creation of entrepreneurial mindsets within the academic studies;** universities and mainly the technical ones should engage entrepreneurship education and combine it with the - mostly - technical knowledge produced. Unfortunately, at least in Greek technical educational institutes, courses on business management and entrepreneurship are treated as second-order and "useless" ones that deprive students of the chance to get more technical and practical knowledge. However, findings of this study indicate the importance of the academic background and the mentality of the LT-KI new entrepreneurs studied.

Likewise, **the DECs framework can provide a basis and a criterion for bodies and institutions that evaluate low-tech venture proposals;** for instance, the level and quality of the dynamic entrepreneurial capabilities may provide the information necessary to decide on the acceptance or rejection of LT-KIE submitted for funding. **Attempting a more rigorous approach, DECs' evaluation could also reveal weaknesses of the proposed LT-KIE effort.** This would be of help for the LT-KIE actors since they could self-improve or ask for the fruitful intervention of relevant institutional bodies and other contacts. Therefore, this measure could eventually

provide a friendlier environment for those attempting LT-KIE as well as new firms and SMEs, attracting more actors to the mature industries[328].

In this respect, **the DEC framework can be a capability-supporting policy instrument that can indicate the relative strength and potential of low-tech but knowledge-intensive new ventures.** The issue is certainly of concern to industrial policy; one cannot assume that such efforts are simply a matter of having the right funding instruments and framework conditions in place; weak dynamic entrepreneurial capabilities may constitute systemic failures that can be even detrimental for the processes of knowledge-intensive novelty creation within saturated markets. Failures add to the almost negative image of the mature traditional industries and may discourage entrepreneurial action within low-tech business ecosystems. Taking into consideration the significant role of these industries, as many times repeated in literature, this will cause significant damage to the industrial economies of the developed countries.

Following the same logic, dynamic capabilities existence in the newly forled LT-KI ventures can further secure the sustainable develpment of the low-tech industries since they would facilitate the renewal of resources as a means of responding effectively to the changing conditions prevailing in these sectors. On the other hand, the lack of DCs or even weak dynamic capabilities might hamper the processes of knowledge production and dissemination that characterizes a well-functioning innovation system (Edquist, 2011) which is deemed as necessary within the knwoeldge intensive approach. It is important to note that success is complex to understand and that policy makers should be specific about the goals they want to achieve before interventions of any kind. In this line, **the DC framework can be a capability-supporting policy instrument that can secure the sustainability of low-tech but knowledge-intensive firms.** Hence, the DEC and DC policy instruments can enhance the possibility of strengthening LT-KIE activities while they may help many low-tech but knowledge intensive firms respond to the severe competitive challenges.

It should be mentioned that "A fundamental pre-condition for this is the development of a new and broad understanding of innovation and the insight that one should no longer equate innovative ability only with R&D activities" (Hirsch-Kreinsen and Scwinge, 2012, p15). The fact that innovation can be more complex than just R&D-

[328] It is reminded that there are almost no new-to-the-world firms in the T&C Greek industry since 2000.

based was evident in all cases and pervades in the whole thesis. **Innovation policy should be re-oriented towards a broader understanding of industrial innovativeness** and this perhaps calls for a new interpretation of former research results and further investigation. Considering the fact that the preset research concerns and EU country, these tasks can be realised through support programmes at EU, national and regional levels.

The study confirmed the fact that low-tech ventures and firms fulfil important roles both as partners in high-tech firms' innovation processes and as buyers of high-tech products. What we suggest as an alternative to the current policy agenda is a greater focus on s**timulating cooperation between industries with high and low research intensity.** Such policies can be of important benefits for economic growth in general (and not only for low-tech industries) by stimulating the interconnectedness of industries for common innovation production.

In the light of the empirical evidence provided by this study, production technologies have a strategic role to play in the development of efficient LT-KI firms. Given that LT-KI firms are mainly knowledge-based novelty producers, **policies should support the creation and diffusion of new technologies;** these would promote the appearance of an adequate number of such firms in the market that would be operating on the frontier emphasizing strategies of technology co-creation instead of passive technology adoption. Secondly, such policies may eventually cause the appearance of local suppliers, which are scarce at least in Greece (and to other countries such as Portugal for example); this *will solve the major problem of distance* as recorded by the interviewed entrepreneurs. Local proximity then will enhance the potential of collaboration among different industries and more precisely with machine and raw material suppliers responding to the necessities of local users and driving innovation to a higher level. Furthermore, such policies would promote collaborations with actors from the transectoral supply side including non-firm players such as sonsultants and research institutes or even individual engineers and other experts.

Another **policy implication** is that this diffusion policy will also promote the technological capabilities of LT-KI firms. In this respect, networks of information and co-operation between firms and other agents involved in the innovative process will be strengthened preparing the ground for more LT-KI corporate venturing. As a by-side effect, DECs and by implication DCs will be upgraded.

However, it appears that policy-makers should consider seriously the individual low-tech industries at national, European and perhaps at global level as well. Therefore, **policies should include also technology and industry-specific measures.** Mature industries share a number of similar characteristics but, according to the research findings, they present significant differences as well; these regard the stage of maturity and other sectoral path dependencies, their relation to knowledge, their very nature (e.g. more or less craft-based, fragmented, introverse etc) and several attitudes such as their approach to exports and even the role they play at national level and their positioning against the relevant global sectoral situation. Thus, it is quite obvious that just applying the same standards and measures to all "low-tech" industries may not lead to satisfactory results. **Different sectors require different expertise and different supporting schemes.** For instance, new-to-the-world knowledge-intensive food ventures need more support in regard of science-based knowledge diffusion and innovation, less beurocracy regarding the novel food products and more facilitation of market channels creation at global level. On the other hand, it is the corporate knowledge-intenive T&C venturing that appears to be in the need of specific measures to find new niche markets and levelage the high-investments in high technology and innovation prepared for global customers, while the W&F industry needs to be mentores to approach innovation (besides design) and become extrovert. It is also questionable whether local authorities and institutions close to low-tech firms are more appropriate to develop such industry-specific measures which would further entail a national approach instead of supranational policy makers.

The study of the case studies indicated that survival and growth of new LT-KI ventures is related to whether they target exports or not. This is mainly due to the small domestic market in Greece which cannot ensure the viability of new low-tech ventures. For example, with few exceptions, most F&B cases were *ab initio* export-oriented. On the other hand, the entrepreneur of a T&C case argued that "our investments in high-tech machinery and innovation would ensure gazelle rates if we were a German company in the German market. Now, we address only the Greek market with a small percentage of exports. It is not fair!" "I was a fan of the motto: Think globally, act locally!": an entrepreneur of the furniture sector whose new firm

acknowledged significant growth for a decade, felt trapped in his own belief in the crisis period. It is then quite evident that **measures to promote exports of low-tech but knowledge intensive novelties** would significantly enhance the new entities' performance securing survival.

Last but not least, **policy makers should also reconsider bureaucracy.** Besides efforts to reduce procedures and paperwork needed for a start-up, bureaucracy shows its teeth even in the efforts to register low-tech novelties or when entrepreneurs attempt to apply for public funding.

9.4 Limitations

> "A disk drive engineer even asked, "It clearly applies to the history of the disk drive industry. But does it apply to its future as well?"
> (Christensen and Carlile, 2009, p. 8)

This thesis was based on an inductive and exploratory study; building on thirty cases of knowledge-intensive ventures of three core traditional industries within the Greek context the author endeavored to generate and verify hypotheses regarding ways of low-tech but knowledge-intensive successful ventures. However, the study bears certain limitations such as the problems associated with the case study method, the level of the interviewees' objectivity regarding self-reported data, its national (Greek) context and perhaps the time that the research was contacted and the time it covered.

Therefore, a number of issues, such as temporal and contextual ones, "set the boundaries of **generalizability,** and as such constitute the range of the theory" (Whetten, 1989). Christensen and Carlile (2009) describe the generalizability problem in a quite vivid way:

> "Consider Christensen's experience after publishing his prescriptive theory of disruption had been inductively derived through empirical analyses of the history of the disk drive industry. Those who read his early papers instinctively wondered, "Does this theory apply outside the disk drive industry?" To address these concerns when writing The Innovator's Dilemma, Christensen (1997) sought to establish the generalizability of the theory by "testing" it on data from as disparate a set of industries as possible – including hydraulic excavators, department stores, steel, computers, motorcycles, diabetes care, accounting software, motor controls and electric vehicles. Despite the variety of industries in which the theory seemed to have explanatory power, executives from industries that weren't specifically

> studied kept asking, "Does it apply to health care? Education? Financial services?" When Christensen published papers that applied the model to these industries, the response was, "Does it apply to telecommunications? Regulated industries? The German economy?" A disk drive engineer even asked, "It clearly applies to the history of the disk drive industry. But does it apply to its future as well?" As these illustrate, it is simply impossible to establish a theory's external validity by testing it on data. There will always be another set upon which it hasn't yet been tested, and the future will always lie just beyond the reach of data."
>
> *(Christensen and Carlile, 2009, p. 8)*

Firstly, it should be mentioned that research fields like entrepreneurship and management are complex topics made up of many actors and factors which derive of a significant range of theories and literature streams. It is nearly impossible to properly examine all of these in a single research study (Easterby-Smith et al., 2002), and for this reason almost all relevant studies are flawed to some extent – the present study is no exception. Furthermore, developing resources and capabilities is a complex phenomenon that evolves over time.

In combination to this shortcoming, the **very nature of the case-study method** lies in the fact that it cannot establish generalizability as filed studies and quantitative research do. Qualitative research is always scrutinized for validity and many quantitative purists will fault qualitative work without cause (Johnson & Onwuegbuzie, 2004). However, properly planned and executed qualitative research is valid, needed and important (Yin, 2008); its purpose is theory development and not theory testing (Eisenhardt and Graebner, 2007).

Consequently, the approach taken in the present study was the most appropriate since the relevant KIE theory was in its very infancy while LT-KIE theory was almost non-existent. Secondly, the study was properly designed and executed to minimize the impact of researcher bias and to establish trustworthiness in the findings. This issue was factored into the study design by:

a) The use of thirty cases studies which is considered an exceptionally big number for such research types, affecting positively the quality of the emergent theory (Eisenhardt and Graebner, 2007). All thirty cases were selected because they were particularly suitable for illuminating and extending relationships and logic among constructs: they were knowledge-intensive, which was the "unusual phenomenon" according to Eisenhardt and Graebner's (2007) suggestions. The emergence of "polar

types" (not purposefully selected) allowed for very clear pattern recognition of core constructs and logic of the focal LT-KIE phenomenon; and

b) the questions and analysis were carefully crafted to provide both practical and theoretical implications. Conducting more than forty interviews, a substantial amount of data was collected and the study was triangulated through multiple techniques (Yin, 2008). The high volume of data led to the creation of the dynamic entrepreneurial capabilities framework which was not the initial scope of the author but emerged by the study and analysis of repeated patterns. Yet, a significant amount of observations and insights regarding the new low-tech and knowledge-intensive ventures of the three industries were inevitably lost due to the need to concentrate on the exact topic and avoid the specter of "***death by data asphyxiation***" (Pettigrew, 1973).

As already noted in the methodology section, self-reported data were mainly used to test the model. Although considerable efforts were made to ensure data quality, both during the data collection and construct validation phases, **the potential of biases** cannot be excluded. For example, the majority of data was collected mostly after the events had taken place, so there is also a chance of retrospective bias by the interviewees; the respondents' perceptions might not necessarily coincide with objective reality. The effect of wrong recollection by the interviewees has been minimized by using more than one interviewee where possible and by backing up the interview data by secondary archival data.

The effects of **possible bias of interpretation** must be considered as another limitation of the present research. The selection of data and the subsequent interpretation and analysis have been carried out by the author alone; inevitably results and suggestions are based on the subjective judgment of one individual. However, discussions with the supervisors have supported the formation and refinement of insights and suggestions several times during the phases of the analysis; for instance, useful indications regarded the positioning of the new framework within the wider dynamic capabilities theory and the use of the emergant relationships between production technologies as operational capabilities with DECs to support the argument that DECs are indeed higher-order capabilities.

In addition, while all reasonable efforts were made to collect data which would cover the whole process, i.e. from the very first inspiration of a new low-tech venture to product production as well as subsequent movements on issues like innovative efforts and new markets at least up to the date of the interview, however **it is not a longitudinal research** with the strict definition of the method. This would require the research to be able to observe all cases at real time and at various milestones. However, the persistence on details and the ability of the researcher to talk again and again with the respondents and watch their further evolvement can be deemed as quite capable to satisfy this shortcoming.

National context is another limitation since it is widely argued that the institutions of a nation's political economy that usually condition (though not fully determine) the behaviour of ventures are inextricably bound up with the nation's history and course, and hence remain nation-specific (Hall and Soskice, 2001). In other words, especially in the sphere of knowledge-intensiveness, venturing and innovation, the way new ventures are structured may not be essentially similar across nations, even among the EU economies. Nation specific factors such as government programmes, industry competition and market demand seem to play a role in sectoral courses, too (Sullivan & Bauerschmidt, 1990). For example, the Greek market size is very small in relation to the Italian or the German one creating different conditions for the introduction of low-tech novelties. At the same time, in contrast to the introvert and skill-based Greek furniture sector, the Italian furniture industry has shown world-leadership which is a result of a centuries-long tradition, of its quality, creativity and design capabilities.

However, such differences can also act as "provokers" for replication in other global contexts but they are unlikely to challenge the generalizability and credibility of the thesis' results. According to the findings, sector-specific differences impact the way DECs are developed but not the nature and their dimansions. While KIE development follows different ways due to path dependency and the different context of each of the three sectors, in all cases, DECs could be developed and harnessed to create unique asset bases and to challenge existing or shape new business ecosystems through novelties in products, processes and business models. Furthermore, the potential links among DECs and DCs do not seem to be sector specific indicating generalizability in the way DECs get embedded or become antecedents of certain DC micro-foundations.

Regardless of the industry (i.e. the three sectors examined), DECs appeared to be the capabilities that offer to LT-KI entrepreneurs the potential to build up operational and technological capabilities by seeking, acquiring and creatively combining knowledge and tradable resources.

Another limitation of the research is related to the **time period of the research.** It should be borne in mind that the venture-creation and first growth data regarded a time of an economic boom in Greece (1999-2007), which certainly influenced results. On the other hand, the severe crisis that followed acted as a criterion for the value of the DEC-DC impact on the cases of the research. However, the DC maintenance and impact were not studed during the recession period.

It could be also claimed that this study has not devoted a great deal of attention to the relationship between the actual environmental turbulences and the DEC-DC development. The issue was not dwelt upon because the highly volatile and turbulent low-tech environment was suggested and justified indicating that "dynamism" can be of several forms and perspectives instead of rapid technological changes. It would be quite interesting to see if DECs can apply in other environments as well as the ones of high-tech industries.

In sum, despite the limitations and even if future research indicates that the present study's results are only applicable to low-tech and knowledge-intensive firms and cannot be extended to other markets and environments, then the findings will still make an impact, as low-technology industries are a major and important part of the global economy. Moreover, the author has a practical background working with low-tech firms and a core motivation of this study was to help entrepreneurs and managers of such firms better understand the value of trans-sectoral knowledge and the key resources and capabilities needed in knowledge-intensive low-tech venturing and early growth.

9.5 Recommendations for future research

The study is inductive and exploratory, building on thirty cases of knowledge-intensive ventures of three core traditional industries within the Greek context to generate hypotheses regarding the suggested dynamic entrepreneurial capabilities and the founding LT-KIE process more generally. This study has also put forth a number

of findings relating to DECs' relationship to dynamic capabilities and their role in the development of operational capabilities and more precisely production technologies in the context of low-tech but knowledge intensive ventures. However, the present thesis has merely "sketched an outline for a dynamic capabilities approach" (Teece et al., 1997, p. 530) and of course this new theory is not offered as *a fait accompli*. As with all such studies, the generalisability must be viewed with care; systematic quantitative research could further test our hypotheses strengthening the contribution of the work.

The effort here was mainly ***to start the discussion*** on the strategic side of the vulnerable early stages of low-tech and knowledge-intensive entrepreneurship in general, since it proves to be the dominant type of entrepreneurship nowadays and within the globalization context. There have been actually only rare efforts to connect entrepreneurship with strategic management and specifically with the approach of a more structured capabilities' framework (Aramand, 2009; Zahra, 2011) in general. Entrepreneurship has been assigned to entrepreneurial talent and series of competencies; the literature has identified a plethora of particular individual-based skills, but it appears that relevant frameworks are rarely - if ever - suggested. Therefore, the umbrella DEC framework suggested here ***calls for a further theoretical and empirical integration*** of the strategy, entrepreneurship and innovation literature to provide more evidence and generate more theory regarding the ways new ventures are successfully created and sustain their evolutionary fitness ***at least in low-tech and knowledge-intensive contexts.*** Research in this direction may also advance knowledge regarding the evolution of low-tech industries with the contemporary turbulent global markets. Keeping in mind the significant role of low-tech industries in the global economy, LT-KIE needs indeed further investigation.

Empirical evidence and theoretical discussion is also needed f***or the proposed measurable constructs of the DEC framework***. In this discussion, researchers of many disciplines and streams such as entrepreneurship, innovation, bricolage and improvisation areas together with the more abstracted theorists of transcendentalism are invited. The proposed construct offers a quantified dynamic entrepreneurial capabilities measure based on a set of three identifiable and measurable dimensions and namely the bricolage, the improvisational and the transcendental capability. In doing so, this study provides evidence that DECs are more than just fuzzy and ambiguous competencies and skills; instead some of them represent or are supported

by composite organizational processes. Even more, it is suggested that these DEC-dimensions may be really effective when they inter-relate each other and act rather in complementary ways than in isolation. ***Hence, this suggestion may open the way for further analytical and empirical work delving deeper into these issues.***

On the other hand, the suggested evolution of some of the DCs from DECs indicates a ***new approach to explain the origins of dynamic capabilities***. The genesis and evolution of DCs constitutes still an on-going debate issue. It has been mainly assigned to learning and learning mechanisms (e.g. Zahra and Filatotchev, 2004) while Eisenhardt and Martin (2000) suggested repeated practice, past mistakes, and experience as the main mechanisms. In this broad discussion on capability development (e.g. Helfat and Peteraf, 2003; Keil et al., 2009), the present thesis argues that specific DC-dimensions are descendants of DEC dimensions. This argument calls for further empirical evidence, as well as theoretical discussion and refinement; DC researchers may be challenged to consider and explore this view further. It should be also mentioned that the non-biased evidence on the DCs existence in the examined LT-KI cases supports the need to ***rethink the dynamic capabilities framework*** when the concepts and notions of knowledge intensive entrepreneurship and traditional industry are engaged.

The research results indicated further that dynamic entrepreneurial capabilities appeared to impact the initial competitive advantage, to create the preconditions for survival and the growth of the newly formed firm, as well as to set the foundations of its attitude towards innovation. ***Further research can clarify the ways DECs affect firm performance and contribute to the future of the new venture. This can be also combined with different configurations of environmental dynamism.*** The present study considered and discussed the turbulent environment in which LT-KIE was born (for example the radically changing business landscape for the T&C industry or the emerging dynamism of the F&B sector). However, this is only "one side of the coin" suggesting avenues of further research; firstly, new findings may add to the reconsideration of the term "environmental dynamism" and its levels. On the other hand, research is needed to shed more light on the role of DECs under different levels of environmental dynamism in order decide ***whether external business environments have a role on DECs development and, in a positive answer, to fully understand***

possible boundaries in their applicability.

In this line, ***research could extend to a broader range of industries including high and medium-tech ones***. We stated that the DEC model may be suitable for only low-tech cases; that means that our suggestions apply only to a very precise type of firms. Our thirty case studies indicated that a low-tech business idea is scarcely based on R&D-based academic patented technologies and products as found in high-tech cases (e.g. AEGIS project) where technological changes are much more rapid than the ones observed in low-tech environments. However, bricolage has been found in the mobile internet new firms (Boccardelli and Magnusson, 2006) and trial and error was evidenced by Stam et al (2007) in high-tech start-ups. Therefore, it is highly suggested that the research objectives and suggestions of the present thesis could be extended to other industries or activities as well. For example, the process of transcendental synthesis could be found within research laboratories as well, especially when referring to high-tech sectors, with certain parallels and divergences between the two categories (LT *vs* HT- KIE).

In addition, the present thesis was limited to national firms, when investigating LT-KI corporate venturing and only within the Greek context. It would be quite interesting to see if the proposed framework and the suggested DEC-DC and DEC-production technologies relationships ***are suitable for multinational companies in international environments.*** On the other hand, research could test and confirm the applicability of the dynamic entrepreneurial capabilities concept ***in multiple national contexts*** exhibiting different constraints and characteristics.

Last but not least, ***further research could shed more light on the role and importance of the functional, operation-level capabilities that are required to be developed in LT-KIE.*** In addition, it could add to ***the role of DECs on these capabilities' development.*** The estimation of the second-order confirmatory model supports further the suggestion that DECs can be conceptualized as a higher-order construct encompassing the three sub-dimensions of bricolage, improvisational and transcendental capabilities. However, further empirical research and theoretical discussion is needed towards this direction.

In sum, further theoretical and empirical work could

- tighten and enrich the proposed framework,
- discuss further the suggested relationship among DECs and DCs contributing to the on-going discussion on the generation of the dynamic capabilities,
- unlock further the riddles that lie behind low-tech and knowledge- intensive entrepreneurship, and
- even create new theory extending entrepreneurship theory to the operational level at least for LT-KIE product makers.

It would be also interesting to follow the studied cases in the longer term. The retrospective glance at the firms' recent evolution revealed that the recession brought many challenges to each of them. Currently it seems that the firms that developed sufficient DECs are surviving and none of them has gone bankrupt. The on-going severe Greek crisis creates fruitful avenues for further research and observation. ***It would be interesting to study the impact of recession and investigate reactions and decisions towards the maintenance of DCs and the revival of DECs in case some of the cases decide for new LT-KI corporate venturing.*** It might be the perfect environment to study the impact of financial problems, instable political environment and fragile business frameworks, among others, on DCs, DECs and LT-KI firms' strategies. For example, the recession forced many low-tech firms including the studied cases to cut expenditure, which may mean that these firms lost some of their dynamic capabilities. Investigation of DEC and DC development and impact would be also compelling ***at the time of the socio-economic recovery.*** *Vice versa,* research could cover cases of a more normal future of LT-KI E with developed DECs and DCs. All proposed environments are quite critical if we consider the vulnerable global markets.

On the other hand, this study observed the evolvement of LT-KIE in a period of prosperity in Greece[329]. This might have supported certain attitudes, strategies and decisions. Therefore, future studies could focus on periods of more normal political

[329] Indicatively: " the low inflation environment and the associated reduction in nominal interest rates, by increasing the ability to borrow and lend at longer horizons, led to an increase in private investment and robust real growth rates of 3.9 per cent per year over the period 2001-2008. This high real growth rate was stimulated by consumption spending, housing investment and business investment. In addition, the
adoption of the euro led to the reduction of exchange-rate uncertainty and finally the reduction in the nominal interest rates and risk premia led to the reduction of the costs of servicing the public-sector debt and facilitating fiscal adjustment leading to resource allocation to other uses" (G. Kouretas, 2012)

and economic turbulence (positive or negative).

Besides the above mentioned suggestions for further research, the findings created a number of specific questions that appear to deserve further investigation in the broader context of LT-KIE and capabilities building:

- Entrepreneurial teams are always at the centre of all research streams regarding entrepreneurship; LT-KIE makes no difference. Results indicated that more research is needed regarding the ***LT-KI entrepreneurial team's consistency and homogeneity*** in knowledge-intensive new venture creation. Are different team dynamics and team compositions affecting the development of DECs and successful LT-KIE in general?
- The impact of the academic and professional background of the entrepreneurs in low-tech knowledge-intensive entrepreneurship was quite evident in all cases. However, results did not allow for suggestions on the role of a diploma which would be relevant to the type of LT-KIE; for example, in food sector most entrepreneurs hold an irrelevant to food industry diploma and yet they raise successful LT-KI firms. This appears also to be a significant difference with the high-tech KIE where entrepreneurs are in their majority specialized in the industry they choose to enter. Therefore, more ***research is needed since education seems to play a significant role but it is not the same with specialization.***
- The role of local proximity, degree of teleology, former condition of the company and the involvement of the entrepreneurs have been set forward as potential parameters of the inability of LT-KI corporate venturing to escape former routines and processes. However, they are mere observations which deserve further investigation.
- The cost of building and maintaining DECs and DCs is an issue that has not been studied. Future research could directly consider the costs and benefits of such capabilities and evaluate their cost-effectiveness.

A quite interesting suggestion for further research would be the discussion of the study's findings ***under the radical subjectivism approach***[330]. Views and suggestions

[330] The author was encouraged to suggest this research direction by the discussant in DRUID Academy conference 2014.

of this stream's theorists have supported the creation of the transcendental capability. In a subjectivist perspective of entrepreneurship, the external environment does not strictly determine decision-making. There are substantial possibilities for the creativity and autonomy of individual choice (Cole, 1978; Penrose, 1959); i.e. entrepreneurs not only respond to changes but they *create change*s (Alvarez et al., 2005). The radical subjectivism theories can provide further hermeneutic interpretations of the LT-KIE phenomenon and discuss the proposed framework or the DC genesis. The involvement of the RS view in the entrepreneurship literature is not new. Actually, conceptual work building on radical subjectivism has begun to blossom in the entrepreneurship literature (Chiles et al., 2007; Chiles, Toggle, McMullen, Bierman, & Greening, 2010; Foss, Klein, Kor, & Mahoney, 2008; Kirzner, 2015; Loasby, 2007; Streb and Gupta, 2011). Therefore, it appears that this research direction can lead to promising avenues.

The proposed multidimensional dynamic entrepreneurial capabilities concept was created to explain successful low-tech and knowledge-intensive entrepreneurial phenomena. Of course, it is not considered to be exhaustive, nor are the suggested relationships among DECs and DCs or DECs and productions technologies completed. Further *theoretical and empirical* research could identify and test more additional processes that would more broadly capture the emerging theoretical domains, confirm, alter or enrich findings on the various emerging issues such as deepening in nature and dimensions of DECs, their applicability, and the relations and interactions with DCs. The insights generated in this thesis could compose a rather aspiring and stimulating agenda for fellow researchers.

9.6 Epilogue

The author is a long-standing active participant and observer of low-tech firms and more precisely of wood and furniture and the textiles and clothing sectors. This research was spurred by the beginning of the AEGIS project as well as a desire to unearth deeper insights on the development of key resources and capabilities needed in such low-tech ventures' successful creation and early growth. Knowledge-intensiveness had never crossed the author's mind before the early discussions with Professor Yannis Caloghirou. For example, besides the importance paid to educate

W&F students and train W&F entrepreneurs and managers on wood science, design, W&F production technologies (i.e. mainly technical knowledge) and general principles of business management, the actual role of the dynamic application of new knowledge was not captured. In the same vein, when working for textiles, innovation was expected to be brought by machine producers. It was then generally accepted that low-tech entrepreneurs need not invest in knowledge (in the broad sense as in the KIE concept) but in other general competencies such as good practical skills, risk-taking and networking and of course sector-specific skills; furniture makers, for instance, should be good craft-makers, cloth-making was connected mainly to well practically- trained good stitchers, while spinners should have a deep knowledge of cotton.

Initially the study looked at *mechanisms and processes of KIE in low-tech industries.* Since KIE was at its very infant steps, back in 2009, initial literature review covered papers referring to low-tech industries, innovation, knowledge and knowledge management, and of course several strands of the entrepreneurship literature and the limited work on knowledge-intensive entrepreneurship. Several research programs were of great help too: INNOVA EUROPE and PILOT with their specific work-packages for low-tech industries, KEINS with the updated discussion on entrepreneurship and the refinements and new suggestions on knowledge-based entrepreneurship.

However, the in-depth interviews during the thirty case studies research and the first reviews of transcripts revealed a more relevant question: *How* and *why certain low-tech but knowledge-intensive ventures survive early death and prosper within mature ecosystems?*

The subsequent reviews of transcripts revealed a wealth of data on patterns which appeared to strongly influence venture creation, while some of them related to certain capabilities attitudes. Furthermore, interviewees talking about the firms' life-course revealed a variety of processes and routines which could be assigned as dynamic capabilities. The author turned then to the strategic management literature and more precisely to the dynamic capabilities literature extending to strategic entrepreneurship and entrepreneurial capabilities, since the research dealt with venturing and new LT-KI firm growth. This further delving into literature revealed further gaps besides the one of the main research question:

a) Little had been said regarding the creation of innovative knowledge-intensive business concepts in low-tech contexts
b) There was no consensus on the entrepreneurial capabilities needed to start a new business in general and more precisely in low-tech industries
c) There were many doubts and scant evidence on the existence of dynamic capabilities in low-tech industries
d) Production technologies, which constitute a core technological capability when starting a new low-tech business, were hardly related to the entrepreneurship literature or the preconditions for a low-tech start-up.

It appeared to the author that at that time there was no real answer to the question set above; i.e. how can someone start a low-tech and knowledge intensive business, which capabilities are actually needed and how are these capabilities formulated? How can this new business survive and grow? However, the author had to delve further in other strands of literature such as bricolage, improvisation, radical subjectivism and even Kant's theory of pure reason to transfer the act of LT-KI business idea genesis in processes and capabilities. At the time of theory development, AEGIS work packages and findings came to support, improve and refine suggestions and hypotheses of the study. For instance, the author adapted the suggestions of Hirsch-Kreinsen and Schwinge (2010) on the role of "A bundle of firm-specific capabilities" for KIE in low-tech sectors, which was later confirmed by empirical evidence, and KIE definition[331], while AEGIS deliverables verified further the role and impact of DCs in new and low-tech firms at a European level (Protogerou and Karagouni, 2012).

The study unearthed several unique insights on the issue and produced rich – according to our opinion – theory, as it has been presented in the above sections. The conceptualized and operationalized DEC framework is among the very first efforts, if not the first, to measure the suggested dynamic entrepreneurial capabilities. The DEC-DC relations are an empirically based effort to explain DC-origins while results provide further empirical support to the DC framework. DEC- production technologies are again among the first efforts to highlight the importance of

[331] The author had initially prepared an LT-KIE definition

production technologies development at the start-up phase and provide suggestions on how this can be successfully done. All findings refer, of course, to low-tech, traditional industries; however, they provide a novel capability-based approach to LT-KIE which appears to have both theoretical and practical implications as explained in the relevant section. Sections 9.1, 9.2 and 9.3 present the theoretical and practical contributions of this study.

It should be mentioned that the size and quality of the sample selected as well as the interviews with multiple key informants and a considerable amount of secondary data secure validity of the produced results. The research started with a broad interest on LT-KIE mechanisms and processes and honed down the resources and capabilities that emerged as important. The analysis began with a multiple step process of abstracting themes allowing for the emergence of theme categories which provided the structure for the subsequent within-case, cross-group and cross-case analysis. Although the methods are not highly unique, what is unique is the massive amounts of data that this study collected and analyzed. The study yielded over 500 pages of transcripts and over 2000 pages of secondary data. What is also unique is the depth of analysis for the really large number of case firms and massive amount of data that the study drew on.

The thesis provided a rich platform for announcements and publications: six conference papers and five papers published in relevant peer-reviewed journals while one chapter in an LT0KIE book used material of the thesis (publishes work listed in Appendix D). The paper of Karagouni, Protogerou and Caloghirou (2012), titled "Autotelic capabilities and their impact on technological capabilities: a focus on production technologies" received "the Best PhD student paper award" at the 5th Annual Conference of the EuroMed Academy, organized by Les Roches-Gruyere, University of Applied Sciences and hosted by sister school Glion Institute of Higher Education in Glion-Montreux, Switzerland, 4-5 October, 2012. http://emrbi.org/wp-content/uploads/2014/09/euromed-newsletter-006.pdf. Yet, there are opportunities for many more papers to emanate from this thesis in the long-term.

Low-technology industries constitute an important part of the global economy. Knowledge intensiveness in such industries emerges as the one-way solution to survival and growth nowadays. Despite the importance of low-tech firms, little is still known on how new resource-constrained LT-KI ventures can be successful and create

the preconditions for financially and even scientifically capitally intensive innovations and early growth. This study makes considerable contributions to filling this gap, hopefully offering some valuable insights and food for thought in researchers, theorists and postgraduate students in entrepreneurship, strategic management and several other fields. Besides the theoretical value, entrepreneurs, company representatives and policy-makers may find some interest in the proposed insights in the low-tech field that has been so far neglected.

The DECs approach together with all interactions among DECs – DCs and production technologies is in its infancy but it has the potential to be developed. It needs much further empirical and theoretical research. Emerging and evolving theories develop slowly, over long periods of time. As Williamson (1999) observes, ‘big ideas often take a long time to take on definition’.

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ΙΔΡΥΜΑ ΟΙΚΟΝΟΜΙΚΩΝ & ΒΙΟΜΗΧΑΝΙΚΩΝ ΕΡΕΥΝΩΝ (ΙΟΒΕ), Φωτεινή Θωμαΐδου, Παρασκευή Βλάχου, (2012), Τμήμα Παρακολούθησης Τομέα Τροφίμων, ΕΛΛΗΝΙΚΗ ΒΙΟΜΗΧΑΝΙΑΤΡΟΦΙΜΩΝ ΚΑΙ ΠΟΤΩΝ, Ετήσια Έκθεση 2011
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Appendix A

RESOURCES AND CAPABILITIES TABLES AND FIGURES

Table A1: Analysis Level 1 - data summary

PRIORI THEMES
Extensive evidence in general relevant literature on Entrepreneurship and KIE
General
Background, traits and characteristics of the entrepreneurs (e.g. education, experience, market knowledge etc)
Founders' motivation – origin of the business idea
Entrepreneurial opportunities (technological, market, institutional opportunities)
Types of venturing
Initial conditions - Resources (other than knowledge)
Financing - Sources of funding –other assets (technical/physical)
Human resources – Social capital
Knowledge
The "knowledge-based" entrepreneurial personality and internal knowledge
External Knowledge sources – knowledge types and bases
Access to knowledge sources
Industry knowledge, knowledge about the type of business, and knowledge about starting up new ventures
Types of knowledge produced
"Knowledge intensity"
The role of suppliers, Interchanges and interactions with high-tech partners /relations to other industries' knowledge
Appropriability methods
Relevant capabilities of knowledge management
Learning –knowledge management
Innovation
Innovation types and patterns
Innovative performance – innovativeness
The role of R&D

Non-R&D innovation
Sources of innovation and their combinations
Out of the box thinking
Physical implementation of business concept
Production assets and technologies
Complementary technologies
The role of machinery and other equipment suppliers
Technology transfer
Networking
Types of collaboration (industry, university, government / within - outside sectoral borders / along the value chain)
Linkages and value chain linkages
Environmental factors
Institutional influences and market environment
Specific economic and social milestones
Specific scientific / technological milestones
Growth patterns
Type of business strategy chosen
Intellectual property- R&D / design facilities /patents – trademarks - awards
Growth and life cycle of the firm
Performance - survival and growth (sales, innovations)
Learning
National - international inputs
National - international markets
INDUCTIVE THEMES
Entrepreneurial capabilities
Initial competitive advantage
Bricolage –resembling patterns (found in Baker et al., (2003) e.g. means “at hand” counting different uses of available resources (in line with Ciborra, 1996; Garud & Karnoe, 2003)
Improvisation-resembling patterns e.g. *the real-time interaction* (in line with Orlikowski, 1997, Miner et *al.*, 2001) and *minimal structures* (Camoche and Cuhna, 2001)
Unique production technologies
Kind of information and knowledge-processing capabilities
Thorough exploration of the specific sectoral ecosystem together with a wider investigation

Continuous experimenting – try and error efforts ((Barrett, 1998).
Paradox thinking
Trans-sectoral knowledge and information
Judgmental decisions on issues such as scarce resources, expectations and choices
Significant knowledge resource constrains in the very beginning
Elements of dynamic capabilities: Sensing and seizing

Table A2: Innovation basis and knowledge sources used

Firm	Innovation Description	Knowledge sources used	
		Within the sector	**Transcending sector[1]**
WCo1	Uniformity in veneer surfacing –design – repeatability – global markets	wood processing technology wood behavior science	mechanical engineering (cutting, pressing and processing chemistry (glues), material engineering and design, market analysis, business management, ICT, e-business
WCo2	Innovative process in MDF production Decrease in the Consumption of Glue and Wood (glue blender). Saving of 1.600 tons of glue and 4.000 tons of wood per year. The final product is friendlier to environment (less formaldehyde E1 and lesser quantity of wood per MDF cubic meter)	wood processing technology, wood behavior science,	mechanical engineering, chemistry (glues), material engineering, business management, environmental engineering, constructions
WCo3	Innovative production model a combination of Italian *distretti industriali* and modular design to cover distance disadvantages	Wood processing technology,	industrial engineering, logistics, cluster management, mechanical engineering, automatization
WCo4	Innovative sawmill (sounded almost a contradiction in the Greek traditional woo processing environment. In parallel for more innovation, exploitation of biomass from wood and agricultural residues • Utilization of wood residues for solid fuel production • Utilization of wood industry waste for innovative gluelam production	wood processing technology, wood behavior science,	mechanical engineering, chemistry (glues), material engineering, design, marketing, business management
WCo5	Use of lightweight paper honeycomb panels[332] in furniture manufacturing	natural and artificial wood processing technology, furniture manufacturing,	Polyurethane reactive (PUR) hot-melt adhesives technology, composite materials processing, honeycomb technology.

[332] The innovative product is a modern wood board material low in weight and with great stability, which allows unlimited design combinations. It is manufactured by a main cardboard honeycomb core paper and it has chipboard surfaces in its both sides, which are coated with melamine or veneers. The use of honeycomb paper in the middle layer of the board for the specific

			Mechanical engineering, marketing
WCo6	Innovative plywood processing (stitching) for higher quality products	wood processing technology, wood behavior science,	chemistry, mechanical engineering TQM, marketing, business management
WCo7	First to produce wood pellets in Greece (exploiting Italian patent)	wood processing technology,	Mechanical engineering
WCo8	Novel box-concept, CIM in kitchen industry in Greece with innovative multi-machinery in whose design and realization participated the Entrepreneur - parameterization in the furniture industry in coordination with design in order to combine custom design with high productivity and flexibility	wood processing technology, wood behavior science,	mechanical engineering ICT, parameterization, material engineering and design, market analysis, business management, industrial design, creative design, automatization, CIM, programming (software, machine programming), logistics
WCo9	WPC production line -product's trademark	wood processing technology, composite materials behavior, profile design, , Core know-how from Strandex (WPC technology),	knowledge on polyethylene and recycling, chemical color technology, control methods, extruding technology, molding technology, constructions and machine installation, process methods, customer training, marketing. (knowledge bases are well out of the company's core knowledge bases and competencies - a furniture maker)
WCo10	Building a totally ecological image around the company extending to R&D on all natural sources for mattresses and linen (absolute ecology all along the value chain) - use of unorthodox methods in marketing and R&D	Application of eco-production methods (e.g. the purity % of natural rubber is 96%, a WCo10 achievement).	all about the phenomenon of sleep, all about a variety of natural products and ways of treatment, strong marketing management
FCo1	Stuffed products with cheese from pure Greek agricultural products / Further differentiation with customization of tastes and addition of exotic agricultural products.	Food processing and packing technology (new techniques, machinery invention, cooperation in new packing methods), New & extended features of conventional agricultural products adding value,	chemistry, product design, marketing, mechanical engineering
FCo2	Use of hydroponics in cucumber cultivation.	Geoponics, hydroponics, specific product planting	Engineering, electronics and ICT, management skills, necessary for the maintenance of favorable condition inside protected structures.
FCo3	pasteurized whole egg, yolk, egg albumin and relative products	Egg homogenization – pasteurization, advanced quality control, Food chemistry, Food processing and engineering	Acquaintance to the use of the specific technology / chemicals for cleaning /practical technical knowledge on the repair and parts replacement of equipment
FCo4	chocolates with natural sweeteners for quasi -pharmaceutical use, organic products -first to propose chocolates in drugstores	Food technology (e.g. chocolate and sweeteners technology and science), plant technology, (main =glycemic index, sugar-free), organic foods	Mechanical engineering, design, environmental engineering, ICT, information on dietary and medical advice (in general and for special groups), nutraceutical parallel products, business management. *"We became engineers, food technologists and*

panel manufacturing, results in presenting the product a better relation between mechanical properties /weight. Former uses were limited in partition walls constructions, for sound isolation and thermal ones, shop fitting interior design and trade fair furnishings; new ones extend to interior doors, tables, shelves, home and offices interior design, partition walls constructions, for sound isolation and thermal one.

			designers".
FCo5	White wheat gluten free bread which would resemble normal conventional bread	General food technology (e.g. knowledge on the properties and potential of semolina and wheat to the use of biotechnology and food technology), geoponics and contract agriculture,	Biotechnology and biochemistry (plant bioactives; antioxidants and ageing; dietary fiber, functional starches; functional lipids; functional food products; molecular nutrition and other relevant aspects of disease prevention and treatment), conventional organic chemistry, mechanical and chemical engineering, industrial design, knowledge exchange on a constant basis with a Greek automation company, economics and marketing.
FCo6	Development of innovative parboiled rice patented process, knowhow and innovative technology: continuous cooking.	New scientific fields in food technology, geoponics, contract agriculture (a knowhow transfer on agricultural issues e.g. seeds, soil and water tests etc)	Chemistry, pharmaceutics, biotechnology and biochemistry, Environmental and Natural Resource Management, logistics, mechanical and chemical engineering, energy sector, economics and marketing.[333]
FC7	Innovative gourmet dairy products	Dairy Science and Food Technology, starter cultures, probiotics, cheese science and technology, primary production,	thermal processing and modified atmosphere packaging and labeling, health information including reference to allergy and food intolerance, botanology, mechanical engineering, marketing
FCo8	KI revitalization of a bankrupt company 2000 and innovative fruit juice production in 2004	Dairy Science and Technology, Pasteurization, Microstructure of dairy products, Animal Health and Animal Welfare, Animal Feed & Veterinary Pharmaceuticals, Microbiological hygiene management, Advanced quality control, monitoring of nutrition-related scientific issues, juice extraction, preparation, pasteurization, bottling, quality control, equipment and process technology, process automation and integration engineering.	Special technological and scientific aspects of processing, packaging, storage and distribution, stretch blow moulding for PET bottles - acquisition of both equipment and know how
FCo9	Production of gluten free snacks and food products based on cheese	General food technology (e.g. cheese, types of flour, additives, modifiers and starches), gluten intolerance.	Biotechnology and biochemistry (plant bioactives; antioxidants and ageing; functional starches), conventional organic chemistry, mechanical and chemical engineering, industrial design, branding, economics and marketing.
FCo10	High quality production of a range of authentic Greek Mediterranean products consisting of both innovative value added recipes and traditional ingredients/ in the international markets and Greece.	Super-High-Density Olive Production, Master Milling, Olive Oil Marketing and Olive Oil Sensory Evaluation, oil chemistry, organic olive production. Food safety, Waste management	Branding, marketing, packing, design, network distribution building, Production control, sensory evaluation, culinary application, marketing and technical communication

[333] The sectoral knowledge base is enriched with scientific knowledge and new technology knowhow. Although the patented knowhow has not been diffused within the sectoral knowledge base till now, there is an advance in the field of rice technology due to the academic publications of the Universities and of Mrs NK, the chemical engineer, Head of R&D Department of the FCo6 as well as publications in the context of the research projects that have been subsidized as referred above.

TCo1	Exploitation of cutting edge technology (some parts of which developed by own ideas) which are the basis of working with innovative high-tech yarns, fabrics and innovative dyeing – finishing and treating elements The newly established plant starts by using of a process for finishing and treating textiles with skin-care oils and emulsifiers, patented a year before.	Textile Processing involves study of chemistry and manufacture of fibers, their chemical processing such as bleaching, dyeing, printing and finishing.	Further study of chemistry as well as application of various kinds of chemicals, dyes, thickeners, and finishing auxiliaries, green chemistry, biotechnology and nanotechnology with special reference to chemical processing of textiles,. mechanical /electronic engineering
TCo2	1998: Introduction of new products with innovative characteristics and a suitable flexible model 2004: introduction of a new product category the bulletproof vests and helmets and initialization of e-commerce and B2C.	technical innovative fabrics, textiles, technology acquisition for flame retardant compounds for cotton, polyester, polypropylene and acrylic fibers, l	membrane technology, technology for durable waterproof protection ("waterproof laminates"), design, ergonomics, production management, logistics, antiballistic technology, composite material technology, plastic deformation technology, operations management, marketing, e-commerce
TCo3	Innovative dyeing method based on one and/or total piece dying with ecological processes and by combining the production and usage of biodiesel under green innovation. TCo3 was the first totally and clean energy producing dyeing plant in Greece with piece-dyed products.	The knowledge bases of TCo1 and TCo7, (at sectoral level)	chemical engineering, refining science, biodiesel science and technology (industrial process technology used for biodiesel production including consideration for quality assurance and subsequence analytical methods), sustainability, performance and environmental issues of biodiesel production
TCo4	Exploitation of cutting edge technology for differentiation and high value products in finishing and treatment elements.	Textile Processing, chemistry and manufacture of fibers, chemical processing such as bleaching, dyeing, printing and finishing, application of various kinds of chemicals, dyes, thickeners, and finishing auxiliaries, fabric and yarn quality control (physical properties (dimensional stability, width and weight, spirality, pilling, bursting strength, extension and recovery) and color-fastness	Green chemistry, biotechnology and nanotechnology, Mechanical /electronic engineering, design,
TCo5	Development of an innovative marketing channel; hybrid system of corporate and franchise sales shop incorporating the benefits of the two models in an effort to eliminate risk and trouble. The achievement of zero stock (at least in some of the shops), the better distribution of the collection pieces	Fashion design	continuous shop portfolio management, organization and strategic management, supply chain management; logistics, inventory management, network management, public relations, operational information system installation and management, development of a pan-European culture and skills to negotiate
TCo6	Exploitation of cutting edge technology for differentiation and high value products and production of innovative products (in cooperation with raw material suppliers)	ginning and spinning technology, innovative compact technology, fiber technology,	agricultural techniques and processes, mechanical / electronic engineering, logistics and marketing
TCo7	Exploitation of cutting edge technology (some parts of which developed by own ideas) on denim dyeing – finishing and treating elements. innovative design based on special denim treatment, branding and fashion making and a turn to a more fashion and	denim production technology, denim manufacturing methods -assembly lines, denim innovative treatment and finishing methods, washing-prewashing processes, design, quality	enzyme technology, organic waste treatment, chemistry

	innovative image that paid back after 5 years by exports to major customers in 11 European countries and a significant increase from 8 (1997) to 31 million Euros (60 million for the Group)	control, state-of-the-art techniques in denim fabric design and manufacturing techniques, technical knowledge of modern denim manufacturing and garment finishing	
TCo8	Design and mass customization production with all parallel changes (from 30 to more than 8000 codes, new production strategy, ERP systems, development of design competencies) new marketing etc.	Design, textile and fabric technology (fiber, spinning, treatment etc), chemistry,	ERP systems, logistics, marketing, sales, new administrative models
TCo9	R&D –based production model (from mass production to mass customization) - Pioneer in Greece, among pioneers in Europe.	Denim technology: denim innovative treatment and finishing methods, washing-prewashing processes, enzyme technology, design, knowledge on apparel industry	NPD, production (mass customization), logistics, marketing and customer satisfaction, management,
TCo10	Design - creative innovation (fashion industry)	Mostly design, fabric properties,	shoe manufacturing, marketing

Table A3: Repertoire Building: Dimension of Bricolage capability

	Environment for problem-making	**'Resourcefulness'**	**Creative Resource Recombination**	**Interactive learning (Dynamic 'knowledge puzzle')**
WCo1	*Problem making*: a need for excellent veneer surface, the need to unfold technology without paying the long standing R&D of the German company, design development. Solutions to be found for: Financial resources limited - innovative technology too expensive. Solutions: turn to other manufacturing solutions and to specialization and tailor -made products	technical assets, social capital and networks, capabilities to acquiring (purchasing) resources, developing resources internally, experience, skills major lack of : private capital, physical capital His former experience on veneer processing serves as a good basis.	Ways to overcome key resource disadvantage: the ***combination of :*** experience in veneer stitching, know-how of material providers, technology development together with machine suppliers (networking) , design by designers who further contributed to the opening of the new niche market by inserting the new products in their projects **to overcome technology and financial constraints** (Creative knowledge recombination). Starts by co-producing as a sub contractor conventional products in order to make the excellence in quality show - Fine use of knowledge developed and network	***Hunt of knowledge*** The E. visits international fairs where innovations are presented: The idea came at the Cologne wood and wood products fair). Veneering, the innovative technology a puzzle of 3 parts (machinery, production methods, know-how) combined mainly with raw material Learning comes from non-direct producers, material suppliers (e.g. the fleece and veneer pieces), wood machine manufacturers, experts. Engages translators / repeated visits. He is trained in their factories: Visiting and training in the manufacturing and the non competitor company, the veneer suppliers, TEI, designers. This "hunt" is done twice in two months time. Proximity: The E is present at the design and construct of the machinery ***Continuous learning:*** The E. learns to enter all parts of veneers in exclusive designs. Ecology turns him to further specialization and differentiation. There is an embedded culture of continuous

				learning - the E. develops skills on the potential uses of the innovative production technology by combining knowledge on innovative material, design and decoration trends.
WCo2	*Problem making*: the most modern, innovative and known MDF producer Solutions to be found for: verticalization, differentiation, excellence, revitalization of an ailing company Success in changing a common need of MDF to high value product with a lower cost, an innovative process method and world-level communication.	Rich physical resources such as human capital, available materials and technical assets, social capital, firm's reputation and networks (mainly a strong team of world leading manufacturers), capabilities to acquiring (purchasing) resources, developing resources internally, experience, skills, firm processes (mainly try and error processes and erection routines) knowledge pools (engineers, local construction companies, TEI knowledge), political support	The Es manipulates resources (old equipment sold) –financial capital enables the participation of almost 20 manufactures, constant try and error efforts lead to innovations, Excellent use of social and business network, combination and exploitation of knowledge pools (engineers, local construction companies, TEI knowledge, political power etc). He believes in close co-operation. ***New products based on existing technologies***: based on conventional science and technology WCo2 managed to cut down costs dramatically without negative impact on quality.	***A longstanding hunt for knowledge.*** A long search of new technologies **(25 years)** in trade shows, TEI conferences and manufacturing and competitor companies (former suppliers) - mostly personal visits to leading manufacturing companies worldwide with a team of engineers (as a customer). The E. uses the market research routines of the mother company to identify new market needs in Greece and innovative trends. Knowledge collected is broad and versatile: from wood and wood technology to innovative wooden products and strategic management gained mainly outside Greece. ***Synergies and interactive learning at all stages:*** exchange of knowledge at the erection stage where actually new technologies are tested.1) Uses experts as consultants by engaging them fulltime for certain periods in order to visit trade shows and companies 2) He is constantly kept informed on all developments in wood technology. All kinds of knowledge are engaged: scientific, practical, tacit, formal or informal, comprehensive or partial knowledge. "Learning came mostly by manufacturers and TEI".
WCo3	*Problem-making:* A clever idea to establish a plant with limited resources but independent from Greek sub producers. The E. located weaknesses of Greek production, superiority of Italian products and the usefulness of clusters (the % of kitchen manufacturers who know what a cluster is very limited). – They want to produce "Italian products in Greece" The Es seek to be engaged in complex and unfamiliar situations: "*vertical but… not vertical production in Greece" "being in a cluster in Italy" in order to "produce in Greece in the Italian way".*	Limited financial resources, sufficient networking pool: TEI, Italian partners, customers, existing market, existing team to work, experience. The entrepreneurial team knows well both the final product and the market as well as the differences among conventional Greek construction and Italian superiority when referring to SMEs.	Flexible use of knowledge and acquaintances: regarding machine and material –modularity -Knowledge and experience on kitchen market and the structure of Italian supply chain. *Remodeling t*akes place through discussions (distance brings up the problem of production integration; this creates modular design -novel production technology –IT engagement). A constant restructuring of the supply chain due to the changing role of the entrepreneurs (from clients of ready to install kitchen furniture to members of kitchen furniture industrial district).	***Hunt for knowledge on:*** cluster culture, modular design, relative innovative technology that could satisfy the new model (production technology, IT, modular design, and logistics). All these pieces coordinated for distance problems to be solved and quality final products (e.g. montage should enclose no danger of non compatibility), and due time delivery to be achieved. ***Interactive learning and synergies***: with manufacturers, TEI members and cluster members. Constant learning on technology, and cluster culture issues. Mostly tacit and practical knowledge in both formal (through contracts) and informal ways in Pesaro with circulation of production and application knowledge and cross fertilization of small innovations. Pieces of knowledge regarded through physical implementation: manufacturing technology for the production line and innovative process technology (modularity, flexibility, efficiency). Flexible automatization technology and knowhow (complex and customized production systems including organizational

				solutions) by joint development between company and equipment suppliers
WCo4	*Problem-making:* A modern sawmill would be enough for the conventional entrepreneur. Still, the two brothers target innovativeness exploiting all possibilities or weaknesses - and that means research: waste use by adding value through gluelam and energy production, ecology, recycling, unique products. They raise the bar in terms of certification, quality, and eco-applications since traditional solid wood as conventional raw material has limited value adding potential.	Adequate physical resources such as human capital, available material and technical knowledge, social capital, firm's reputation and networks (at national level), experience, skills, Shortages" technical assets, financial capital, specific knowledge	A flexible use of existing knowledge, experience and contacts to produce new knowledge (through research) exploiting a) investment on modern machinery through subsidies, b) K-cluster c) acquaintance with TEI experts and promotion channels Informal and formal ways of establishing collaboration help a concurrent and fast development of technology, research, NPD and future strategy	***Hunt for knowledge on:*** wood processing technology and knowhow, IT, composite material scientific knowledge and research. Synergies with TEI, manufacturers for efficiency improvement, equipment modification and experimenting, innovative uses through gluelam and energy and ecology issues. Marketing was a further piece of knowledge that added to the puzzle in order to start market networking. Networking with customers improves NPD directions (e.g. with frame makers and then the focus on architects) Company's establishment story (as well as its course since 2003 and future plans mentioned) reveals a culture of ***continuous learning*** and discovering through scientific - technical and practical knowledge.
WCo5	*Problem-making:* "Something innovative in furniture". The Es question the need for novel materials in furniture with new characteristics and possibilities. (Note: However, they seem not to pose questions on applicability, supplementary material, communication of the novel product and customer (furniture makers) training – these appear to be major weaknesses) Result: "the Greek market is very difficult. It does not accept such products easily..."	Shortages in knowledge, physical capital, human and social capital, and weak ability to reach information combined with weak mechanisms for resource-seeking, learning and networking- Dependence on one major customer who refuses to offer any help in research or problem solving: "When asked to support us in order to develop the knowhow, they refused".	Constant try and error for 2 years using panel maker's knowledge, glue-suppliers knowledge and customer's denial to help (*"We decided to experiment with the changes for a year"*). Flexible use of resources (machine, material, know how) and synergies (TEI) to reach final product in order to fit to Greek furniture industry demands: *"We could not afford money for development and knowhow. Dr Nt (TEI expert) helped us many times without a penny!")* Friend-based pilot uses of the product in furniture manufacture and promotion. Resource recombination targeted mainly in solving problems and defects.	***Hunt for knowledge:*** Mostly technical and practical, but limited and insufficient to make a dynamic puzzle. Mainly Internet searching and personal contacts: the Greek supplier (Mr N.) who is keen to promote the honeycomb (*"we made together a patent on the material processing"*) and TEI (due to personal relation and the will to help without charging). Supplementary material knowledge and foreign supplier contacts not well captured in spite their significance for the new product (e.g. glues, strips (made by only one European company - the specific type honeycomb inventor). Many problems were due to ignorance (e.g. they had not studied the new product behavior well known by the inventor). Learning is not based on a dynamic progress basis but as a remedy to problems A reluctance of further adding knowledge or developing skills***;*** instead they "hang on" others and let them produce both knowledge and business concept. WCo5 offers all rights to its strongest customer, a large group which does not seem to be the best way to market. The new venture expected support on R&D matters which never came.
WCo6	*Problem-making:* A minor in-house	Pre -existence of abundant	Experimentation and learning by trial and	***Hunt for knowledge***: not dynamic and based on WCo6's core

	problem regarding stitching quality and wasted okume strips was brought up to a major strategy problem. The Es question the potential of advancing quality by innovative processes in order to excel further and differentiate their products at global level. *"There was wastage of really expensive wood in the production of deroulage veneer. Trying to find ways to avoid it, we looked closer to stitching and we chose innovation; it is the most expensive way but it would give us world leadership in quality"*	tangible and intangible assets and resources: core knowhow, technical assets, knowledge, raw material, financial and human capital, strong extensive networking cycles, well-developed firm processes and structural mechanisms, ability for developing resources internally, firm's reputation among suppliers and/or customers	error through a continual process of testing and permutation; existing resources manipulated using mostly cutting edge technology, the existing knowledge and experience and new knowledge assets. A multidimensional interaction but only within sectoral borders (e.g. different machine manufacturers, changes in process technologies, different wood processing, new specifications). Contracts with manufacturers and laboratories (formal) and customers (informal)	strategy (best quality of marine plywood in the world). Hunting mainly through trade fairs and close cooperation with machine manufacturers who hold the latest technology. Supplementary knowledge is gained through installation and pilot production but also by the quality control labs and first pilot uses (synergies). The "***pieces" of knowledge*** refer to technological, practical but also scientific knowledge (on technical specifications, material behavior, wood processing). Consistent with the company's culture experimenting is a prerequisite in applying new process technology. Training and learning (both formal and informal) at all levels: e.g. suppliers who train the engineers in the plant. Training is then established.
WCo7	*Problem-making:* The E. poses the problem of a unique business idea within the wood value chain. (Note: However he lacks the ability to pose questions to form the problem and rests on the technology suppliers)	Shortages in almost all types of resources such as physical capital, human and social capital, existing knowledge of the sector and the individual activities and ability to reach information combined with weak mechanisms for resource-seeking, learning and networking	The E. prefers key-turn solution and technology suppliers decide about the new venture's strategy. No resource recombination or flexibility evident.	**WCo7** contented itself to the patented technology initially adapted to local conditions (by the technology provider) without seeking any new skills, capabilities or novelties to add and incorporate during the starting stage. **WCo7** showed a ***reluctance*** of further adding knowledge which resulted in many problems to be confronted at all levels and activities.
WCo8	*Problem-making:* A young man with many alternatives (family well-established company, alluring job offers). The problem he creates regards the reaping of mass production benefits in a model of flexible kitchen manufacturing to address high income customers in Greece. Questions are mainly of technological nature (e.g. the parameterization of functions), the lack of relevant machines, the building of the process model	Significant entrepreneurial milieu (social capital), PhD education, multinational experience, i.e. knowledge (both academic and practical), financial support (mother), "a plan of action" (the "boxing" concept, CIM introduction, interaction among design-materials-innovative production method), Capabilities for acquiring (purchasing)	The E. acquires flexible resources (knowledge, equipment, capital, contacts etc). Dynamic, bilateral interactions among strong networking cycles (manufacturers, suppliers), external data, capabilities (design, IT, production technologies, networking) and the market especially in case of strong ties (e.g. common project of high interest with machine manufacturers, the one with the programmers etc. (reminds Ciborra). IT sector engaged as core and not just supportive. Combinations and contacts with leaders when no direct	***Hunt for knowledge***: The E. selects knowledge by all contacts made and new networks on the basis on his personal knowledge of industrial engineering, experience on carpentry from the family company and a dynamic way of exploring all relative sources through running common projects (to build the "multi-machine"). Synergies for novel computer programs, working with material suppliers such as Egger and the introduction of corian for solid surface kitchen (*"I was the first to bring corian in Greece"*) (Note: which needs a very special treatment and required technical and scientific knowledge), develops *bummerang* (Note: **not** boomerang) systems (totally unknown in Greece) in order to implement his initial vision of total verticalization on a CIM

	It is almost the same problem as WCo3's but the Es use different ways of solving. "Boxing" (casing) concept was created by the E. who saw kitchen manufacturing out of a totally new option and led to an innovative way of production which encompassed manufacturing, industrial design, programming, material selection / handling and new production managing knowledge.	resources, developing resources internally	solutions can be found (*"I could find no technology to combine the parts of the equipment. Then I turned to Homag"*)	basis under his own concept of boxing. Initial reactions sometimes negative due to the novelty of machinery (the joke on potatoes and CNC in German). ***Learning*** occurs by direct involvement, through interactions with manufacturers and suppliers (*"I myself designed and manufactured in specialized companies specific machinery to suit my concept; parameterized little things but flexible to support the production I wanted"*) in a perfect improvisational way e.g. due to arising needs or improvements or links among novelties that emerge when some of the plan's components are set in place; the E. benchmarks leading design companies. Learning appears as a continuous and highly dynamic process at least for the first years although processes of new technology selection and overall improvements are incorporated into WCo8's culture
WCo9	*Problem-making:* Real problems (wood shortage and wood residues volumes) constitute the basis for a famous furniture manufacturer to question expansion, out of its activity borders, and engage in the R&D and production of an innovative raw material. The decision demands high quality of specialized knowledge, an entirely new approach of recycling materials plus wood, new plant, new value chain and customer information and training. The extreme wood shortage in 2015 justifies further the new idea	Significant knowledge resources (e.g. wood processing and relevant market - extruding technology through the executive). Abundant financial, human and social resources, strong networks, reputation, power in the wood products market, existing team to work, well-developed capabilities for acquiring and developing resources, significant relevant structural mechanisms.	Resources act as orchestrators for: further knowledge generation (beyond the one supplied by the American company) and trial and error processes (e.g. color, profiles, material ageing). Flexibility and working out of routines, budgets and estimations was crucial for the realization of the concept within a short time (less than a year) process. Executives and E. try to capture as much extensive knowledge around WPC as well as ways to collective activities.	A product and a technology completely strange in Greece that causes in the early 2000 nothing but mistrust. ***Hunt for knowledge***: Decision for production starts from thorough information on the uses and advantages of the material and stretches to knowledge on the product's composition, process methods, know how, complexity , forming, etc. through scientific papers, internet info and product cannibalization. Core knowhow from Strandex but development of ***interactive learning***: bilateral knowledge transfer and development of knowledge on profile design, polyethylene and recycling, colors and their mixtures, as well as installation technology, expansion of knowledge on wood processing and extruding (an experienced director). "*They lagged behind in knowledge on the Greek environment – the Mediterranean" This was the main reason for being collaborators and not a simple supplier-customer relationship"* (Note: environmental conditions have a significant impact on the material; A Mediterranean climate requires different characteristics from the rainy weather typical

				of the Atlantic; CORNET research project (2006-2009)). Learning[334] takes place continuously from the design of the plant (where company executives demanded and succeeded to participate), constant visits to the American company. Matching with local companies and technology transfer for supplementary materials (some e.g. recycling plastic did not work) and product users (for installation - e.g. product behavior unknown in expansion - construction). A well organized process of acquiring new knowhow and adapting technology during project and equipment development, the erection phase and the pilot / normal production (*We had a team of 4 people in USA for a month. Then they came in Greece for a month to solve the major emerging problems… We were together in the production line development. There was a continuous flood of technology and knowhow. We worked together for a long time* (Note: with the American team).
WCo10	*Problem-making:* The E. after his first success to go against the established opinions on mattresses and resisting the first objections (due to the *"total lack of awareness on the sleep phenomenon and the absolute contempt of mattresses as products directly related to our health"*), tries in 1998 a wider ecological and nature-friendly approach at a global basis using unconventional methods. In answering the question on fitting with the market demands, he answers that his business idea fits with nature and he is the one to define the market demands for those who accept to be educated. *"We*	Significant accumulated experience on mattresses and exploitation of eco-materials. Satisfactory financial, human and social resources, existing networks (suppliers, promoters, ecology-supporters, political world etc), emerging reputation, well-developed capabilities for acquiring and developing resources, significant relevant structural mechanisms. Existing technical assets and potential for further development. Extraordinary passion.	An exemplary case where the E. reworked pre-composed material, plans and designs in relation to unanticipated ideas conceived, shaped and transformed under the special conditions of widening raw material range (*"We thought of an entire ecological business with 100% natural materials and 100% natural ways of production*). Combination regards material and processes, networks and promotion, social capital and message of ecology communicated to strengthen the unconventional image (such as rebranding, bartening, promoting a holistic approach of natural life, opening unconventional corporate shops abroad and promoting products in unusual ways).	***Hunt for knowledge***: the E. started by collecting pieces of knowledge on mattresses, physiology and anatomy secrets and natural materials to make the "ultimate mattress": *"In order to answer our questions (see in Problem making) we visited all trade shows, searched in journal and science, asked in Universities, big companies and experts and all kinds of knowledge sources. We travelled to Sri Lanka to see in person the coconut palms –its cultivation is science there!"* In order to build the global image and his innovative business model he collects knowledge on ''how the firm will select its customers, define and differentiate its offerings, define the tasks it will perform itself and those it will outsource, configure its resources, go to market and create utility for customers" (according to Slywotzky, 1996). All concepts of *natural life* are used as the cohesive force for synergies and micro-processes developed (e.g. hotels selected, partners around the world, new natural material suppliers, R&D on natural materials, production technology with energy shaving

[334] Το είχαμε οργανώσει πάρα πολύ καλά. Όλος ο χρόνος που ήταν αφιερωμένος στην ανάπτυξη των μηχανημάτων να γίνει όλα αυτά συνεχώς περνάγανε οι εμπειρίες της τεχνολογίας και της τεχνογνωσίας. Έμειναν οι δικοί μας κι εγώ στην Αμερική και μετά ήρθαν κι αυτοί εδώ δηλαδή δουλέψαμε μαζί πάρα πολύ . Μάθαμε κι όλη τη συντήρηση και τα πάντα. Εκεί έχουμε προβλήματα που μπορεί να ανακύψουν – άρα έχουμε συμβούλους, κάνουν ελέγχους βάσει της σύμβασής μας κάθε χρόνο

	tried to delineate our product: What does "good mattress" mean? What must it contain to be "good"? Which is the difference between an orthopedic and an anatomic mattress? Why is there no mattress in the world whose cover to be able to get washed? How can we manufacture a mattress in the absolute eco-way? We had to get answers to many questions as you see!"			and environmental care, quality and EFQM etc). Pioneer in many ways (e.g. the first mattress with zip, the first mattress company to be certified with ISO 9001:1994. Awards support the image and attract interest and knowledge. He admits that he is a knowledge hunter ("*There are a thousand things you don't know in the beginning*"). ***Continuous learning*** through any possible way during the period of the new business model building: quality, social responsibility, business excellence, eco-production (*"If you try to develop mass production in the eco-way, you really feel alone…")*, innovative marketing. According the E. there is a great need of a wide range of skills and knowledge since *"whoever knows only about mattresses, actually does not know even mattresses*". Cross-functional skills are evident on the charismatic E. but they are also detected to be embedded in the organization.
FCo1	*Problem-making:* The Es search for an innovative idea in a known field. They create two categories of problems: a technological and a market one, in order to create market niches at world level. Indicative questions posed: the product development and process, the gourmet product communication (there was even a problem with the name – of the innovative product group), ways to capture specific tastes (per country) and packaging. "Then we had: 1-The Idea 2- How to sell 3- How to communicate it 4- How to produce which was the most difficult part for us since there was no relevant technology.	Abundant social capital and networks, capabilities to acquiring (purchasing) resources, developing resources internally, experience, skills Satisfactory financial capital *Knowledge at hand:* accumulated knowledge on food technology from the family enterprise: good market and supplier knowledge, utilization of food technology techniques, food marketing knowledge from the MSc education.	The business networking with the food industry, due to the previous industrial activity of the family, enabled co-operations in equipment, raw material supplies and establishment processes. We can observe an excellent and flexible use of all resources at hand (capital, knowledge, contacts) in order to reach new resources and a constant *crescendo* in their exploitation (adding new product in a high rate, adopt to foreign tastes, improve packaging, enrich targeted market groups) all through try and error (both in lab and markets) in order to best fit with demands	***Hunt for knowledge***: The Es after forming the initial idea: study a lot, search the internet, consult an expert, and contact a chemist (who they later recruit). Mr D. travels a lot to explore tastes (mainly in Europe and USA), reads recipes from all over the world. Suppliers and manufacturers are engaged to offer knowledge, chefs advise the Es through their books, and chemistry is engaged (e.g. the need of the starch for the filling). The puzzle is rather complicated-new knowledge is sought for: production, marketing, tastes, packaging, health issues for different countries (e.g. USA), novel production technology and even new machinery. ***Continuous learning:*** a wide range of cross-functional skills, competences and extensive knowledge on a variety of subjects is needed to achieve the desired results and fill the gap between vision and reality: equipment specificities, sanitation and contamination techniques, quality controls, waste management, different treatments and ingredients according to laws and norms, packaging difficulties for both practical and aesthetical reasons that result in an innovation, development of design capabilities, working within channels and giant foreign chains etc in order to turn the vision into an efficient productive enterprise.
FCo2	*Problem-making:* Thinking of "a	Pre-existing resources: Plot,	Geoponics, hydroponics, engineering,	The initial idea was intensive farming (greenhouses). The idea of

	step beyond the conventional ways of land cultivation" Mr D. thought of intensive cultivation (greenhouses). Yet, that was not enough and this was the core problem; how to add value. Hydroponics was an answer but a spring of problems too well located by the Es: an entirely unknown method in Greece, known only by the theoretical approaches of University professors – on the other hand application in North Europe could not be copied in Greece. Questions on institutional and cultural demands such as issues of ecology, safety, energy saving etc.	accumulated knowledge and experience on agriculture and the specific (final products) market, contacts, adequate financial capital (high initial capital, high risk) lack of : physical capital, specific knowledge	electronics and ICT were some of the knowledge bases the 3 partners had to become familiar to and mix in the most proper way in order to run a viable innovative enterprise in the agro food sector. Accumulated knowledge and experience combined to the existing contacts and the ability to network provide solutions (e.g. they turn to Spanish equipment suppliers and Italian installation suppliers and cope with the technology transfer and the emerging problems). .	hydroponics impressed them but they were also totally ignorant of it. ***Hunt for knowledge***: "Hunt" for information and know how on the method, technologies, search for science (scientific knowledge on the cultivation derived from University and relevant consultant), and practical knowledge such as production technology and installation (from Spain and Italy). *They must also embrace the relative culture; adopt a different way of thinking*. Difficulties arise in what seemed to be "simple matters" such as seed planting (which they learn the hard way), ingredient analogies or diseases. Knowledge comes through multiple directions and covers production, organization, culture, IT use, market penetration. Pieces of knowledge are collected by external collaborators, literature, experimenting, suppliers and competitors (in a way) ***Continuous learning:*** There is much disembodied knowledge flow: through all skilled personnel that were trained as well as knowledge exchange with experts, agronomists, automation and energy saving equipment suppliers and supplier companies and embodied knowledge flows (through specifications and machinery)
FCo3	*Problem-making:* The 2 Es search for an innovative idea that could make them leaders in some Greek market sector. The idea of the Italian friend was exciting but they knew (they were conscious of the fact) they would enter a KI area with almost nothing at hand but just their experience in (common) entrepreneurship and the promises of 2-3 friends. They secure the gap (Discussions with friend chemist shows that Greek market is ready for the product since imported quantities regard inflexible big volumes, time would be their advantage, and legislation supported their choice). Direct confrontation of problems	Existing resources: mainly social capital and adequate (but not abundant) financial capital, capabilities to acquiring (purchasing) resources, developing resources internally Lack of knowledge of the specific products (the whole value chain)	Turnkey solution was an excellent choice considering the Es' ignorance of the sector, (the manufacturer provided even the building designs and blueprints) and further technical support. However, it was a fine combination of social capital, capabilities to acquiring (purchasing) resources, and capabilities of developing resources internally that led to the acquaintance with the technology (Italy), the transfer and the further networking with experts (University of Thessaly).	A case where ***knowledge was really hunted*** starting from practically nothing (complete ignorance of the technology and the sector - Entrepreneurial experience in irrelevant fields). Four months studying and searching in order to understand the field. The Es visit the two relevant companies in Italy to get familiarized (*We stayed 2-3 days; you know for the basics; important things that would come our way*). Training by the Italian manufacturer (practical knowledge). Acquaintance with a University Professor (introduced by a friend) in order to solve quality problems – beginning of a long lasting collaboration on quality, improvements and innovative products. ***Continuous learning:*** Learning comes through formal ways e.g. manufacturer and the professor and informal ways such as the support of the friends (food technologist, the Italian) and of course internet (scientific knowledge on the method, European egg – producers were found by internet search etc) and personal study on food processing and engineering and mainly egg pasteurization. Knowledge is also developed through solving common problems (e.g. Product quality, maintenance and

	and obstacles (e.g. the egg breeders' war, the technical problems etc)			breakdowns), People with specific knowledge are engaged in crucial areas (expert, machine shop, cooperation with *Lever*). There is much disembodied knowledge flow (through trained personnel as well as knowledge exchange with experts, University, equipment suppliers and supplier companies and embodied knowledge flows (through specifications and machinery).
FCo4	*Problem-making:* Conventional chocolate quality turned to "problem" in producing innovation ("*Otherwise we could not survive as an industry that we wanted to be"*) but that leads to the need of scientific knowledge. Financial resources limited to apply to foreign company for turn-key solution. Targeted market demands (diabetics, children) and search of natural sources (stevia, spirulina) form the technological environment of problem making. Packaging and communication constitute the market problem environment.	Former experience on chocolate (handicraft production) serves as a good basis. There are no significant resources at hand such as technical, financial or human capital. However, there are capabilities to leveraging the acquiring (purchasing) of resources, capabilities for developing resources internally, experience, skills and passion. Social capital exists but it is rather mediocre.	Obstacles are surpassed by being flexible mostly in using pieces of the knowledge pool. Tailor-made plans and solutions, once mixture proportions and process decided. Exploitation of networks (customers, acquaintances). Creative combination of resources is evident in the description of interactive learning (next cell of this table).	***Hunt for knowledge***: Starting with study of stevia (source: internet) the Es understood the value of knowledge-based innovation. Co-operation with University professor for stevia and other herbs, with nutritionist for nutritional issues and study on medical value; introduction of the quasi pharmaceutical chocolate. There is knowledge developed on manufacturing and production technology and knowhow by many *try and error processes* Developing further design and promotion techniques around the idea of totally natural "home-made" attractive organic and semi-pharmaceutical chocolate. *"During the founding process we had to learn food technology, business management, design, and promotion. We became engineers, food technologists and designers. We would crosscheck internet sources with Mr L. (note: the expert) and mix up the ingredients. Then that had to be translated in continuous production (*Mrs. K) ***Continuous learning:*** on organics, new directions e.g. use of grape extracts, superfoods etc.) through synergies such as research projects and co-operations (all based on mutual trust). The company goes on collecting knowledge from variety of sources (e.g. packaging came through a discussion with a wholesaler and trial and testing by selected customers to decide for the use of transparent material ("*it gives a sense of luxury*"). *Starting with the conventional chocolate knowledge, the E. expanded knowledge on cocoa, sweeteners and other natural ingredients moving to more complicated areas of health and wellness, natural and organic sources, etc.*
FCo5	*Problem-making:* Entrepreneurs make problems such as "conventional products are not enough" or "quality is a must but	Pre-existence of significant resources: business and scientific networks, social capital, human capital,	FCo5 combines "Resources at hand" and develops certain capabilities for networking, collaboration, and effective knowledge transfer and knowledge	***Hunt for knowledge***: On purpose selection of integrated knowledge on production and quality of conventional flour, contract agriculture, flour and wheat technology in the beginning. Internet research to learn more about celiac disease

	still is not enough", "we seek innovation in the mature world of graining" The answer to such questions comes from a TV program on celiac disease and a phone call (someone asks about the existence of such bread). The idea creates a series of questions regarding scientific (development of the product, health claims), technological (production lines and process technologies) and market issues (communication and confrontation of final consumers' hesitation, suggestion for final products, target groups).	technical assets. The business networking with the chemical industry, due to the previous industrial activity. Accumulated knowledge on food technology from the previous enterprise, experience, firm processes (mainly try and error processes), and the ability to create knowledge pools. Strong capabilities to acquiring (purchasing) resources including knowledge, developing resources internally,	exploitation at a wide range of activities. Experimenting and cooperating is established in order to present new concepts in the market (e.g. biscuits and bars for travelers and athletes or appealing to children which presupposes the cooperation with biscuit producing companies). Wishing to keep the core technology secret, he whole process is broken in sub processes with different contractors both Greek and foreigners (instead of the easy turnkey solution). However, this choice demanded a further elaboration and combination of the resources mentioned and especially regarding knowledge. ***Indicative quotes:*** An excellent choice of an expert as collaborator: "Η πρώτη συνάντηση δεν είχε επαγγελματικό χαρακτήρα αλλά καθαρά ενημερωτικό αλλά από τα πρώτα λεπτά καταλάβαμε ότι αυτά που λέγαμε και οι δυο είχαν κάποιο ιδιαίτερο ειδικό βάρος. Τους έκανα κάποιες προτάσεις – αυτοί ήταν σε μια κρίσιμη φάση γιατί έβλεπαν ότι το κομμάτι των σιτηρών και των αλεύρων είναι κάπως χωρίς μέλλον . Γι αυτό ήθελαν να μπουν στα βιολειτουργικά για τα οποία ήξεραν αρκετά πράγματα και σιγά σιγά ξεκινήσαμε ένα ερευνητικό πρόγραμμα το οποίο το πλήρωσαν εκείνο" Dr K. "I think I could not say how much time we spent on it (i.e. literature research). The man-hours we devoted to study ... In order to find a component ratio and contact the	and then market research. Starting to think about the *technology*, they studied the existing literature, the Greek and international market on such products and they also collected all information that seemed important for the new market segment. Scientific knowledge comes by the University Professor (biotechnology expert) and his team (*"If but Mr K we would not be able to move on! Of course that was also the turning point for us, since this cooperation led to the further development of totally innovative bio-functional products". Mr T)* Experiments take place in both labs (University and firm). Knowledge on production technology / the innovative production methods (e.g. the different demand in water when separating gluten, a different type of rollers etc through synergies with manufacturers (T and engineers responses.) One can detect Knowledge on the properties and potential of semolina and wheat to the use of biotechnology and food technology, marketing, manufacturing and design through training, individual studies and efforts, co-operations with clients and suppliers and the build of a strong research team devoted to the company's vision. Knowhow transfer on agricultural matters (GMO, seeds, quality cert. etc), a knowledge exchange on a constant basis with a Greek automation company// formal and informal linkages to the manufacturing companies. Cooperation with pharmaceutical companies in marketing. Synergies through bilateral training, individual studies and efforts, co-operations with clients and suppliers and the build of a strong research team devoted to the company's vision. ***Continuous learning:*** Literature research engaged: Food technology and chemistry study -many research papers on gluten-free products but not on the specific subject. Literature research in combination with experimenting - expert gave a new direction to research. Sample tests and analyses at the first stage. At a second level, formation of final products (e.g. bread, cakes, pizza dough etc) with particular tastes, textures, colors and other properties. Technical staff training to take over the maintenance of the whole process equipment. Cross functional skills on business, production, marketing management on an advanced basis (not too simple for a conventional mill to move to that direction -

			experiment you may search and finally find nothing to assist you. And then you have to decide by yourself! The existing literature was at infant level" (a research member in the lab). Note: One should think about how introvert Greek companies of the food sector are.	changes are vital to organization and culture)... FCo5 invests further in process technologies, skilled staff and know-how, in order to improve efficiency and quality, raise productivity and enhance flexibility
FCo6	*Problem-making:* The new plant posed the problem of a challenging compromise: the old generation wanted a plant close to the best qualities of rice in Macedonia and for the increase of the company's productive capacity. The new generation bet on it in order to innovate shaping an entirely "high-tech" strategy for a very traditional product. ***First challenge***: start with innovation on rice process technology supported by relevant know-how and novel equipment (to fill gaps they have identified with the less turbulence (HORECA products) which they carefully try in the market and proceed). ***Problem set:*** Introductory innovations have to surprise while at the same time to be largely accepted to secure the avoidance of early death of the new venturing. The innovative framework would allow for research projects to be implemented. *The new generation's vision had a clear technological-scientific*	Significant "resources at hand": much accumulated experience and firm-specific knowledge on rice (It took them about 10 years (1990-2000) to collect scientific knowledge, diffuse it throughout the company and change the existing traditional culture (old generation) . Rich physical resources such as human capital, available materials and technical assets, social capital, firm's reputation and networks, capabilities to acquiring (purchasing) resources, developing resources internally, experience, skills, firm processes (mainly try and error processes and erection routines), knowledge pools (engineers, University, TEI), political support The old generation's experience and new generation's knowledge combined with absorptive	***New applications for existing technology*** (Baker and Nelson, 2005): FCo6 developed an innovative process technology (patented) by using existing technology. The establishment of the research laboratory and scientific personnel recruitment (New Product Development background with scientific personnel, a lab and knowledge creation on food technology). The establishment of close relations with universities The contract for the patented technology The choice of the core target group to supply the novel product Social capital, firm's reputation and networking support the choice of the place for the new plant and the persistence to local reactions and competitors' war. Experience, skills, and firm processes support the successful technology transfer and co-development and the innovative alterations to machinery, production technologies and market entrance.	***Hunt for knowledge*** regarding mainly new production methods and processes, food quality, specifications. Knowledge is gathered ever since 1997 (scientific world, contacts with manufacturers) and act as orchestrators for the rest resource environments (strategic place, constructions, local farmers, market channels, subsidies and capital, parallel research project etc) being used in a constructivist approach. "Hunting" included literature research, cooperation with the German leading company for the production line which included the built of a pilot line in the manufacturing company's installations, science applied to new experiments, sample tests and analyses at the first stage. At a second level, it included the formation of final designs and the search for supplementary manufacturing companies. *Synergies and processes of learning through co-operations at all levels*: - In 1997, they started investigating the new method with Mrs. NK, the chemical engineer as scientific champion - Later entered PAVET 97 the new plan in cooperation with a big German global leader in *continuous cooking* systems. - In parallel, the new plant is further equipped with modern technology quality equipment Most parts of the innovative plant are pilot-made and there is much knowledge exchange among foreign and local suppliers and customer - Through a self-funded research program with a professor of the Food Technology Department of Athens TEI (Technological Educational Institute) they

	orientation.	capacity		developed new control methods (e.g. aflatoxins HPLC). - At the same time another self-funded research is carried out on kinetics of rice and artificial aging. By the end of 2000 the new state of the art plant is ready, fully equipped, and innovative while a strong scientific basis has been created for further innovation. The new plant is a result of a dynamic puzzle of knowledge on process and product technology, quality control, automatization etc. which should fulfill both productivity and innovation requirements. One can recognize a constant bidirectional knowledge flow of both embodied and disembodied knowledge through skilled personnel, training, plant and equipment designs and descriptions, consulting, mutual experimenting, machinery and equipment.
FC7	*Problem-making:* Innovation in an extremely mature sub-sector. How easy is for a micro firm to innovate on dairy products with no research lab, research team or other sufficient sources to organize R&D? Researchers of the Greek relevant companies would stress the obvious difficulty. The E. counts on quality, PDO and other certifications, flavor and locality but these are not enough for him. He wants to differentiate more. Initially, the E. focuses on US goat milk products ("*I had focused on some of the goat milk properties which could be of value in the health sector*"). Questions regard a) the production of similar products under a Greek signature (technological, technical and market issues); b) communication of it highlighting health supporting properties (Note:	Existing technical assets and potential for further development, social capital and networks, capabilities to acquiring (purchasing) resources, developing resources internally, experience, skills His former experience serves as a core basis. Satisfactory financial capital, passion.	The E. uses all resources (including knowledge) flexibly: reverse engineering, many try and error processes and a flexible and most feasibly constructed special equipment. He invests modestly in innovation: he fits the demands for healthy and light dairy products as well as more flavor and appearance (he invests on design). Difficulties of production technology advance new knowledge and technology inquiries and enhance experimentation. Imitation leads to innovation; the dynamism of knowledge puzzle creates a new edge of novel types of cheese such like melityros. Once patented the new goat cheese is ready to produce a variety of gourmet products when mixing with herbs.	The E. has been collecting pieces of information and knowledge even since he was studying philosophy (references when he talks about tsalafouti and melityros). He hunts knowledge in Europe and USA: - focuses on goat milk products and their properties in his visits to US farms. He extends search of knowledge on goat milk and health in internet and relevant literature (it resembles breast milk, it contains globules of very small size which are eliminated by the human organization due to their size, etc). - he visits French farms and re-engineers chevre type cheese production. However, French coagulation process does not suit Greek environment it turns him to further knowledge and technology inquiry and much experimenting. *"We had to develop new knowhow to suit our parameters")* Imitation leads to innovation; the dynamism of knowledge puzzle creates a new edge of novel patented process technology and novel types of cheese such like melityros. Once patented the new goat cheese could produce a variety of gourmet products when mixing with herbs. ***Continuous Learning*** was the process seconding the development of knowledge necessary to start, grow and manage the new venture idea. Literature on dairy and cheese making

	this did not seem to work) c) Advance with innovation (beyond imitation) with gourmet high-quality products that advance wellness. A disadvantage can be found in his denial to cooperate with a University Dpt -maybe some mistrust?			technology engaged, while experimenting, leads to further knowledge hunt since difficulties result in weaknesses and problems. Cross functional skills ranging from equipment construction to marketing and customer networking are developed. FCo7 invests on knowledge but it is quite is modest when money and other resources are acquired
FCo8	*Problem-making:* The major problem was the sustainable revitalization of a totally sunk company (a real bet according to the E.). The new milk products had to gain market shares in a mature market. The Es set the problem of differentiation (but not production of milk for specific target groups e.g. enriched for children): First target is quality challenging the TMF standards and an innovative bottle and questions regard technology and production lines as well as marketing. "S. Milk" became famous even abroad without being sold in foreign markets (It has been said that some VIPs buy it and transport it to Italy and France for their families)	*Significant knowledge* and accumulated experience on cheese making. Existing technical assets and potential for further development, strong social capital and networks, political support, capabilities to acquiring (purchasing) resources, developing resources internally, experience, skills	Knowledge and experience on cheese leads to advanced knowledge of milk. Financial capital combined to contacts and networks provides networking with high-tech suppliers to provide innovative production technology and human capital to support and sustain innovation. Combination of relevant skills to develop and communicate differentiation in fast paces.	***Hunt for knowledge*** mainly among leading manufacturers and best practices. The Es are conscious of the power of knowledge in achieving differentiation, and are also conscious of this weakness of theirs; so they collect knowledge by heavy investment in human capital, contracts and knowledge holders, while, in parallel, they get deeply self-involved. As described by Mr S.: *"Knowledge then was provided by our executives. However we had to learn as well; the E. is the one to devote his time in order to decide on certain issues or to prevent problems that are created with no reason actually. But we had to devote all our time to get deep into that knowledge areas"* Half TMF (Total Microbial Flora) had to be translated in innovative process and communicated in innovative ways (firm chose innovative bottle). <u>All this required new knowledge.</u> ***Continuous Learning***: Well educated human capital with high-level scientific and technical knowledge regards even machine handling (*"All production is run by people who hold a TEI degree in engineering…. Yes, this can be called an innovation itself!"*). Integrated scientific coordination of the milk zone under strict controls and management (dynamic pieces of knowledge). Organizational learning is in progress all over the venture creation.
FCo9	*Problem-making:* The Es seek the different (*"The effort to start with sth innovative means significant risk and constitutes a challenge"*). They set the challenges alone in order to be creative and risk a lot since they cannot guarantee the acceptance of the new products. Many and complex problems are set: e.g. the	Knowledge and experience of the bread market, financial capital, social capital and networks (father) The Es: capabilities to acquiring (purchasing) resources and especially knowledge, developing resources internally,	Flexible combination of capabilities supports the intense try and error efforts, not only in the lab but in the production, as well. Money devoted for knowledge acquisition, technology development and communication are combined with the knowledge on networking: e.g. links to people with food market knowledge and	***Hunt for knowledge*** Need for knowledge appears after the formation of the idea, Knowledge is gained a) through try and error processes in the old company's lab for almost 26 months, with the collaboration with an expert research institute and external collaborators for the product and b) manufacturers for the production technology *" …at the end it needs to be formulated into an industrial food environment. So how do you get this?*

	product itself, its production (*"We could not anticipate the number of parameters we had to consider in our effort to transfer lab production to mass production"*), and initial market entrance (*"unless you communicate properly the snack, the consumer will not get the message because the snack category is very large"*), promotion methods (still they had a significant problem with the Greek market and the firm's name), raw material selection Unexpected problems: institutional (EOF and Prefecture could not decide about the name, the category of special nutrition product and the relevant license)	significant bird's view.	distribution channels and links to experts on relevant packaging and design. Difficulties turn to opportunities due to the ability of the Es to recombine their resources and redirect their efforts (from Unismack to Wellaby)	*So how do you translate, let's say that little part into a product which you can produce in a constant and industrial way and sell?" We had our collaborators committed to make machinery which could produce what we asked for!"* ***Continuous Learning*** is gradually becoming imperative since the mass production turns to be rather sophisticated and affects all the value chain. Personnel's synthesis proves the importance of new knowledge's excellent assimilation and manipulation. Initially, food technology and relevant knowledge comes through employees and partners but Es master all relevant knowledge and deepen in it in order to manage efficiently the whole process.
FCo10	*Problem-making:* Mr K was a successful businessman but he is still "looking for trouble". He glimpsed an opportunity but went further to create a concept with intuition (the *meze* concept) which is a major characteristic of bricolage. Still it is a very primary form of KIE. KIE in 2003 enters with the vision to influence eating habits through education and coaching worldwide. There are multiple questions to answer then: packaging design, further culture building and promotion but all this should be backed up by high-quality, innovative and astonishing products. The second problem is then the creation of a plant for innovative products / processes not even created. The general framework was	Rich physical resources such as human capital, available materials and technical assets, Strong social capital, firm's reputation and significant networks worldwide. Strong political support (the use of prisoners amazed me…). Significant capabilities to networking, acquiring (purchasing) resources, developing resources, significant knowledge pools Significant accumulated experience, reputation	One can clearly see a multi-dimensional interaction between various trans-sectoral sources and the agent: network and brand building, design engaging, culture creating, connecting to quality production -the 1st factory and distinguish it from plain entrepreneurship. Networking with the relevant stakeholders from a point of power is very important.	***Hunt for knowledge***: *Start-up (1995):* Knowledge refers mainly to market, packaging forms including design and brand building (due to the English lady guru) as well as the product i.e. the olive and oil and its environment in a rather practical way (since the E. had no relevant experience). The E. works hard on concept building (innovation of the culture of sharing-(meze)). This cost much-much money: "The amount was really huge! And imagine… before even the product!" However, it is mainly knowledge of the sector (and not in terms of KIE) "We knew almost nothing. So, we had to learn the international market; we visited ANUGA, Sial, USA, and Europe!" ***KIE (2003):*** All six years after foundation, the E. had been collecting necessary information by markets, knowledge by producers and general information on possible ways to differentiate (e.g. environmental, nutritional, culinary matters) together with experience in promotion, channels and branding. Knowledge now includes production technologies, ecology, oil chemistry, organic olive production, food safety, waste management, sensory evaluation, culinary innovative efforts. Besides project assignments, collaboration with plant

	a flexible, modern and "smart" production in order to follow initial innovative concept with relevant products. The created "problem" sought "solutions" that started with the products of the 3rd line (shaping the full Greek table concept, the POP oil and a search for adding further value).			manufacturers, olive producers and chefs strengthen the potential of innovation and the final value of the new products (3rd production line in the plant produces novel products as well as the 4th later). ***Continuous learning:*** The E. states that knowledge is born by the entrepreneur (he refers to the spherical entrepreneurial and sectoral knowledge) but by time it becomes a characteristic of the total. The whole story reveals an upgrading of knowledge and learning with a continuous experimenting in multiple processes. Training and information sharing add to the development of a variety of cross-functional skills. *"Knowledge is multiplied because of the team that loves and believes in our firm's vision. People do not leave the company. Most of our executives have been born in here!" "We travel to maintain our markets but this is the big school as well.* Note: In this case we really see that "Entrepreneurial learning is ... described as the continuous process that facilitates the development of knowledge necessary to start, grow, and manage a new venture" (Politis 2005). No reference to try and error efforts.
TCo1	*Problem-making:* Strong entrepreneurial drive and motivation towards differentiation through a successful focus on current and future trends - <u>problem created by dissatisfaction on dyeing and on the emergent area of innovative yarn and fabric</u>. Gap: inability of existing plants to repeat the same color (*"it was always almost the same"* (the E.)) or to dye properly innovative fabrics. Several technical problems to solve: environmental conditions, water requirements, mixture phases, conventional equipment modifications, process modifications, material quantities,	Significant resources for the whole process. Market knowledge... Rich physical resources such as human capital, available materials and technical assets, Accumulated knowledge and long entrepreneurial experience on the sector by both entrepreneurs who engage important complementing capabilities. A thorough knowledge on conventional and innovative textile and fabric properties and potential to the finishing, dyeing and special treating.	Combination of the physical resources with the strong business network in order to: - create technology (knowledge, experience and skills of the E (mechanical engineer) +networking+ abundant resources such as technical assets and human capital - build machinery - meet innovation (networking+ ability to adopt innovative chemicals to production processes (i.e. create new technical capabilities)+ ability to communicate it + ability to require resources - create markets (a major ability of the second E.+ networks + social capital + reputation)	***Hunt for knowledge***: Search for technology and mainly process innovations and for new patents for pilot application in the new plant. Technology literature research, patent searching and trade shows of different industry sectors (chemical /Fiber / fabric / equipment manufacturers). Customer requirements are also taken into consideration. Creation of the knowledge puzzles of various technology, science and practical areas through individual studies and efforts, co-operations with clients, suppliers and companies of the sector with a different market orientation, trade show visits and other company visits. <u>Separation of the technical part (knowhow) from the "process" part of the problem under the umbrella of innovativeness.</u> a). Networking with machinery and equipment suppliers enables the choice and construction of original high tech machinery and its combination in innovative ways using ICT and other techniques such as for safety mechanisms and mechanisms for feasible tailor made solutions (the technical part – innovative plant).

	time and speed of the processes etc which required close cooperation on design and manufacture or required technology. All efforts target the best adaption to market requirements abroad and the development of the most value adding solutions for Greek customers.	Strong social capital, firm's reputation and significant networks in Europe. Significant capabilities to networking, acquiring and purchasing) resources.		b) Searching in the chemical industry and networking with chemical companies enabled the selection and application of the patent, extension to special effects, the full-scale recovery of effluents for reuse in production, waste water treatment, energy saving. This is the creation of a new niche market. ***Continuous learning:*** A close cooperation on design and manufacture or required technology. All efforts target the best adaption to market requirements abroad and the development of the most value adding solutions for Greek customers. Pilot use of patented chemicals and relevant modifications keep company a leader.
TCo2	*Problem-making:* It is a case where problem making is due to very good sensing capabilities of the firm ("*conventional production and products would migrate in Asia. It was evident that labor and production costs would increase and Greek T&C sector's competitiveness would be questioned"*). Threat led to the idea of getting away of mass production. Here starts problem making: the idea of entering a very precise, highly advanced and KI sector of tech-clothing for special target groups created important problems both of knowledge and knowhow selection and application as well as production and delivery problems within the notion of the weak image of Greek companies in this sector. A major concern is to fit with the relevant market demands (specifications, trends, institutional requirements) and to create new needs (e.g. add value or new target groups e.g. hunters) *"Greek public*	Rich physical resources such as available materials and technical assets, Strong social capital, firm's reputation and significant networks in Greece (mainly customers) and Europe (suppliers) Satisfactory financial resources Significant dynamic capabilities. Ability to networking, acquiring (purchasing) resources and developing resources, Significant knowledge pools (R&D-based suppliers, University) Significant accumulated experience, reputation	Fine use of pre-existing resources, multi-dimensional interaction between various trans-sectoral sources (suppliers, high-tech material, production facilities, army specifications, etc) and advance on capability building regarding: Technological aspects: R&D Dpt development, design team, novel production facilities, Innovation: regarding mainly products, promotion: extreme flexibility in order volume (for a military corps down to one piece), e-business etc Development of networking and other capabilities From the very beginning there was a creative mindset that nourished the company's evolution and choices towards exploiting new opportunities. All three DCs appear in conversation: they support resource recombination Enrichment of human capital, *The Es worked to develop their own*	***Hunt for knowledge***: TCo2 developed formal and informal relationships that allowed the firm to build on knowledge coming from external sources. The most important source of external knowledge is their suppliers and namely DuPont, 3M and Gore providing in **formal or informal ways** (e.g. "*Good relations and trust is important. For example, it was the fire-protection material; we had started an official co-operation with a laboratory in England, the leader in its area. We had a really fine relationship and people there would give us information and knowledge when just talking – I mean informally"*): know how, information, technology, knowledge and advanced services (e.g. knowhow and process for aging tests) come through contracts, joint projects, knowledge spillovers, personnel hiring and customer service. As an established firm, TCo2 also ***had sensed*** the interest of customers in design and the opportunity to diversify to the casual and sport wear. Therefore preparing for KIE it searches for design knowledge: TCo2 acquires a team of a designer - an engineer and a quality control executive) and an advanced CAD-CAM system. ***Continuous learning:*** Cooperation with these three companies did not only provide them with reliable raw material for their products that increased their credibility in the market but also created a reliable channel for knowledge flows regarding technical textiles. It also ensured them leadership in the Greek market in introducing new special use and high performance fabrics, garments and protective systems.

	organizations where very skeptical in trusting a Greek company for high performance fabrics and garments. This was an obstacle to overcome and show that we were reliable."		*solutions combining their knowledge of the Greek market with the knowledge on specialized materials. They ended up with innovative solutions well ahead of the conventionally business activities such as the bullet proof vest and helmet and the protective mask.*	The company systematically built on the technology and know-how obtained with reverse engineering and in cooperation with technical consultants and suppliers (all years before KIE) on technical textiles but NPD processes as well (contrary to the majority in the sector) Additional knowledge is sought by academia researchers and research projects (e.g. ETAKEI, PAVE 1984 and 1994), quality labs and customers. Team building widens capabilities of TCo2; The new plant's model, technology and culture in Albania drives also to the widening of cross-functional skills for both NPD and customization (e.g. design -distant production -logistics –e promotion)
TCo3	*Problem-making:* Combine the competitive advantage of the production of renewable energy with innovative ecological high value added clothing treatment. The 2 Es are both lovers of innovation and KI opportunity creators. When energy production under novel ways started being popular and renewable energy sources looked promising the 2 Es decided to extend to such production. Yet, it was too little just to produce energy. The innovative piece-dyeing processes would attract large fashion houses offering exclusive color designs and ecologic treatment.	A strong basis of pre-existing resources on knowledge, experience, technical assets, relationships to other firms and markets, all along the value chain as well as a very clear vision of the new venture's strategy. Very strong social and business capital and networks. Strong capabilities to acquiring (purchasing) resources, developing resources internally, Significant accumulated experience on dyeing (but no experience on energy production). Significant financial, human and social resources, Significant reputation.	Flexibility of the mentioned resources is far more than obvious in this case study. Having a rather complete knowledge puzzle on dyeing: TCo7 uses piece-dyeing and TCo1 has a very advanced laboratory and a very good experience in natural and advanced colors) ("It was, I could say, a knowledge mixture of the two sides. The denim treatment of TCo7 which is a whole body of knowledge including fashion, technology, tricky materials and the innovative production lines of TCo1 and its ongoing innovations". Resources and capabilities of both sides are combined and complementary.	***Hunt for knowledge***: it regards mainly the biodiesel system.. They collect scientific and technical knowledge mainly by University and TEI of Thessaly (*"It was the second of the name that required knowledge; energy. We co-operated mainly with Dr Zaoutsos from TEI and Dr Gemtos from the University"*). The dyeing innovative process knowledge comes mainly from the two other companies of the Es. Engineers provide knowledge and experiment outputs in informal ways. Knowledge is combined for the two innovative processes (one of the piece eco-dyeing and the other for the energy eco-production) with different chemical labs and different advance in research which at the same time are interconnected for the final result (co-specialization). ***Continuous learning:*** Synergies and micro-processes are either formal (e.g. with contracts -Univ., manufacturers, suppliers, labs) or informal (e.g. with the teams of the other two plants) (*"The two mother companies bring us knowledge"* CEO of TCo3) ***Note:*** The new venture leans on the extension out of the sector (energy production) and a further innovative step within the sector. There is a certain widening of skills and a significant coordination not only among the different Dps of the nascent firm but also among the three dyeing plants (the two of the 2 Es' other companies). Research goes on combining certain characteristics of all three dyeing plants.
TCo4	*Problem-making:* Since mid 70s in the sector, the E. knows that he has	A well organized plant where conventional knowledge is	Knowledge ranges from a thorough knowledge on conventional and innovative	***Hunt for knowledge***: Knowledge is required by manufacturers and suppliers on the basis of cutting edge technology on

	to fit with the new demands of the market environment; according to his sayings: produce "the different - the difficult -the knowledge intensive". Thus, the main problem is the creation of a flexible unit, keen to produce and apply innovation regarding products and services (this is not self-evident in the sub-sector). Cheap product was already offered by companies in East Europe (None could foresee China's role). The initial business idea is clearly knowledge intensive: textile innovation such as tailor made products and solutions using novel treatments and processes on fiber and colors. (*NOTE 1: The plans for KIE existed before the fire. I think that they would remain plans due to existing conventional production lines which satisfied customers. I suspect that investments would be less significant than the ones that occurred (60 million)* NOTE 2: *However, the company's culture did not escape path dependencies i.e. dependence on machine technology)*	well exploited Significant resource pre-existence: financial, human and physical capital, well- formed social and business structures and networks, deep experience, broad knowledge and resources. Abundant technical assets and potential for further development. High reputation DCs, Capabilities to acquiring (purchasing) resources, developing resources internally	textile and fabric properties and potential to the finishing, dyeing and special treating, combined with a strategic focus on high value market needs and a significant clientele. Technology transfer mostly among the company and the manufacturers/suppliers but triggered by customers. All three DCs appear in conversation: they support resource recombination Enrichment of human capital, advancement of technology and R&D capabilities	sensitive and special garments: *"It was cutting edge technology at least at European level. It required significant experience of course, but there would still be many deficiencies in technical issues. We were of course the leaders when we filled the technical know-how gap. This type of mass production could not be found in more than 4 plants in Europe"*. The company invests in **human capital** for knowledge: a strong R&D team of 15 engineers, a**s well as on its relations** on personal basis (*"I remember the technical director of Dupont; he was a moving library. He offered too much to us not only on the contract basis but in terms of experience and knowledge on a personal basis"*). Proximity is important in a sense of direct contact (*"We felt too close with their team. We would phone or send an e-mail and discuss everything"*) and the further development of interpersonal relationships. Knowledge regards also design and quality control (both strong competitive advantages since there were but a few companies all over Europe holders of such know-how). The design Dpt is organized and besides the in-house knowledge due to the Dpt's director there is knowledge flows though co-operations with other designers. ***Continuous learning:*** There was a culture of continuous investing in machine and production lines installation and application of supplier's material as well as of quality matters and a tendency to R&D. Learning and experience is gained mainly through these processes. The important part refers to learning through feedback from collaborators, suppliers, machine manufacturers, and other parts of the business ecosystem. It is the first time that company hires a leading American consulting company for production and business model organization (Not said in the interview but it was known through press and within the sector's news. ***Werner*** was the most famous consultant on textile and clothing organization subjects worldwide). (Note: Abundant capital resources enable an unstrained hunt for knowledge. However, I would say that marketing had not received the attention it needed by then - maybe due to the

				existence of big customers and the flourishing market - nobody could foresee the *tsunami* that China brought after 2003).
TCo5	*Problem-making:* The problems of the existing network (hybrid corporate / franchisee) and the forthcoming crisis set the problem of restructuring in order to fit to the market environment and establish better control all along the value chain. (Note: The problem is not a transcendent one but the solution is quite innovative).	There is certainly a strong basis of pre-existing resources on knowledge, accumulated experience, assets, structures and routines, relationships to other firms and markets (e.g. existence of a franchise manager since 1997), all along the value chain as well as a very clear vision of the new venture's strategy. Existing technical assets and available material and potential for further development, Social capital and networks, human capital, satisfactory financial capital. Reputation DC, capabilities to acquiring (purchasing) resources, developing resources internally	TCo5 has a long path dependency in changes and change management. Existing resources have been flexibly used in order to fit to the new model's demand (from design policy to logistics. Services provided include warehousing, industry-leading logistics information systems and inventory management -- from forecasting to order fulfillment. A combination of knowledge, networking, physical resources, reputation.	***Hunt for knowledge***: TCo5 searches for knowledge in many areas: sales model and consequently business model, technology, logistics and sales restructuring. *"The whole question regarded the problem. We knew what we wanted but we did not know exactly what to do. Then, it was a sort of a chain problem; the solution of a problem led to another problem…"* Main knowledge providers: University of Bocconi, University of Piraeus, ICT company New skills and capabilities are developed in logistics, semi-automatization, accountancy, marketing, sales, relationships among partners, inventory management etc. ***Continuous learning:*** A continuous experimenting is evident in order to make the system work "as a Swiss clock". According to the E's sayings. Results are embedded in routines.
TCo6	*Problem-making:* A need for differentiation BUT through what (excluding the emerging trend towards technical textiles)? A complex situation: OK buy innovative machinery BUT for what purpose?	Existing resources: rich physical, human, financial, technical capital, relevant structures, Versatile Knowledge on raw materials, technologies, knowhow and markets. Significant networks and influence in the business environment DCs, capabilities to acquiring (purchasing) resources, developing internal resources	(1) Τα στοιχεία που συνθέτουν το νέο όραμα καλύπτουν το τρίπτυχο καινοτομίας «α' ύλες – εξοπλισμός –ειδικά εκπαιδευμένο προσωπικό». Many expensive resources: a loan of about 30 million (too heavy and a trap) – Manipulation of resources: machinery developed due to strong networking and reputation leads to innovative material based on the ecological strategy through many try and error processes and the	***Hunt for knowledge***: The company follows sensing routines but when they decide to do something entirely new they turn aggressively to knowledge: *"Once we decided to do it, we started conversations with big customers, we invested in the analysis of success stories, new trends and new specifications, innovation by Aachen Spinning Science Dpt where I had studied and kept personal contacts and friendship"* Knowledge regards mainly organic cotton cultivation, organic chemistry and manufacturing knowhow and is sought in University, fiber producers, machine makers and trade-shows. TCo6 provokes even synergies among leading manufacturers to achieve the desired outcome. *"We were the first to make them get out of their shells and work together. We were very strong by*

		Significant accumulated experience on mattresses and ecological culture High reputation,	human capital. Multiple innovation directions: e.g. TCo6 produces novel technology (compact yarn, 2002) while working on eco-products (Qcotton to present it in 2003) - innovative machinery totally installed 2004 and Tencell in 2005 (flexible use of all resources). All products satisfy new upcoming needs for fabric makers of high value (e.g. Tencell is the "Harry Potter" in yarns	*then".* Q-cotton (the introductory innovative product) was a knowledge-based combination of trained cotton producers- agriculturists – and innovative manufacturing know how of the new ginning and spinning mills). Compact yarns, Tencell Q cotton, B100 etc. follow. ***Continuous learning:*** planned, practical and scientific knowledge and training resulting in new know how, new production, new cotton cultivation and treatment and so on). Competences of coordination and later strong training for all executives and personnel.
TCo7	*Problem-making:* One cannot say that there is a problem making in the strict sense. It was mainly difficult to dare realize the target: <u>become equal at European level to denim legends such as Levis and Diesel in a time that Greece worked only as subcontractor of big foreign clothing firms.</u> Problem making refers then to the difficulties and problems set within the transformation process from concept to realization: innovative treatment of jeans, development of design, a strong culture and image, communication of the message, in order to persuade on the comparability of the products to famous ones.	Existing technical basis and potential for further development, Business, social capital and networks Capabilities to acquiring (purchasing) resources (knowledge, technology, machinery, human capital), developing resources (design capability, NPD capability, branding) internally, experience, skills Emerging reputation	Collected knowledge generated knowledge and ideas through an interaction between the Es experience and his ideas: Pre-composed material and designs: existing knowledge on denim culture, manufacturing installations, experience on dyeing requirements, former efforts to widen knowledge on adding value processes, benchmarking the leaders Lead to hunt for more knowledge (the E's visits Italy, establishes connections, collects knowledge and human capital). Knowledge and techniques is transferred in processes, co-operations and human capital composed of Italian technicians and designers. Heavy investment in branding (combinations of financial and physical capital, networking, knowledge and experience) and promotion while securing innovative treatment technology and its success "secrets". (Considering the sector's status of 2000, it was rather fast accepted by major European customers -2003).	***Hunt for knowledge***: **<u>(before KIE)</u>** The E. was among the very few of the many Greek sub-contractors who got interested in the value and nature of the denim fabric he was subcontracted to work with. He searched the fabric, its production, the culture behind it and its business landscape. This search did not imply KIE but it certainly differentiated him from the other Es of the sub-sector. *"He would visit –quite often – Italy to search for denim fabrics, although denim was not a fashion yet. He was studying it and questioned himself why LEVIS managed to be at the top".* **<u>KIE:</u>** Focus on denim product treatment turned knowledge hunt on dyeing processes, innovative treating methods, denim handling, designing, branding, culture building. First contacts were made in order to gain knowledge on cutting edge treatment technology and plant building; the idea is enlarged to follow the best in fashion-branding-quality. <u>Knowledge providers:</u> Italian jeans producers and manufacturing firms, Japanese firms. <u>Founder focused mainly on individuals to reap knowledge:</u> Italian CEO, technicians, designers. Knowledge is mostly practical, technical and market knowledge. Technological knowledge regards mainly the novel treatment methods and modifications to suit local conditions. ***Continuous learning:*** The acquired knowledge, its dynamic combinations and the ways it is implemented creates the competitive advantages of TCo7.
TCo8	*Problem-making:* There was already	Rich physical resources such	There is an important resource pool of	***Hunt for knowledge***: it regards design, innovative material and

	a problematic environment sensed by TCo8 which seeks differentiation in order to survive since global sectoral markets change rapidly. <u>Major problems set by the firm:</u> development of high-level design and relevant human capital to be found (not that easy to get according to the narration[335]), the development of a fashion culture, the complete restructure of the entire value chain to fit with the demands of the market, the complete restructure of the production against the heavy investment of automatization the previous years. Design and flexibility became vital in a company that used to work on a small number of codes and a fully automized mass production. It is a case where one can clearly observe the domino effect.	as technical assets, available materials, human and financial capital Significant business and social capital, strong networks Reputation DCs, capabilities to acquiring (purchasing) resources, and developing resources internally Sectoral knowledge, experience, skills Commitment to change	sectoral knowledge, technical and financial assets which is used by TCo8 in order to manage its new image e.g. technology and knowhow assists the introduction of innovative material. Existing human capital and networking enhances the development of NPD and design Dpt (external collaborators, designers hired, further networking to the fashion world) Experience on technology and automatization supports the significant changes to mass customization and the ICT involvement Market knowledge and social and business network support the change of the image and the sales model.	their use in production (TCo8 used only cotton and usual synthetics till then), chemistry in finishing and dyeing, modern administrative and commercialization models, ERP, a new image as fashion company: *"We invested in innovative knowledge: Fiber technology, spinning and knitting technology, design, ability to adopt innovative raw material… They were really new areas of knowledge for us; we needed to turn to a big variety of disciplines such as chemistry, modernization of the business and commercial model, ERP development, lingerie and image building… all this combined to new materials, novel fibers… This meant co-operation with consultants and other firms for innovation. A big effort to combine design, materials, knitting techniques and production."* Knowledge comes through consulting, training, technology and knowhow transfer. • Synergies and micro-processes through collaborations with suppliers :e.g. Lenzig -test of innovative material, • joint projects e.g. with TCo4 for dyeing, • famous designers, • ICT providers: *"When we started we could not find firms to support our plans. The first ICT systems were some Jewish ones developed by a multinational in USA. We started with them but then Computerland was established and we co-operated with Antoniadis. We became the guinea pigs and had got big problems in our efforts, because first efforts did not succeed but it was worth doing it! "*. TCo8 tried even to apply innovative production systems (e.g. cells) and a modern sales networks and techniques, in order to manage the complete business model restructuring. ***Continuous learning:*** A strong case of continuous learning of an already knowledge-based company which develops a wide range of cross-functional skills, knowledge and competences on a variety of subjects; from graphics and design to micro-

[335] "There is a significant problem with designers in Greece, especially the young ones. They are a constant problem since they actually do nothing! The most promising ones actually were kept and trained on the job. But the firm could not rely on them alone. Their ability rests in studying fashion journals and cutting patterns. However, they miss the knowhow. You cannot use a whole piece of expensive fabric just to design a tiny thong!"

				informatics, ERP and sales reconstruction: *"We turned to fashion shows, we watched and learned the novel fiber technologies, we were introduced to novel machinery which we had to modify. We were trained to change our culture and the way of work, we tried to create the new image of the firm. ERP was very important but before we find this solution and develop it, it was the "black box" for us – a big problem... We had to combine* novelty *in material-design –production and promotion! "* Note: The final outcome created strong competitive advantages that would pay back more if the company was in another European country ("*We had developed technology, knowhow and the relevant infrastructure that did not exist in Europe! If we were in Germany, we would be 5 times bigger!")*
TCo9	*Problem-making:* It is a case where we cannot claim that TCo9 caused or created a problem - the problem was market-driven (imposed by the global markets and customers).	Rich physical resources such as technical assets, available materials, human and financial capital Significant business and social capital, strong networks World-level reputation DCs, capabilities to acquiring (purchasing) resources, and developing resources internally Sectoral knowledge, experience, skills Commitment to change	Although there is a deep knowledge pool and accumulated experience (beyond the very own knowledge of the president and the members of the Board) company starts to seek knowledge to all those (new) areas that are needed to fulfill initial vision. For this purpose all existing resources are engaged to develop R&D-based NPD Dpt and the relevant culture (new physical, human and technical capital, knowhow and knowledge) Development of mass customization (technical assets, technological capabilities, managerial capabilities) Management of the whole new business model.	***Hunt for knowledge***: it regards a holistic approach of the challenge; i.e. a complete renewal of capabilities and resources to introduce the novel mass customization: new equipment, capabilities regarding flexibility, logistics, marketing, and new processes of NPD and marketing, new production planning, new philosophy of customer treatment. Knowledge flows: descriptive, procedural, planned / scientific, practical, tacit, formal or informal, and all ranges and levels (research, production, management, marketing, sales). Synergies: co-development of innovative products, co-operation with machine and automatization manufacturers, specialized HR hired. Custom made applications to satisfy planning. Both practical and management knowledge were important to complement technical and scientific knowledge. (It is important to mention that at the same time TCo9 verticalized with a cotton ginning mill). ***Continuous learning:*** Remodeling and improving with the assistance of customers in the beginning till the final step of being totally independent and the "reward" of competitors to try to copy products. Gradual improvements and further organization. R&D Dpt becomes totally independent. NPD pays soon back; several novel fabrics were adopted by very important global customers who used the name of TCo9 and some of them were rather difficult to be copied.

TCo10	*Problem-making:* Mr Z while a successful designer, fashion discussant and editor, found a niche to realize his dream - to become an entrepreneur - designer.	Existing resources refer mainly to knowledge, experience and reputation. Strong social capital and networks in the business. Major lack of : private financial capital, physical capital	Reputation and strong social capital support the provision of financial resources and of physical capital (the shoe manufacturing plant). The E combines most existing resources to create its physical business environment, develop manufacturing and entrepreneurial capabilities and first products. Former business experience and reputation support promotion and market introduction. The designer-entrepreneur manages to create his own design-culture.	***Hunt for knowledge***: With a career spanning 20 years and counting in the fashion editorials business, the entrepreneur collected deliberately pieces of knowledge in order to become the designer, stylist and boutique owner. Knowledge on trends and designers, marketing, promotion, manufacturing but mostly consumer's behaviors. Practical knowledge on manufacturing. Synergies mostly with shoe manufacturer and fashion magazines. ***Continuous learning:*** It is the case where a designer must extend knowledge to entrepreneurial, managerial and operational level. Still, there are many functions at operational level that are a little disturbing… *"You cannot prepare bows and at the same time to work on the firm's economic! But we have to combine both! Yes!"*

(1) Μετά είδαμε κάποιες ιδιότητες του κατσικίσιου γάλατος και επικεντρωθήκαμε εκεί γιατί έχει κάποιες διαστάσεις στο χώρο της υγείας. Αυτές τις ψάξαμε στο διαδίκτυο, σε άρθρα για το κατσικίσιο γάλα και σε βιβλία κα ι σε προγράμματα. Σε δεύτερη φάση έψαξα και προσπάθησα να μάθω πώς γίνεται η πήξη του γαλλικού chevre και το αντέγραψα τέλεια. Αυτό το διάβασα, αλλά και το είδα στην Αμερική. Όμως η πήξη αυτή δεν ήταν κατάλληλη για την Ελλάδα

Table A4: Concentric cycle networking: Dimension of Bricolage capability

	Initial network pool	**Networking**	**Participation in collaborations (at the founding phase)**
WCo1	Family and close business network (furniture makers of the region)	TEI, manufacturing companies (Europe), sophisticated veneer and innovative eco-material suppliers and designer networks (Europe). Translator engaged. --- The E.: - meets the company that sells the necessary fleece (the core component for the innovative process to the innovator) - stays in a German non-competitor's plant (the pilot user of the innovative technology) to study some of the techniques of the new product (the pressing process). In this factory he was also introduced in new design techniques and in the culture of eco-friendliness and waste elimination. - finds the company that cooperated with the technology innovator in the machinery sector and works on personal solutions cooperates with W&F TEI to excel his own innovative technique. He stays at the manufacturing companies during the machinery design stage. - He visits repeatedly the raw material producers (veneers) to combine their innovative	Technical cooperation agreements: Collaborates in the design of the new machinery. Pilot user of innovative raw material and designs of European material suppliers and designer networks

		material to the new machinery specification – long stays there to learn more. - Meets designers (a European network) who highlight the potential of the new material and the novel stitching process	
WCo2	A strong business, political and social network which started 25 years before. TEI	Further Networking with: - new technologies providers and developers, - new partners worldwide ("the leaders") - selected engineers as first employees. The E. chooses partners through a trial process being close to the reality of organized work (the process innovation was developed with the Italian engineer that erected the relevant part of machinery- parts designed and constructed by local firms when possible - many trips to the manufacturers involved - on line communication) *"When erecting the plant we were like the Tower of Babel"* (Entrepreneur) The E. states that networking is vital: *"the company is open to everybody and competitors and suppliers all over the world....Networking will let me enter the market of USA"*	Technical cooperation agreements: With machine manufacturers for specific production line modifications (e.g. the Italian manufacturer for the glue application) With competitors for the two innovative "laminate" and "flooring" products Collaborations fail when trust is not satisfactory; "*Your development is our development"*
WCo3	Suppliers of kitchen cabinets in Italy, customers (kitchen cabinet retailers) TEI, WFDT Dpt known (same town - one of the entrepreneurs in the Dpt)	Further networking with - The Italian cluster community. *"Since we became family, the Italian manufacturers collaborated in solving the problems caused by the distance and technical solutions to our modular production model. Otherwise, it would be difficult and too expensive; we are not NEOSET of ALFAWOOD to support the implementation of such innovative ideas…"* - Employees come mainly from acquaintances and TEI.	Technical cooperation agreement Within the cluster and with TEI (production organization,ISO9000 application, design)
WCo4	TEI , WFDT Dpt machine manufacturers, regional business milieu	Further networking with: - A sectoral journal and MEDWOOD (sectoral trade show) mainly due to WFDT Dpt - IT companies, - Frames association (through customers) and - portals abroad (personal contacts of the two brothers - professional B2B platforms for Wood & Timber industry) (NOTE: later further networking due to research programs and cluster participation (through TEI and with customers improving NPD directions (e.g. after the frame makers they turn to architects) Team building by the 3 brothers and 3 loyal and skilled employees from former plant.	With machine manufacturers (knowledge exchange and creation of new knowledge) R&D – with TEI
WCo5	Customers, machine manufacturers TEI , WFDT Dpt	- Personal acquaintance with a honeycomb panel producer, the only person who tried to promote honeycomb in Greece. - sectoral journal connections, - contacts with raw and secondary material companies as main suppliers and then customers - Special use machine built by E. and partners due to proximity and trust. Trust is always a request (the first customers are friends - there was "good chemistry" with the panel producer). The expert explained that he went on cooperating with Mr K because	Collaboration with a big Greek firm of artificial timber customers for pilot use in order to solve problems and improve the product and to promote the innovative product by using it in their products (to reach the final consumer)

		they trusted each other during cooperation in K-cluster. *(NOTE: they should contact the company that invented honeycomb; they could have expanded the cycle more -they are too introvert)*	
WCo6	An important and well developed network of suppliers and customers due to its excellence in marine plywood (the best in Greece).	Although no further networking was reported during KIE, A year later WCo6 had to contact a French company that produced melamine films in order to produce the differentiated base panel (it is the most profitable product of F6. It resulted from reverse engineering - pioneer in Greece and among the 4 producers in Europe). This was a new area of activities. They also entered the FSC (sustainable forest management) network and WWF in order to highlight the ecological image of products and company. Team work can be detected. Trust has been established due to long lasting relationships. Distance is a problem according to the E. since the machine manufacturers cannot develop their innovations in cooperation with a plant that is far away Maintenance and problem solution is also a problem which is solved by exceptional training and a strong maintenance team within the plant.	There is only the typical and formal supplier – customer relationship although there are deep long-lasting relationships and mutual respect.
WCo7	Business ecosystem at local level	Networking to -technology and machinery provider: the Italian company - raw material providers (mainly woodworking and furniture companies) - the market of central heating systems, stoves, furnaces, boilers and other heating appliances Turn-key solution by the technology provider who further provided the first customers	Licensing agreement with the Italian technology provider. An effort of WFDT Dpt to collaborate with WCo7 was not successful
WCo8	Family, social and business network (due to family business – suppliers, machine manufacturers, customers)	Networking expands to - Machine manufacturing companies (e.g. HOMAG), - Computer programmers (e.g. co-development of bummerang systems, CIM plans - Sophisticated materials networks through latent connections to implement initial concept. He visits material suppliers (e.g. Egger) repeatedly. The E. stays at the manufacturing companies during the multi-machine design and development stage: *"We discussed my initial idea with a team of engineers – mainly mechanical, electrical, hardware and software specialists- I personally worked on the software. I was also there during the creation of the prototype machine. We contacted an impressive number of tests and we would always improve and add something more!*"). The E. wanted to establish relationships with the Greek Academic World but failed to do so since there was no relevant Dpt (Note: Relevant TEI Dpt established also in 1999 and fully self-functioned in 2002). A general comment: Networking seems very natural to the E.: *"Of course I used my contacts besides knowledge and skills!"*	Technical cooperation agreements: The E. established formal collaborations for: - The development of the multi-machine - The CIM system - The bummerang systems - The introduction of corian Close cooperation on the same project establishes trust with foreign suppliers and manufacturers.
WCo9	Established in 1980 and a leader at national level the company had	The new venture required extended networking since the new activity exceeded the existing company's activities. Network expanded to	Collaborations established a) Licensing agreement with Strandex: "A

	already a well developed network. (manufacturers –suppliers – market channels – customers in Greece and abroad) Existing business relations were used in construction (e.g. AKMON), production (resins), test control (ELKEDE) and sales (existing customers).	- specific technology provider (the American Strandex), - new suppliers (MILAKRON - polyethylene suppliers, colors) and - customers (other than the existing ones) Plant's employees a team that were together from the very beginning and were trained on the new technology. Co-operation through visits, training, phone-calls and internet use. A strong supporting American system. Personal and business relationships were very important in promoting the product in Greece and abroad and expand customers' network:"*We first attempted exports with the support of Stradex and its offices in London. However, we also had personal contacts. I visited many wood product firms which were strong in parquet flooring. It did not take us long to form our new networks"*	bilateral knowledge transfer: We adopted the best of the firm's experience who were lagging behind in knowledge on the Mediterranean conditions Actually, our co-operation was the real innovation!" (environmental conditions in Greece need different technology - running research program CORNET) b) MILAKRON: the company had to reorganize production to suit the specific needs of WCo9. Other relevant companies appeared within the year to co-operate with WCo9.
WCo10	Established in 1989 with the experience of an unconventional plant in 1992 and the engagement of TQM (1996), WCo10 had already established well developed business and social networks in 1998	It is a case of no special references to specific networking activities but the E. talks a lot about networking as very important mostly in shaping visions instead of buying technology and equipment. In 1998, the E can choose his partners: - Suppliers are chosen for their natural-made and pure products, and their commitment in quality (e.g. in the period 1998-2002, natural material providers in Sri-Lank had to be certified with ISO 9001:1994. - Partners e.g. hotels (in terms of bartering) for their ecological image The E. managed to create cohesive teams around the world for researching, developing, supplying and promoting products to selected customers with no corporate compromises The E. strongly believes in networking: *"Networking is vital; of course it is you that you develop networking. I do not believe that Obama can influence more than five people. And it is important that you trust these people."* Partners and employees share or are educated in living with nature (the slogan is "sleep on nature"). "The company chooses its customers". .	No special reference to collaborations at the time of KIE. However, collaborations (after KIE) are mentioned regarding R&D or marketing.
FCo1	Family (financial support, endowment of social capital – successful family business in the sector, the largest in Balkans and among the largest in Europe) : the core Machine manufacturers Local environment is more supportive because of previous family social ties and a well-established reputation	Raw material suppliers are approached by father "Our father had long and deep experience with Greek suppliers" Customers such as big market chains sought in international trade fairs (ALDI, Carrefour, Sainsbury's Taste & Difference, Oil and Vinegar who establish collaborations since FCo1 chooses to work with private label products) Knowledge providers: mainly a food technologist and a chemist (friends of them) to cope with related challenges. Package machine manufacturers in Italy for innovative packaging Local workshops to create specific machinery ICT companies Contacts include also institutes, markets, political environment.	Research contract-out with the Italian company and the technologist Technical cooperation agreement Contracts with big customers
FCo2	The agricultural background and	Networking expands to:	Research contract-out with the University

	the consultant on agricultural issues (Bonding social capital based on strong ties, since all entrepreneurs have grown up in the local agricultural environment).	- Dr Kittas, a professor (an acquaintance of the consultant) of the University of Agriculture Science, Thessaly - equipment suppliers (approached through the professor), and actually Spanish equipment suppliers and Italian installation suppliers - the community of hydroponics in Greece (a few member producing mainly tomatoes) and abroad (mainly Holland -approached through the professor). - ICT providers In parallel, there is a customer cycle enlargement (to local super market) since the basis was already known to the Es (local wholesale market). One can observe a rather small scale CCN due to the very small size of the company.	
FCo3	No initial relevant contact core. Bonding social capital based on quite strong ties: **friendship** an Italian friend who introduced the product (Italy is famous for such products), a chemist (second friend)	Due to the **Italian friend**, the 2 Es - entered 2 relevant companies in Italy to "get to know the product" and - turned to an Italian manufacturing company that offered a turn-key solution. Cycle extends to customers by the help of a **second friend,** a chemist of the food sector: he supports market research, - Introduces potential clients (restaurants, caterings, bakeries etc) to his friends and they introduce their product, and - introduces the professor of the Vet. Dpt (who at the beginning came as an individual in order to help "a friend's friend"). A **third friend** prepares the feasibility study. Networking appears faster after that: egg suppliers first Greek and then from other European countries, package and cleaning material suppliers (of high importance for a food company), customers, machine shops, quality controls, supplementary material. When asked about what was the decisive factor, the Es answered *"the right people – the right moment"*	Research contract-out with the Vet . Dpt of the University Technical cooperation agreement
FCo4	Confectionaries that buy the conventional hand-made chocolates and accept to try the new ones. National general machine manufacturers	Demand for knowledge makes the E contact a professor of the School of Agricultural Sciences, University of Thessaly (personal contact - approached by a teacher of the confectionary school at Korinthos) Networking engages a designer (personal contact), the organic food communities bio-shops. In order to create sales and promotion networks, they are rejected by the medical sector (an obstacle surpassed by changing market philosophy). Still contacts are difficult if not on a personal basis; they tried to reach a professor of bio-technology but without success. NOTE: In 2010, networking included two experts from Germany to work on novel products (3rd product family) and further specialization of the other two. FCo4 also receives calls for collaboration (researchers - already two submitted research projects, suppliers from USA, Spain, super markets, etc), as well as many plant manufacturers and a tight informal network between the research staff of the University, the companies and the suppliers on a	Research contract-out with the professor Technological agreement for collaboration with the national machine manufacturer in order to develop the innovative machinery

		mutual trust basis.	
FCo5	Initial pool formed by the former company and work with international companies such as Nestle and Heinz to be customers and local producers to be suppliers.	Networking includes: - scientific personnel: Besides Mr T who is a chemist, a research team was built, composed of 14 other people: an agriculturist specialized in food technology, 2 other agriculturists, 3 chemists, 2 food technologists and 6 specialized assistants - Dr Kouretas: the biotechnology professor of the University of Thessaly. They met accidentally but it was a "gift from God" since there was "a missing link when experimenting" when problems "threatened to cancel everything". - Targeted final consumers: the Pan-Hellenic Association of Patients with Celiac Disease who accepted to help them - High-tech, bio-technology industry to provide raw material such as suppliers of specific enzymes and knowledge about them, because many of them were first time developed in the process of testing and transformation of conventional flour to gluten-free flour. - There were also a number of Dr K's students that were added later (when the collaboration started) and would stay as long as their thesis lasted. - Plant manufacturing engaged a network of local constructors, as well as some machine shops on custom-made or self-made machinery (e.g. for pipelining, electrical installations, transportation lines, automations etc) (region of Macedonia). This was possible due to the social network of the family. Main production lines were ordered to foreign manufacturing companies. - A larger scale clinical research was enabled through the social and business networking of Dr. K. Trust is more that a prerequisite since Greek Es usually mistrust the academic world *"They (note: academics) usually want to take advantage of your name. They do research just for themselves. They tell us to put our signature –just do it! Then you don't need to do anything at all! But Dr K is different. He is more anxious than us to offer really useful products"* Sensing process (for innovative concept) almost simultaneously with startup (2001) by the search of niche markets on high –quality products with high nutritional value. Not organized ("keep our eyes open, while preparing a lab for our conventional products"). Later: Gradual expansion to new cooperation (e.g. with biscuit companies), long cooperation with labs & informal contacts. Cycle is expanding to marketing area as well (pharmaceutical and super market chains- collaborations in USA and Russia). Specialists transferred their respective knowledge sets as well as assimilated the knowledge of others (*"These specialists frequently engaged in knowledge transfer as feedback from each trial; this not only required interpretation but also required additional knowledge transfers to identify the next highest probability trial")*.	R&D agreement with the lab of Dr Kouretas. Technical cooperation agreement An excellent collaboration with the Pan-Hellenic Association of Patients with Celiac Disease. This first collaborations established trust and respect and led to further ones with other special teams (such as cancer patients with an 8-year boy as the mascot of the collaborating group).
FCo6	Significant social and business network of the mother company	The Es moved fast in networking with the academic world while preparing a quite strong R&D department. In 1997, knowledge on food technology at a scientific level was obtained	R&D agreements Licensing agreement

	Long relationships with leading plant manufacturing constructors as well as with plant installation constructors (e.g. for pipelining, electrical installations, transportation lines, automations etc) as well as some machine shops on custom made or self made machinery. Farmers	mainly by the recruitment of the chemical engineer who *"made the company a second family"* (the E.) (They started investigating the new method) They entered PAVET 97 the new plan in cooperation with a big German manufacturing company, a worldwide leader in continuous cooking systems. Networking with the academic world in order to start an innovative process but also for constant collaboration (the importance of research and scientific knowledge in a rather underestimated area of agricultural products foreseen). Establishment of a stable and continuous cooperation with the BIC of Patras and the University of West Greece. Co-operations and joint research projects are built on personal relations among individuals and not institutions. *"Since the establishment of the new plant, we decided that we should have a core team of external collaborators. I was lucky enough to find Dr P, professor in the University of West Greece and active member of the BIC in Patrai. After our first conversation, we felt a mutual respect for each other and we saw that we could trust each other. Since then and till now there are many research projects that run under Mr P's guidance*" (the E.) A research self-funded program with a professor of the Food Technology Department of Athens TEI (Technological Educational Institute) for new control methods' development (e.g. aflatoxins HPLC). At the same time another self-funded research is carried out on kinetics of rice and artificial aging. Although there was a plethora of external collaborators the core team consisted of the 3 cousins mentioned above and the two chemical engineers through the whole project. Collaborations with researchers on a constant or a temporary basis: In manufacturing knowledge networking extends to leading foreign and local manufacturing companies. The application of Good Agricultural Practice provided enlargement of the cycle and strong relations with modern farmers. Mr KP underlines the need to establish trust and long lasting relationships with the suppliers: *"We used the leaders. We knew them. We had worked with them. And we trusted them. We were clear in our expectations. They knew from the very beginning that they were chosen because they were the best and because they would assist us when the next innovative idea would come. Of course they knew that this would happen soon after they finished with this project"* Already existing commercial network in Greece and abroad (social capital) but it had also to develop a new one since the new products entered the company to catering, hotel and restaurant market and opened a new market of specialties and niche products. This was enabled through personal and business links and an aggressive promotion policy. Special labs and automation companies are added to the cycle. A rather selective cycle enlargement mainly towards the scientific world. The E. highlights the importance of social and local/national networks. According to him entrepreneurs should be involved in state committees, public and academic conferences,	Technical cooperation agreement Establishment of long collaborations with farmers (organized groups that had to be educated and follow specific rules) (described in the networking column)

		institutions etc in order both to be able to dispose their environment with its needs and prospects and to make public relations with academics and other researchers.	
FC7	the business network of the mother company with the traditional supply chain contacts.	FCo7 realized that *"traditional products –no matter the quality- cannot make you differentiate"*. Trying to chase novelty the E. contacts knowledge providers in international trade shows, builds relations with farmers in Europe and USA, consultants and graphic designers. *"I visited the Fancy Food Show in San Francisco and New York and came in contacts with producers who invited me in their farms in Wisconsin. I visited them and I "saw" opportunities – I mean what I could do"*. A special reference to a trader of Greek products to USA (where one can detect a high level of trust). Networking regards also chefs and product retailers where trust is a prerequisite. (NOTE: Common opinion with Evmorfidis of Cocomat: *"I first find someone I trust from a city and I then open a shop in that city"*)	Collaborations with local manufacturers for the design and construction of special equipment since *"some things are difficult to describe to manufacturers"*.
FCo8	The business network of the mother company with the traditional supply chain contacts regarding mainly cheese Social network	Networking is expanding to • world leading manufacturers and innovators in PET products i.e. more advanced co-operations regarding mainly innovative processes and packaging (the innovative bottle). • University (School of Agricultural sciences). mainly for the development of an integrated system of milk providers • Designers • customers (SMs) • a team of engineers and mainly chemical engineers: *"When you do not have the knowledge, you "buy" it. You get it though companies such as Sindel and Tetrapak, from collaborators such as Mr Avramoulis or personnel; we hired an impressive number of engineers"*. Further networking appears 4 years later when company creates the fruit juice SBU. The existing networks (customers (SMs), distribution networks, transportation and refrigerators enabled the expansion to juices mainly with technology and raw material providers. Here we can see the case where the company accepts agents who seek collaboration or where contacts are easy to be made	Licensing agreement for technologies
FCo9	Family (father in the same sector), technologist to realize the idea from the company that bought father's company – manufacturers	Networking: • scientific personnel (employment or contract) • research institutes: *"to solve some really difficult problems we contacted a highly specialized company; they specialize in food R&D. We found them in Internet. We did not know any Greek relevant company."* • executive food marketing promoters and distributors (different in Greece and abroad but actually big names) • brand design and concepts makers (*"in cooperation with Brandexcel"*) • special groups involvement such as nutritionists and celiac disease associates	Research and R&D contract-out Technical cooperation agreement

		Market is eventually entirely new, although first attempt (the typical snacks market i.e. the Super Market shelves) failed. An opening towards science (*"Now we have turned to Greek Academia as well"*) especially after the shift to the exploitation of the gluten-free characteristics of the innovative snacks	
FCo10	An existing entrepreneurial basis: all 3 Es familiar with the international entrepreneurial environment (existing overseas shipping company). The English guru in the area of gourmet food is the first important link towards the food sector: *"It was there, during my postgraduate studies, that I met Marion Carthwright, a food gourmet, who expressed surprise that while Greece had so many authentic products you could never find them in English supermarkets. She said: 'That is what you should do.'"* Significant social – international network Cosmopolitans KIE: The acquaintances of the startup period constitute the pool	*STARTUP:* Networking • a design company in London introduced by friends • a promotion team (guru's friends that entered products to a big English super market chain). (NOTE: Knowledge refers mainly to market and brand building due to the English lady.) • olive and oil producers, packaging and labeling plants (trust important but not achieved ("*We had the label problem twice. The first time I had to stick 45000 labels manually. A couple of friends helped me. The second time it was with an order for Denmark; we used a group of convicts serving long sentences").* The Es have to learn more about olive and oil packing and prepare their own factory - a simple conventional olive packaging plant. KIE : networking towards more sophisticated and knowledge based directions: • The E. occupies highly skilled executives to build the new plant, scientific personnel, deepens relations with olive producers, extension to other cultivations (for tapenades, sauces etc) • Contacts Swiss institute for carbon-free • Contacts experts for energy and water saving • chefs and a refinement of special food distribution channels. • The E. selected very carefully the absolute market leaders in the distribution of specialty food products in their respective markets developing long term mutually exclusive partnerships and investing heavily in branding.	Strategic alliances with olive producers Licensing agreement with Swiss institute Research contract with Israeli expert
TCo1	2 network pools of social and business networking in Greece and Germany that have grown within the mother company: Mr R president and member of many technological and entrepreneurial associations. Networking for innovating and product promoting Mr E in Europe:	Further Networking: Contact a fairly new Swiss specialty chemical company (personal acquaintance) which was also trying to grow for the patent application (NOTE: established in 1995, today the company is one of the world leading companies with business units and corporate offices all over the world) Employment of key executives: Although Mr R and Mr E were in charge of the whole plan there were two managing groups, i.e. two chemical engineers, a textile engineer and two mechanical engineers apparel industry. Mr R.; A mixture of ideas and applications has been elaborated with both foreign (mainly from Switzerland and Germany) and national companies. Further networking (with other	Strategic alliance with the chemical company Licensing agreement (chemical industry) Technical cooperation agreement (machinery) Formal and informal contacts and networks. Informal networks mainly as loose ties with customers, equipment suppliers, raw material suppliers and suppliers' technical staff (personal contacts)

		equipment suppliers) enables the choice and construction of original high value machinery and its combination in novel ways using ICT and other techniques (e.g. "safety or bottleneck valves") which solved existing problems in existing finishing units) and a well built in-house team. Long-lasting relationships: *"We have worked hard with Sclavos' (a major Greek machine manufacturer) engineers and that paid us back all these years. I mean when we need some modification, we can have it in really good time. We enjoy it that the company is here in Greece. We had nothing to do with patents. We did not need it!"* (Mr R) Mr E. networks in Germany, Austria and Switzerland regarding customers and trade channels; he opened the perspectives of the mother company and led to the establishment of the spin off. Important formal linkages with specialized laboratories for all processes in Greece, Switzerland and Germany, A constant collaboration with a Greek automation company (and ICT) The company builds up its reputation and consequently enables the cooperation on new products with big multinational chemical companies (such as Clariant) which will be later strengthened by several fruitful projects. Results : emergence of new ideas (e.g. anti-smell which was proposed by a customer and realized by a cooperation with a supplier, the need of an "open fabric" machine due to some customers needs etc) and products (anti-peeling), as well as technical solutions to automation etc. *"You have to foresee the next step and find the right partner. And Mr R can do that. He finds the missing link at the right moment" (PM)*	
TCo2	**<u>1998:</u>** existing network pool consists mainly of conventional yarn suppliers and customers (including hospital, army and similar bodies) **<u>2004:</u>** Established relations of trust with the 3 R&D-based leading companies in order to be the pilot user of new material. New relationships with existing customers (army, police fire brigade etc)	**<u>In 1998</u>** with the construction of the new plant and with the 2 sons become really active within business company turns to knowledge intensiveness. Networking regards: • Contacting new suppliers in advanced sectors: advanced fire rescue fabrics and high performance fabrics. • Starts a long-lasting and close cooperation with 3 leading and R&D intensive companies: T Gore for waterproof, windproof and breathable fabrics, DuPont for flame retardant fabrics and 3M for reflective material and clothing. • turns towards design knowledge by building a team of a designer, an engineer and a quality control executive • Introduces CAD-CAM advanced system (the first in Greece in the sub-sector **<u>KIE 2004:</u>** Investing in new niche markets required Common R&D with the three suppliers Cooperation with technical consultants from Israel approached through a Turk collaborator *"Technical consultants were another source of knowledge from Israel that worked with the company and brought in their specialized know-how on composite materials for armor-plate*	Strategic alliances and R&D agreement mainly with the three technological companies and the Israeli expert Partnership: member of the NOMEX group

		or bullet-proof. They were proposed by a cooperator in Turkey while a partner in USA assured their quality" (Here we can see other ways of finding partners than just searching.) Upgraded co-operation with ICT companies due to further development of the design and product development capability in order to combine small batches down to one piece with long distances and constant update of novel products. A quality lab in England Later: other material and know how suppliers (e.g. for the helmet), Universities for production restructuring and logistics, it turns to promotion as well with e-commerce and B2C. Proximity gained mainly through long lasting relationships and by TCo2 becoming a member of a relevant network. NOTE: A very interesting case of CCN within the notion of knowledge. A conventional sheet maker turns to technical fibers due to DCs (senses SWOTs) and seeks first knowledge providers starting knowledge-based but not knowledge intensive course. In this way the company became a constant innovator (at least for the Greek market) developing innovative products for very small niche markets.	
TCo3	Network pool: the ones of TCo1 and TCo7 in 2005	Mostly utilized: existing network of suppliers, customers and other knowledge providers. The eco-limitation extends networking to the innovative and knowledge intensive area of bio-energy production by adding value (eco-venture in parallel use of water and natural colors instead of chemical treatment): • Departments of the University of Thessaly and TEI of Larissa involved • hiring of 3 chemical engineers • new manufacturers mainly for the biodiesel installation; they worked mainly together with the two new executive - chemical engineers while the dyeing process was supported by the engineering teams of the two dyeing plants of the 2 Es. NOTE: Knowledge well out of the sectoral borders	Strategic alliance –joint venture Research contracts with academia
TCo4	The company owned a strong position in the markets in the 90s A significant network of well known European manufacturers and global customers (apparel brands).	Actually the E. does not enlarge his network cycle but strengthens the existing relationships; a kind of symbiotic partnership, intensifying R&D collaborations with suppliers: "When Adidas set specific requests we called Dyestar and Du Pont. Chemical engineers of the three companies collaborated on the research question. This has been repeated many times since then. Advanced co-operation with manufacturers for installation and function of innovative machinery and combinations Trust due to long term reliability and efficiency (*"You cannot achieve high standards unless you have trustworthy collaborators"*) Strengthening of R&D and design Dpt human capital: A well educated team to plan and organize R&D (about 15 engineers). Team culture evident when interviewees narrate common project stories.	Strategic alliances R&D agreements Technical cooperation agreement (machinery)

		Efforts to extend customer networking cycle by demonstrating the company's new capabilities, in international trade shows and with personal contacts not successful (NOTE: Perhaps due to the fact that they tried to satisfy needs of already customers? For example, Adidas provided work but did not bring new customers...) . This weakness was further mentioned by the GD *"We may have not found the proper way to reach new customers. It is not easy, you know…".*	
TCo5	After the first important enlargement that took place in 1998, the company's image and strategy changed completely mainly in terms of incorporating design (moved to original brand name manufacturing). Network pool encompasses mainly fabric producers and other raw material, component and machinery suppliers.	Networking with knowledge providers: Bocconi University (after attending two seminars of theirs for textiles and apparel industry) ("*We had to dig deep however, to pay their support"*) and University of Piraeus (after attending seminars too) ICT – provider The new co-operation with the shop owners is also an expansion; both parts have to learn a lot about this new form of cooperation	Research contract-out with the Italian University Contracts with the Professor of the University of Piraeus Technical cooperation agreements The Consignment partnerships (the novelty)
TCo6	The new idea is born based first on long and trusting relationships with manufacturers starting in a quite unorthodox way (first innovative machines -then products; NOTE: it resembles FCo10).	Further Networking with • Innovative fiber producers: e.g. Lenzing TENCEL, *LG* a and the German Lederer Elastic Garne for the development of special products • Raw material providers (Qcotton) • Project team comprised of two textile engineers and a chemical engineer (existing personnel) and enriched by a mechanical engineer (hired) and a chemical engineer as a project manager (external collaborator - an old acquaintance and friend of the E.) No further networking with other machine manufacturers. The ones, they collaborated with by then, were world leaders. Trust exists between manufacturers and company, and is established between fiber producers and company (both had good name in the market).	Strategic alliances Technical cooperation agreements R&D agreements Acquisition of 57% of a Greek cotton-gin.
TCo7	Business network: mainly jeans fabric producers in Italy; *"I was an important customer, so I had access in their plants and we would discuss ideas".*	"Everything is networks" (the E.) Networking regards • knowledge providers mainly due to the jeans fabric provider in Italy: big Italian dying plants, chemical raw material suppliers and the world of design • human capital: the Italian specialists, the designers and the engineers for the new plant[336]	Strategic alliances Technical cooperation agreement

[336] .. εμείς φέραμε και σχεδιαστές που γνώριζαν την καινοτομία του πατρόν και του ρούχου. Με αυτούς ήρθαμε σε επαφή μέσα από τους κατασκευαστές υφασμάτων – γιατί αγοράζαμε ύφασμα κύρια ιταλικό – από Fampiani ... Και πηγαίναμε στους Ιταλούς γιατί είχαμε και τις βοήθειες από κει – γνώση κύρια. Ακόμη οι εταιρείες που έκαναν τα χημικά προϊόντα που εμείς χρειαζόμασταν απευθυνόταν σε αυτές τις εταιρείες γιατί αυτοί είναι οι κύριοι καταναλωτές τους και έτσι από εκεί τους γνωρίσαμε. Οι Ιταλοί ήταν στην πηγή τους. .. Ήρθαν εδώ μέσα από αυτή τη γνωριμία, τα βρήκαν και οικονομικά με την επιχείρηση κι έτσι έγινε ένας κύκλος γνωριμιών και ήρθαν και οι Ιταλοί εδώ... και κάποιοι έμειναν… Τότε ήμασταν πελάτες δυνατοί. Έτσι σαν τέτοιους πελάτες φυσικά σε βάζουν και μέσα στο εργοστάσιο και σου δίνουν και ιδέες και σου κάνουν και γνωριμίες

		• finance providers (due to initial contacts of the existing company) • equipment providers and control labs (it is where German technology enters) • promotion networks when building the new image (jeans treatment becomes his strong competitive advantage) *"Mr D tried hard to network with the Italian business environment in regards of materials, equipment and know how. We even have Italian executives!"* PD	
TCo8	Significant business network regarding: cotton and conventional components suppliers, machine manufacturers, automatization and ICT, market channels in Greece.	Networking regards: • Innovative fiber and components (such as elastic waistbands and laces)suppliers • designers • Complementarities are built with dyeing plants and waving plants, some of which will later turn to joint ventures: "After the co-operation with L. we had mutual problems in dyeing. We turned to K., a big dyeing company which unfortunately does not exist today." • logistics and ERP systems (the company turns from 30 to more than 8000 codes every six months), • assistance in the development of new administrative models. • new market channels and fashion marketing (NOTE: today they have turned to shop in shops and corporate shops) • Existing contacts with control labs are strengthened. Team-bases structures are also built: • a strong team of a creative Dpt with designers, modelists and patronists working closely with external European designers, • building of a strong ERP team (the head of the relevant Dpt is now a member of BoD) • focusing on sales (50 employees for T8's shops and many shop in shop stores-changing the business model (they used to sale to big chains and other customers(3). Target: change the company's image from a quality white underwear producer to a modern fashion (under)ware solutions for younger target groups.	Strategic alliances Technical cooperation agreements R&D agreements Joint venture
TCo9	A strong existing business network (TCo9 started as a joint venture of the family and a Dutch multinational)	Deeper relationships with: • two experts on apparel as external collaborators (*"We had the knowledge of fabric but not of the apparel. This was a significant weakness")* • strong customers (Levis was a major knowledge provider) • suppliers (Dyestar, Tristar) • manufacturers in order to acquire more flexible machinery for mass customization. • New human resources (specialists from the apparel sector • Logistics (custom made solutions for mass customization) Today networking is expanding to energy and nanotechnology	Strategic alliance Technical cooperation agreements

TCo10	Fashion and social network	Extends to • The "hardware" of fashion products; i.e. shoe making, use of former employer resources and knowledge (a shoe plant and its workers), suppliers (e.g fabric), customers (fashion world from fashion magazines, where he was involved for 20 years) and financing (looked for business angels) • Space from friends (first collection was presented in a friend's atelier (a known designer) • prior fellow workers: mainly promotion through the magazines ("*With zero expenses I was in the pages of most known fashion magazines. This was a huge success!"*)	A business angel

Table A5: Entrepreneurial Characteristics found to favor Bricolage Capability

	Experience	Unconventional	Open Attitude	Personal touch
WCo1	Since childhood in the family business	• Unconventional idea (why not question) • information and data gathering: establishment of friendships in order to avoid paying for technology • resource selection and knowledge acquisition: offer plant for experimentation • contacts: some of them in bars and cafes	The E does not restrict the further capitalization of the innovative findings Easy in making relations a collective behavior which however has to be supported by mutual trust. Open to ICT	It is evident – the E. acts alone
WCo2	CV[337]. More than 40 years in the sector	The E.: • planned 4 lines when official analyses and managers suggested only one • dared the combination of more than 20 different technologies and cultures, speared time and money in try and error processes to be innovative, engaged innovations not tried before. • Contrary to all strategic rules and innovation management principles the E. spread details of his innovative process to all who might concern.,	The E. welcomes all knowledge and information: an increasing number of engineers, connections with leading competitors (market entrance strategy). Open attitude towards science: Greek TEI, foreign contacts Open to everybody who wishes to know his "secrets". More than 20 manufacturers	Glue innovation came out after the E's co-operation with an Italian erector) *"Knowhow is mine, then the companies had to provide the machinery after my approval. Still I was always there. That's how innovations come up!"* Project executed by managers under the eye of the E. All executive are obliged to have a personal involvement in production in order to gain experience.

[337] CV: corporate venturing

WCo3	Previous 10 year experience in the sector	Attitude is unconventional regarding ways of thinking and confronting the Greek kitchen cabinet production eco-system. (NOTE: From personal experience clustering has been many times rejected by the W&F sector – even the open mindind)	Open to collaborations; e.g. the Italian suppliers and the entrance to cluster, Open to TEI	Evident (startup case)
WCo4	Since childhood in the family business Experience of many years in wood processing (about 15) and about 10 years in the plant management.	Conventional is not enough for them: • they have fresh ideas on productivity • they approach ecology • they dare product innovation • they want <u>their own identity</u> on the new products - that is e.g. the wooden bricks although innovative as products bear the special design of the Es in collaboration with the architects; this can be achieved only due to the modified cutting edge CNCs.	Open attitude towards business and scientific networking and activity. Work mainly with people (Ntalos, personal acquaintances of manufacturing companies, Angelopoulos of Epipleon).	Evident (startup case)
WCo5	The 1st E owns some experience (family business) but the 2nd has neither experience not knowledge of the sector Both lack experience and competence in marketing.	Both companies' agents are too introvert and not really unconventional. They are both open to cooperation but within Greek borders and with people (not companies) and created long lasting relationships.	They are rather introvert - they do not share knowledge - they do not trust foreigners - they cannot manage properly the new relationship with the big customer	Evident (startup case)
WCo6	Long term and successful activation in the sector	The Es are not unconventional but plan and execute rather based on their long experience. The E. mentions many times that they plan carefully. There is a deep involvement and a long term experience that result in a calm conviction about who they are, where they want to go and what they can achieve.	Open minded and in a constant search for excellence.WCo6 has a long story of communicating world leaders and important customers.	They are always personally involved. The 1st E. in administration and the 2ND in production. In CV they co-operated; each one would take the lead in his area of excellence.
WCo7	The E lacks former experience and knowledge of the sector	Not really unconventional. The idea was actually introduced to him and he considered a nice idea since he would be given technology and he would be the first in the market.	The E. cannot be characterized as open minded – it was a matter of accepting an opportunity	Not actually a personal involvement. The plant was a key-turn solution and first market provided by the Italian technology providers.
WCo8	Multinational's experience after PhD education in USA and entrepreneurial family milieu	The story reveals an unconventional character that cannot rest on conventional solutions. The E. alters the local market's established practices; "Everybody thought of kitchen cabinets as furniture. I did not see it that way!" "I brought new materials – corian!" "Then I told my father: This plant has to b e demolished!" (NOTE: The family business	The E. let the partner profit from the co-developed technology to actually profit: *"This multi-machine was based on my idea and incorporated my requests. I personally worked on its software. It actually won the first prize in CEBIT Hannover in 2000 (NOTE: technology show). There was a significant number of such machines sold*	With a personal signature on technology, software, business model management and design. His narration indicates a complete personal involvement in all founding activities

		occupied 50 people and was one of the best in North Greece)	*after that but I was not interested in that direction anymore"* Open attitude towards any kind of development project, innovation and co-operation without trying to keep secrets or even very personal work. He does not hesitate to help even competitors" "*They asked my help*. – Q: Even to competitors? – *I did not see it that way!"*	
WCo9	Long-long experience (pioneer in element systems, soft forming, modular and then knock down furniture etc) -CV The E. has a "guru's"' experience of the furniture sector, in all facets, stretching from industry-specific knowledge matters, market recognition and user knowledge to administrative duties and management, business contacts and a strong capability to built new ones all along the value chain.	The E. has been unconventional since the very beginning in 1980 (see company's history - he was always pioneer) with a big experience on organizational activities. He opens an unknown niche market within a market that knows extremely well NOTE: Yet, the venture appears to rest in the known paths and the group does not risk creating a new eco-system although it could (e.g. new applications)	Open-mindedness is embedded in the company's system and culture as well as collective behavior.	Managers work under the eye of the entrepreneur Open interaction between internal and external environment, while trying to shape both of them for the sake of the new venture (with complementary industry, installers etc).
WCo10	Long experience in the sub-sector - CV	Known worldwide for his unconventional way of thinking and acting. Well known to be totally unconventional, the E. has often challenged the business world: *"When I was talking about ecology and transparency 20 years ago, everybody laughed. The same laugh followed my eco-vision of the new firm in 1998. But customers responded." "I presented my multiple mattress – once again I heard all kinds of nonsense; how am I going to make the bed?"* He opposed conventional industry: *"Conventional industry cannot understand us – even my own brother. And they get crazy of our success and our eco-culture"* He appears not to be afraid of his "anomaly" : *"OK,*	He is very extrovert and open minding providing that ideas and suggestions do not oppose to his own ecological ideas. There is a plurality of nationalities and religions, as well as employment of people with special skills proving that he trusts creativity with no usually established limits on people and their condition.	Although production and routine work are not his responsibility, there is his personal touch in all new ideas and concepts even after 20 years of WCo10's existence: *"You ask me if I have secrets. Well, I haven't because everything is totally mine; it bares my signature!"*

		why should I be afraid now? I was not afraid when I was about to go to prison and my children did not have to eat. But now? Why?"		
FCo1	Entrepreneurial family milieu, educational background	Personal traits: autonomy, imagination, entrepreneurial alertness, innovative spirit - catalysts for entrepreneurial and innovative activity. They want to be unconventional in order to bring differentiation. They do not use market research to plan innovation – they sell innovation before preparing it (before producing it in production line)	Due to their entrepreneurial milieu and studies, the Es are open-minded and cosmopolitans. This is more evident in their networking to suppliers and customers than to science and technology providers	Personal involvement and imagination keeps a central role. The E. creates the product idea and promotes it. He also helps in the development of custom-made machinery
FCo2	Family business Many years in the business (around 20)	Mr D, the idea champion is rather unconventional (his whole life is unconventional according to his narrations) and loves challenges. He searches for unconventional ways of cultivation *"I am a 4th generation farmer and I wanted to make a step beyond the conventional ways of land cultivation"*. The Es do not surrender even when encountering major difficulties: *"We were told that people working in the relevant posts within the offices of the Region were betting about when we will bankrupt!"*	A very diverse team with complementing capabilities: 2 farmers with a significant experience in agriculture, an IT graduate, an experienced manager and a man with experience on local commerce. Although Greek farmers, they have an open attitude towards novelty and science at least at European level.	Personal touch is evident. The whole process of the venture creation bears their signature
FCo3	Long entrepreneurial experience but in irrelevant business	Rather unconventional for the Greek reality: the 2 Es study pedagogical sciences and IT but turn to entrepreneurial activities as soon as they finish with education and army. For almost 10 years are occupied in various business searching for *THE Idea* but they are also willing to learn. Unconventional ways of data gathering: rely on friend's advice – enter Italian plants to learn,	They are open towards any support either coming from science, technological sources or market and customers. They believe in people: "the right people appeared at the right moment" They strongly believe in people-to-people relations.	They want to be the only ones to know "the whole package"" *"No-one else has the whole picture of our lines. Not even our chemist!"* and are involved in all stages of the business activities.
FCo4	Significant former business experience in the pastry sub-sector They admit many difficulties due to inadequate education on entrepreneurship *"Many of us know some craft and open a business. But this is not*	Neither pastry nor conventional chocolates are enough for the family who search for innovation. The son (not active in the founding stage due to age) wanted to engage formal methods of sensing-seizing and written strategic plans, "according to our flexible way of thinking though" as he clarifies. NOTE: a) There is a remarkable love for ecology,	They belong to the few of micro food companies that are not introversive and are not afraid of knowledge. Efforts to reach academics (not easy without personal contact) and other institutes (Food Allergens)	Significant personal touch on all business activities and even choice of tastes, image formation, trend name and design besides cooperation with professionals. *"... Design is ours. Our designer has intervened only in a few points. We have further registered the names"*

	entrepreneurship. The state should exam out entrepreneurial knowledge before supplying the business license. Otherwise you are contemned to shut down. We need training on entrepreneurship!"	cocoa and chocolate that impressed me. b) The son proves to be very active- in 2015, he has enlarged the company, started exports, extended to super-foods and other products like organic jams and fruit juices Innovative market entrance: the semi-pharmaceutical products in drugstores		
FCo5	Significant business experience in the food sector, family business (conventional activities), Experienced and serial entrepreneurs (30 and 22 years in food sector before FCo5's foundation) Both well educated.	The Es started searching for innovation in 2001 in order to differentiate. They are among the few in Greece to seek science-based innovation. NOTE: The following innovative projects are rather unconventional in Greek terms and an unfriendly institutional environment. Reasons are also unconventional: the research turned to cancer patients due to a little boy with cancer and not a feasibility study. *"They are people of a special category; they don't just see ahead, they are ahead. They have a special approach and risk, they love risking; they want to do things based on knowledge and get out of the box. This is rather difficult within the Greek entrepreneurial environment! It is very hard, indeed!"* Dr K.	Turned to several co-operations but they keep certain areas for themselves. Sales to the final consumer by bypassing the direct hierarchical business relations within the supply chain since they want complete control of consumers' actions and a direct contact. Still they turn to people and not organizations. They reject collaborations when proposal comes from people they do not trust (3 times with 2 big University Dpts). Attended many courses on food technology specialized in quality, technologies and methods mostly abroad as well as in the customers' companies. They shared the results of their research and development in multiple ways: An example: the new wheat needed somewhere in the process to enter the next step more clean and fluffy that the existing system could offer. That was a major problem which was solved by FCo5's technical department, while some parts of the machinery of the new product line department was manufactured by a foreign company which finally engaged the new solution in their production lines (with the permission of FCo5)	Decision making Research Technology development; certain parts are designed by Mr T himself Contacts with groups are made by Mr T and his managers. He personally talks to patients Development of co-operation with Dr K is a personal achievement of Mr T.
FCo6	Entrepreneurial family milieu, (almost half a century) educational background	The Es - overcome established concepts on agricultural products,	They are extremely open towards business and social networks They get involved and share the results of	Mr KP is the key person and the soul of the innovation activities, since he is the champion who strongly believed in this

	CV	- Develop R&D Dpt ("what for" according to the old generation) - embrace science and turn to other directions as well - search novelty in different models	their research and development in multiple ways.	strategy Yet all the team exhibits a strong commitment to the final target since they all believe in the necessity of the new direction of the company.
FC7	Family experience, long involvement in the sector CV	The E. is unconventional both because of his studies (he also chose a partner of similar University Degree and a Master in Philosophy) that give him a different way of thinking but also because he never felt satisfied within the limits of the existing traditional dairy products ecosystem.	Open attitude is not too obvious. The E. is open to receive knowledge mainly within the sector from global competitors and marketing experts but not Academia. He is a strong supporter of person-to-person relations.	His personal touch is evident throughout the story, since all experiments and ideas are his own. Ever since 1995 the whole range of company's activities were controlled by Mr P. and quite successfully according to the company's records.
FCo8	CV - Family experience, long involvement in the sector, grown up by a farseeing father (cheese maker): *"Our father introduced us to this entrepreneurial environment. I remember him coming late and we would discuss about production and competition until 4 o'clock in the morning! Ant we were just schoolboys!"*	Although not well educated they "think out of the box" and have an excellent view of the power of knowledge. They invest in the *"why I have not seen it before"* question; thus they think out of the box "*for thinking consumers*".	Passion, love and an open attitude are the main characteristics of the Es.	FCo8 was a "personal bet" of its founders. Managers under their eyes; they are responsible for all strategic decision making and prove to be strong enough to stand against the "unfair war by the established giants till then".
FCo9	entrepreneurial family milieu, educational background, professional background (the 1st son had been participating in the SBU's management of the joint venture for at least 5 years) Experience of father (Un. degree in Economics and master in management in Germany – manager of food company and entrepreneur himself.	They start by seeking differentiation. They think out of the box against all rules: *"What you say is impossible! – this was the final answer of a large number of experts. The discussion – one of many – had lasted almost all day. The two brothers and on the other side the specialists"* (P. Tsakiridis) *"We are really excited to create something new, something out of nothing!"* http://www.mywaypress.gr/wellabys/#thethe-accordion-content-12	The entrepreneurs do not restrict the further capitalization of the innovative findings *"Such firms have a special department for developing the know-how required by the customer. Sizes and profit margins are that big that it really interests them. Besides our formal contract on appropriability* ***it is not really important for us."***	Ideas, search for markets, machinery, concept, image building and all activities' co-ordination – the only thing the two Es do not do themselves is the actual experimentations of recipes for the final products. They admit this weakness of theirs and hire food specialists.
FCo10	Founding stage: already important entrepreneurial activities, educational and social background (but in irrelevant areas)	Mr K is unconventional in certain ways*: "I started backwards; first marketing and packaging and we created brand identity without the product!"* He denied family culture to enter the arena of politics	A true cosmopolitan Open attitude is evident. Significant networking with a wide range of people, firms and institutes worldwide (chefs,	The core strategy belongs to the founder; however, according to his sayings, he appears very keen in orchestrating his well-selected team.

	KIE: Entrepreneurial experience has been enriched by sectoral and markets' knowledge	and turns to KIE. He competes for the victory. He engages unconventional methods for • Contacts, networking methods and market entrance strategies (uses cinema stars and Hollywood events) and • Ways of production (sub-contracting but under specific conditions). During founding stage the importance of knowledge and innovation has not still been understood. First plant is conventional but it will be soon inadequate. KIE: More technocratic areas: Mr K proves once again the unconventional character - a 3rd line for products not yet decided and plenty of space for innovative ideas, e.g. carbon free olive oil – first in the world. "*1995 was easy. We had no competitors. Now differentiation needed more than quality and authendicity; it needed innovation. This is how we planned the plant. Initial ideas regarded eco-friendly activities and a strong wellness and healthiness image besides the Greek origins. The plant would have the potential to support innovation on a constant basis".*	promoters, research institutes, water and energy experts). First employees are highly skilled and expected to render more in terms of a harmonic realization of the new vision.	
TCo1	CV - Significant business experience of the two Es: Mr R =Production manager in a textile industry for 7 years and owner of a similar company for the next 15 years) Mr E is an entrepreneur in the textile sector for more than 30 years	Not evident	Both entrepreneurs are open to any challenge be it cooperation with industry, University or customers. ID not imperative but required (e.g. seeked for patent. That is a task set)	Personal touch: *"being a mechanical engineer Mr R evaluated the technology developed and /or offered. He knew weaknesses and had precise requests to fulfil. He would spend many hours on details with the engineers of Sclavos in order to achieve what he wanted*" (PM) *"The fact that Mr R s a mechanical engineer with an experience of more than ten years in the T&C sector was of great importance. He was actively engaged with the corporate venture. He could always evaluate a technology that he would notice in some place or manufacturers would*

				introduce to us. And this played a significant role in actually deciding what we really wanted to do" *(PM)* Mr E developed the customer network alone
TCo2	entrepreneurial family milieu, educational background long experience in the sector CV The Es experienced all company's important transformation phases - they became active members of the management team in the early 90's. Father was a pioneer as well (first to use technical fibers, among the first to sense the rapid changes in the sector worldwide and turn to advanced production and a less massive market)	Unconventional thinking regarding the clothing sector. They turn to high-tech and R&D against all conventional perceptions of the sector.	They all have an open attitude towards innovation and cooperation and are extrovert: they sold to Europe even before 1998 - involvement in public tenders and a relationship to that clothing subsector	They are active in all directions – they even contribute personally to R&D
TCo3	CV – joint venture among the Es of TCo1 and TCo7 Both Es are almost at the peak of their success as European Es (both companies have been more than once among the 300 best in Greece).	They change the way of dyeing – one piece dyeing is quite extreme	Not evident in the interview text	*"They both love innovations. The initial investment* (NOTE he refers to the physical implementation) *was guided by the two Es but managers were free to take initiatives and we all co-operated closely with the Professors mentioned above" (*Technical director)
TCo4	CV - long and successful experience in the sector at all stages and almost all subsectors (more than 30 years).	The E. mentions that one has to take risks and love one's business very much. *"It is quite important to give the different"* (NOTE: This is not usual in the sector). However, the E. relied mostly on technology based methods although it was of high risk (more than 60 million Euros),	The E. used already well known, leading cooperators *"We had significant knowledge flows and exchange with manufacturers and suppliers"*	All decisions bear the E's personal touch according to both interviews: he bet on his idea he relied on his team, he would evidently decide about almost everything.
TCo5	CV - long and successful experience in the sector (CEO since 1978)	TCo5 has been known for its policy to use unconventional -for the Greek reality - ways e.g. strong Creativity Dpt with 10 designers.. A strong commitment to change: *"However, the most important thing was our will and our commitment*	The entrepreneurs are open to science and technology. They do not restrict the further capitalization of the innovative findings Brand awareness of TCo5: 90% since 2002	Personal touch: the idea has been captured by the E. and then developed by the two academic Institutes The company's branding and fashion design is directed by the E's wife (she produces the

		to changes; this lead us to the search of knowledge"		major part of the new collection)
TCo6	CV - long and successful experience in the sector One of the leading firms of the sector at European level with national awards and global recognition.	They provoke and make their own combinations in machinery and product mix - the new venture was really a chaos (*"sth innovative with cutting edge technology"*) with clear targets ("*differentiated products based on innovative know how and ecology"*)	Market recognition, strong business contacts, strong networks, a strong R&D Dpt since 1992 a pilot spinning laboratory in co-operation with leading manufacturing companies NOTE: significant knowledge flows and knowledge exchange - they don't mind sharing knowledge	Managers work under the eye of the entrepreneur.
TCo7	CV - long and successful experience in the sector	The E is unconventional in many ways: he is among the few to brand and see denim in a different way in Greece. He wants to compete with Levi's and Diesel starting from the "tiny" Greek market and having to confront the Greek reputation of "Greek subcontractors due to cheap labor" as well as the total absence of any design culture: *"Starting a large scale and ambitious business in Greece is against all odds. Its market is small and there is no Greek signature to support such an effort regarding Greek style culture; I refer to the "made in" signature like Italy, France or even Spain"* He is considered as a pioneer of the sub-sector: "*He was always one step ahead at least regarding Greek entrepreneurs!*" (PM).	Deep involvement in the denim world: strong networking with the affiliated sectors (fabric producers, dying -treating sector, fashion, sales networks, branding)	The E. had a direct and constant involvement with the whole range of activities and a passion/an obsession for denim. One can detect a strong interpersonal dimension, with the focus on individuals seeking for compatible actors to execute suitable tasks NOTE: If Hans Hinterhuber (1992) wanted to empirically prove his theory on the special relationship between the entrepreneurial vision and the person (*"entrepreneurial ideas are an expression of one's own life and professional experience"*), he could use this E. as an example.
TCo8	CV - long and successful experience in the sector	TCo8 *tries to* become unconventional since it was a well organized mass production company with strict laws of quality, consistency and lead - times. KIE leads TCo8 in diving in new unknown deep water.	There is certainly an open attitude towards innovation and creativity. Experience in co-working with multinationals, strong networks and a rich pool of resources of all kinds.	It is a case of the few: not one-man - show but a BoD where of course there is always a "gatekeeper".
TCo9	CV - long and successful experience in the sector A well established company - well known all over the world (upper segment of the market), among the 3 best in Europe for many years	Decision for R&D department and mass customization are unconventional in regard of the sub-sector and the time of decision	He has an open attitude towards innovation and networking: an open view of incorporating science and new technologies	A deep involvement of the president (and main shareholder) of the company. Relevant studies at Master level and special courses on the subsector technology and management. Still the question that the interviewee did not answer (not recorded) about the percentage of his personal involvement in the important

				decision of TCo9's shift towards mass customization remains without answer.
TCo10	A long significant experience in the fashion world with well-established relationships to both the production and the market.	Unconventional in many ways (his life story highlights that). Among the few designers in Greece to become entrepreneurs. First collection in a friend's atelier	The E. is really too open to all; he welcomes all kind of promotion, funding and production support.	Clear personal touch -all business supports his design and fashion trend.

Table A6: Information flowing: Dimension of Improvisational capability

	Real-time information – communication (RTIC) ***the interaction within and between the teams based on timely information (Brown and Eisenhardt 1998; Vera and Crossan, 2005)***	**Flexibility** ***The spontaneous respond to arising circumstances and obstacles, allowing exceptions to rules. 'The ability to change or react' (Thomke 1997: 105), the capacity to rapidly create and seize upon initiatives and opportunities (Evans, 1991; Grewal and Tansuhaj, 2001) regarding resources, structures and decisions.***	**Experimental culture** ***Exploring, continuous experimenting, tinkering with possibilities without knowing where one's queries will lead or how action will unfold*** **(Barrett, 1998).**
WCo1	In many cases during KIE (many channels): e.g. • from the trade show directly to the two German factories for 2 and 3 days, • From trade show to meet producers, • nights spent with TEI expert. • With material suppliers in their plants Almost no time lag between occurrence and reporting of the information, While experimenting, try and error and on line info exchange with manufacturers and customers with visits to veneer suppliers for learning on material behavior RTIC mainly to solve emerging technical problems and to find solutions to leverage limited resources High degree of knowledge and information	When the E. discovers that innovative technology is too expensive, he turns to other manufacturing solutions and to specialization and tailor -made products. He seizes upon the opportunities he comes around: the expert in the bar, the discovery of the Spanish supplier (he uses the firm to get educated on innovative material). He starts by co-producing conventional products as a sub contractor in order to get money and fulfill his vision.	Exploring and experimenting examples: In Kiefer's factory the E. gets introduced in new design techniques and in the culture of eco-friendliness and waste elimination. He goes on experimenting when all equipment is installed in continuous contacts with all supply chain stakeholders.
WCo2	RTIC mainly in the implementation stage.-improvisation regards mainly the innovation which appears to be an inspiration of the moment.	Flexibility in structures: WCo2 worked with a very limited number of former employees and none by mother -company, while the two entrepreneurs were the only connection among the	Too much try and error: e.g. the percentage of glue, necessary conditions, type of raw material (proper composition), times in each stage. Innovation was a

	RTIC mainly through informal personal relations of both the E. and his managers at the erection stage (interaction among people of more than 20 firms)	mother and the new company: *"The team should be "fresh" (i.e. new) and small"*. Flexibility example in confronting obstacles: *"That innovative technology came out after our disagreement with the German manufacturing company. We insisted on what we wanted but tried to find alternative ways; we turned to a Greek manufacturer. It was actually a bet. Later the German company asked to use our technology. We had no problem to reveal our secrets, since we are no machine makers!"*	result of experimenting
WCo3	RTIC during discussions: e.g. distance brings up the problem of production integration ***that*** leads to modular design and production ***that*** leads to discussion on novel production technology ***which*** introduces the need of ITetc. A constant restructuring of the supply chain due to the changing role of the entrepreneurs from clients of ready to install kitchen furniture to members of kitchen furniture industrial district: channels include firms of the Italian cluster, TEI experts and machine producers with a significant volume of knowledge and information exchange to answer the above mentioned emerging questions (at the time they emerge)	*"We wanted to verticalize but our budget did not allow for it. We turned to other companies for cooperation. But that is rather impossible in our sector. There are many companies that work as subcontractors but they do not guarantee uniformity. Doors seemed closed for our initial concept. Still, we did not want to become "a conventional company". Being former representatives of Italian kitchen furniture, we knew their way. I mean distretti industriali. Then it was the problem of distance. Modular design solved it creating the problem of the production line. All of these problems while we were accepting orders and working in unconventional ways."* *"You know structures must adapt to your vision. They have the power to ossify it"*	Experimentation regards mainly the organization of production in order to achieve good results of the modular design concept.
WCo4	RTIC through • formal contracts: machine and IT suppliers, TEI • informal :experts, customers which support the almost concurrent and fast development of technology, research, NPD and future strategy	Not evident for the KIE stage	There is continuous experimenting and technology exchange with Mr N., TEI, and partly other suppliers: *"We made several experiments to achieve the quality of the final products. Then, the following year we experimented on our innovative products through the K-Cluster…. Experiments went on for almost a year both here (the plant) and at TEI's labs."*
WCo5	Low-level RTIC mainly by engaging customers in testing new products. Story indicates interaction with environment but mainly solving problems and defects with the Es not to be really aware of the situation	Flexibility regards mainly efforts to solve technical problems. It is not really evident in this case	There is continuous experimenting and technology exchange with TEI, mainly due to mistakes. Experimenting mainly on production technology
WCo6	RTIC excelled the implementation of the new technology through • the knowledge and information exchange emerging from the lab results and	Flexibility is not present in this case. It appears than new knowledge and information is used in the formerly organized processes.	Experimentation and learning by trial and error through a continual process of testing and permutation. It regards mainly production technologies combined with design. Experimenting culture is embedded in

	• communication and use of customer's observations. RTIC through contracts with manufacturers and laboratories (formal) and customers (informal)		firm.
WCo7	Not evident	Flexibility regards only the problems of adapting technology to local conditions	Try and error processes to solve technical problems
WCo8	RTIC through dynamic interactions among the networking cycle, external data and the market especially in case of strong ties. The E brings knowledge and demands knowledge, e.g.: the common project of high interest with machine manufacturers that led to innovation; according to narration there was much knowledge exchange: • the E stayed in the manufacturer's plant and worked on the machine • during the project with the programmers (IT sector engaged as core and not just supportive) • with corian producers or even in cases of new contacts: "I asked for bummerang systems (NOTE: case fits Ciborra's suggestions). Plans change when danger signals are received: "I change that strategy as soon as I saw that Greece could not support it".	Flexibility serves the perfect improvisational way and appears in the form of resources and decisions, e.g.: • due to arising needs or improvements or connections and links among novelties that emerge after the erection of some of the plan's components; • by benchmarking leading design companies • by the efforts to suit vision to specific conditions It appears as a continuous and highly dynamic process at least at the foundation phase, although processes of new technology selection and overall improvements are incorporated into WCo8's culture	WCo8 used extensive try-and-error on innovative material use and the new production technologies (based on the boxing concept and the innovative machinery) combined with design.
WCo9	RTIC is provided by formal business contracts: it is a case of technology transfer, so a) appropriability is secured, b) Synergies are required in order to solve problems that arise due to novelty of technology. Besides emerging technical problems, RTIC regarded knowledge and information sharing with: • special supplementary product providers under company's directions, • product pilot users for testing results (etc) Executives and E. try to capture as much extensive knowledge around WPC as well as ways to collective activities. Initial business contact in a trade show was translated to a modern plant in Greece	Flexibility and working out of routines, budgets and estimations was crucial for the realization of the concept within a short time (less than a year) process. "Getting out of existing routines, avoid processes and be flexible" was the strategy set by WCo9: *"In an established company, if one wants a new venture, one has to take the whole project out of the everyday routines and processes – otherwise you cannot be flexible either with knowledge or other resources"* Existing knowledge resources (e.g. wood processing and relevant market - extruding technology through the executive) act as orchestrators for the rest - they provoke further knowledge generation (further than the given one by the US company) and trial and error processes Special care of the E. to avoid liabilities of everyday business routine, liabilities of age and bureaucracy. The Entrepreneur committed the team to deal only with the new SBU project.	Decision to buy patented technology and turn-key plant reveals former consciousness on experimenting: *"We realized that it would take us long – actually too long - to experiment and make our own "recipes" and technologies since it is a product of high technology. We had also seen that the few efforts in Europe ended up with failure"*. Experimenting regards mainly adaptation to the Greek and Mediterranean conditions and solution of technical products through try and error. Osmosis of technology and design (learning interaction): *"We started with decking profiles which were compact. However, during erections we had to turn to other solutions for several reasons… our profiles should be lighter. Therefore we had to develop them"*. Technology and knowledge transfer to product users

			Experimenting through try and error and mainly regarding: color, profiles, material ageing
WCo10	The E. engages high-level RTIC with customers, partners or even researchers in his projects or ideas making them stakeholders of his ideas - and this are a fine way to have real time information and promote and improve or abandon initial concepts.	WCo10's policy to use no routines when important changes take place is strongly backed by the exceptionally unconventional personality of the entrepreneur. Flexibility regards everything: human resources, suppliers, materials and a big expanding network regarding R&D: pilot use of mattresses in hotels, alternative uses of natural raw material, alternative production methods to fit with nature, (today even the medical world of many countries and pilot uses in hospitals)	There is a lot of experimenting in all fields, e.g. "*How easy is it to use sea wrack as a raw material for mass production or even how easy is it to turn the idea of a hotel bed mattress to a marketing concept?"* Try and error is one of the E's motives: *"If you do it once you will see your mistakes in practice and you will correct them. Then you will do it again and you will improve"* *"I tried many things. I did not know if I could make something out of them. I could not tell about the market. When I put a zip in my mattresses, everybody was laughing. Now everybody wants transparency. It is the same with the seaweed. The raw material does not cost – for the time being-but one has to think of industrial production and this is not easy. Still, I go on experimenting!"*
FCo1	A constant improvisation on products and ways of industrial production (e.g. the preparation of pepper cutting the edge, the special equipment, the new recipes, the espresso offering) on a basis of constant improvement and refinement of the initial idea. (NOTE:this is well embedded in company's culture (e.g. improvisation on taste ideas, in solving problems as the use of waste(e.g. problem with waste: a new product category has been created, spreads, to exploit economies of scope). RTIC refers to customer's requests or remarks, rejections or acceptance of products, new raw material info, laws and norms etc and establishes a stable interaction among Es and environment. RTIC surprises at the initial stage when products just out of the lab (pilot productions) are tasted during the international trade fair in order to start working with customers: *"Yes, we had only the lab, we were having the plant built, we would experiment and see the problems, we prepared the products for the trade show and we had a tremendous acceptance!"* Right timing is of great importance for market entering	Flexible use of all resources at hand: capital, knowledge and contacts and a constant *crescendo* in their exploitation: increase of the initial new products' number, adaption to foreign tastes, improvement of packaging, and enrichment of targeted market groups. Flexibility in order to "catch and couch the strange in the language of the familiar" (definition of innovation, Chiles et al., 2010)	A mixture of try and error and experimentation to exploit information and technology and integrate pertinent available knowledge*: "Once we had decided the core raw materials, we would try on many possible combinations in laboratory. We were not sure about the final results and even when we presented some of them at the international trade show, we did not know how we would produce them. We were in Hamburg and still the laboratory was experimenting."* Try and error both in lab and markets

	according to the E.		
FCo2	All KIE process is a case of constant improvisation and regards decisions on expensive equipment, conditions of working place, seeds to be planted, promotion, and packaging. The Es relied on RTIC regarding all stakeholders in order to proceed with the new venture: e.g. knowledge and information on theory of method, ways of plant etc which were not captured in the beginning but were sought during KIE stages. The way of learning how to plant is amazing: there was no-one to show them practically how to plant or consult on the proper climate conditions and ingredient analogies. While they think of turning to foreign producers, *they are lucky to find a woman* who had worked in a similar greenhouse in Holland. “She taught us how to plant the seeds". The constant knowledge diffusion facilitates the improvement of methods and techniques, further plant modernization, the adaptation of innovative methods through the whole value chain (information, promotion, knowledge exchange through internet, energy saving, disease elimination etc), emergence of new ideas (e.g. on packing) and products (start tomato and squash), as well as technical solutions to automation etc. The final production plant and products were quite different from their initial ideas.	Flexibility regards decisions and resources Examples: initial idea on greenhouses changes to use of hydroponics with decisions to be taken quite fast besides the quite significant size of the entrepreneurial team Obstacles find solutions using contacts and experience in flexible ways The Es were not easily disappointed besides the negative bets for the viability of their start-up or the two damaged productions	Try-and-error efforts in order to create the identical climate for cultivation. The preparation phase took two years before foundation and 2 years after. Try-and-error efforts led to the damage of two yearly productions.
FCo3	The Es literally followed the conception of action as it unfolded exploiting real time information of manufacturers and markets mainly through networking, communicating with their environment and adopting all necessary steps even if not initially planned. RTIC regards: • the role and engagement of quality controls a • the cleaning processes (not even known initially • the adoption of new machinery to the specific conditions of the case • the need for novel packaging • the hard way to learn about transfer. Customers training, packaging and transportation were issues that emerged during the start-up stage Commitment	The initial entrepreneurial idea as shaped in the mind of the 2 Es was many times reshaped, regarding production technologies, product handling and marketing issues. A case of fruitful combination and exploitation of existing knowledge on common entrepreneurship, a 'plan of action', loose social structures and resources while seeking missing pieces and ways of finding them.	Experimenting, although time consuming, is the main way to solve problems: *Try and error* in order to solve even minor problems due to the uniqueness of the equipment in Greece (egg pasteurization), cleaning, transportation etc.

	of resources (human capital - chemist / expert and relevant knowledge, money - refrigerated trucks, cooperation on maintenance know how etc) were needed to answer the challenges		
FCo4	There is a constant flow of information and interaction with fructose suppliers, experts, manufacturers, GMO (EOF) and selected consumers. Informal routines on real time information (selection, discussion, experimentation, trial, correction, selection). Networking expanded (as noted above) ("the right people – the right moment"). A significant form of RTIC regarded the idea application to drugstores.	Flexibility is evident in terms of surpassing obstacles such as the limited financial resources and the need of scientific knowledge: Exploitation of networks (customers, acquaintances). Targeted market demands (diabetics, children) using acquaintance's drugstores and confectionaries, further search of natural sources (stevia, spirulina) Plans change easily and solutions are tailor-made to suit emerging circumstances, once mixture proportions and process decided	FCo4 started from simple experimentation on biological mixtures to end up with R&D on semi-pharmaceutical products. There is knowledge developed on manufacturing and production technology and knowhow by many *try and error processes* Experiments with new ingredients and techniques in order to produce pure -natural products (e.g. no lecithin or chemical preservatives, no oleaginous, sugar or preservatives). Trial and error loops a) adding more attractive features and design - reproducing an improved concept b) channel approaching (through doctors? - pharmacies? - other shops?) Unfolding the manifold by further experimenting, integrating the product concept, packaging, networking with pharmacies (pioneers) and organic shops, training etc
FCo5	**RTIC and consequences:** Within the initial concept of gluten-free bread, besides the main challenge, other knowledge problems emerged e.g. around patients' taste and tolerance of the new product, ways of solving the mass production without the need of changing production lines, new opportunities by testers, due to real time info of stakeholders. Besides consumers real time information came from partners (e.g the new lab), employees (the research team) etc. ***Examples:*** they kept in contact with the Association of patients with workshops and questionnaires ...The final products were tasted by most of the company's employees in order to improve the taste and find the best recipes not only for bread but also for cakes, pizzas, etc. Then these products were sent to the association's patients to test their reaction (if the products are tolerable by their body, as well as the taste. Knowledge flows in the whole process starting form designs till the pilot production. Malfunctions and problems quite often produce new knowledge and sometimes FCo5's	Emerging issues led to a need for further investment (from the initial amount of 3.5 million to 5 million Euros) in order to fit to market: e.g. seeing that the new gluten-free flour should need a brand new production line; or detecting other properties by tasting (the girl on diet) they turned to that direction as well. Production technology requested significant changes which emerged even during erection e.g. the need of the flour to be more fluffy Results lead to new decisions e.g. the impact of the product to the cancer patient Discussion and initial co-operation with Dr K led to the bio-functional food direction.	Try and error processes in order to fit to customers' tastes and institutional and medical conditions: linkages with the medical world which become later stronger for research projects (e.g. a clinical research on cancer patients in the Diavalkaniko Hospital of Thessaloniki). *"Trial and error is not like R&D. You do not devote a certain budget in working hours. You and your team deal with the unexpected."* (CEO of FCo5) FCo5 developed high-tech R&D lab. *"I think now, I could not say how much time we spent on it (i.e. literature research). The man-hours we devoted to study ... in order to find a component ratio and contact the experiment you may search and finally find nothing to assist you. And then you have to decide by yourself! The existing literature was at infant level" (a research member in the lab).* Sample tests and analyses at the first stages. At a second level, formation of final products (e.g. bread,

	solutions are adapted by the manufacturing companies (see above in open attitude). Unforeseen difficulties led to a need for further investment (from the initial amount of 3.5 million to 5 million) Euros in order to fit to market. Info on flour prescription led to drugstores[338]. Culture of constant interaction with environment embedded: "messages" by all possible sources internal or external turn to business ideas and experimentation.		cakes, pizza dough etc) with particular tastes, textures, colors and other properties. Experimenting is established in order to present new concepts in the market
FCo6[339]	A formal business contact in a trade show was translated to a modern plant in Greece, employment of experts or and R&D contract **RTIC:** An excellent example of Improvisation where we detect reworking pre-composed material and designs (plans and knowledge selected on certain purposes) in relation to unanticipated ideas conceived, shaped and transformed under the special conditions of performance (first results of rice produced and further refinements and improvements): At the stage of preparing the plant for the innovative parboiled process the first (pilot) product that comes out is quite different: the Es import relevant rice to catch the market, they engage energy production and novel farmer production management and stretch to more novelties regarding NPD. At the same time they engage improvisation in order to solve the emerging technical problems due to pilot machinery using as well as market segment capturing.	All actions although improvised are well planned following an organized interaction with environment (suppliers, market, investment laws, N . Greece culture etc). This is possible due to new networking (in N. Greece) with raw material suppliers and local manufacturers, new markets and relevant channels etc Improvisational actions are both exploitative (process methods, market penetration, raw material use) and explorative (creation of new knowledge for novelty, value adding a dynamic collage of knowledge, resources and ways of applying them). Unforeseen difficulties led to further investments and more research. It is a case where the new generation tries hard to surpass liabilities of age	*"In-house try-and-error is usually more efficient that trying to reach more advanced second-hand experiences"* FCo6 developed high-tech R&D labs. The built of the pilot line in the manufacturing company's installations meant many experiments, sample tests and analyses at the first stage.
FC7	RTIC comes from different directions: local conditions, humidity, packaging, local milk characteristics etc During KIE there is much knowledge and information sharing mainly with competitors abroad Information channels regard also promotion (including	Flexible use of the knowledge gained from re-engineering, visits, trade shows, internet and books in order to react to the traditional character of his products. He maneuvers among the demands for healthy and light dairy products, the production of gourmet products with exceptional	FCo7 started experimentation on a basis of re-engineering using the existing installations, followed by gradually intensive try-and-error efforts in order to be differentiated (from imitation to innovation) in an exceptionally mature market.

[338] Since the flour can be prescribed in a pharmacy prescription book and the patients take their money back, they started ordering it through drugstores.

[339] Mother company had already developed a culture of innovativeness but in a rather practical way due to first generation's views. Iit was the first in Greece to produce standardized branded rice, invented the upright paper bag with the see- through window and a second inner bag in order to further protect the enclosed product of the first generation. In 1969, the entrepreneurs who wanted to be able to manage the whole packaging process decide to buy the printing machine which cost as much as the whole machinery of the factory. In the beginning of the 70s they start producing in a classical way parboiled yellow rice of "American type" being again the first in Europe. They further innovate by being the first to produce rice husk thermal energy in cooperation with a Greek manufacturing company in 1973 which is enough to cover the thermal needs of the whole company. In the middle of 80's it was the first company in Greece to become the sponsors of the only musical program on the Greek TV.

	chefs)	flavor and appearance e.g. (he invests on design) while he bets on patented technology.	Experimentation examples: different processes and techniques, combinations, shapes, packaging techniques (*"today it is 42o C. If we had not tried this technique the product would have failed")* etc) and novel products.
FCo8	RTIC appears mainly though the reworking of the ***initial idea*** adding gradually unique features: first a modern plant (initial target), then quality limitations, 3rd raw material integrative selection[340], etc. followed by decision making on the fly:"*I was still thinking about the idea. I was in a super market in Rome where I notices the packaging. I knew it was expensive (around 5.5 million Euros against the 1 million for the paper pack. However, it was a piece of the puzzle for our new product… and we adapted it!"* In the fruit juice KIE, improvisation is more structured - experience and confidence are obvious. A better exploitation through RTIC, through contracts for the innovative equipment and the raw material providers, try and error processes in cooperation with the channels and known promotion companies.	Improvisation appears mainly though the reworking of the initial idea adding gradually unique features – all activities indicate the flexibility parameter regarding mainly decisions and resources: first a modern plant, then quality limitations, 3rd raw material integrative selection, then innovative packaging due to the visit of the Italian super market. In the fruit juice KIE case improvisation is more structured - experience and confidence are obvious.	Try and error loops are mentioned even in the form of testing by pilot market launching check reactions (sell). Experimenting regards mainly the achievement of the high quality standards (in lab and in plant) as well as the best functioning of the novel production lines
FCo9	Unexpected laboratory results, pilot market launching and reactions are main forms of RTIC. RTIC on market leads to idea upgrade turning the product from "*a different tasty snack of 40-45% cheese"* to a healthy snack for all, but also for gluten –free product buyers as well, enhancing the targeted market share. Constant reshaping enacts RTIC in the areas of raw material, promotion, marketing, and branding. Production is especially affected by RTIC since it depends on the transfer form lab to plant, interactions with manufacturers, and insertion of different parameters as the idea is evolving etc. RTIC is formal (through contracts), or comes from suggestions and even mistakes (e.g. the placement of the product next to tasty and relatively cheap children's snacks.	An initially "easy" production turns to rather sophisticated and affects all the value chain. However, the Es are flexible: *"The truth is that it came up accidentally. It wasn't among our initial targets. But we saw immediately its huge potential… There was a significant trend (towards gluten-free products) abroad, so it was actually our strategic choice to focus on that property."* They set the challenges alone in order to be creative and find solutions to emerging complex problems; e.g. institutional (with EOF), with mass production, and initial false market entrance. Idea improvisation leads to a better fit with the demands of the market environment offering the product a special position on the shelves mainly in foreign supermarkets and enhancing opportunities.	*"We started to make something without what we call R&D and we ended up with 10 months of R&D till we could have satisfying results"* Much try and error not only in the lab but in the production, promotion, raw material selection etc. through a continual process of testing, permutation, and substitution of pre-existing objects.

[340] Είχαμε τότε προβληματιστεί και είπαμε Ωραία! Θα κάνουμε πιο αυστηρά κριτήρια, θα κάνουμε αυτό, θα κάνουμε εκείνο, ήμαστε οι πρώτοι που καταφέραμε – τότε ήταν πολύ πιο δύσκολο από ότι είναι τώρα – και ταΐζονταν οι αγελάδες με μη μεταλλαγμένες τροφές και χίλια δυο άλλα πράγματα αλλά μας έλειπε από το παζλ το κομμάτι ότι κοιτάξτε αυτό το προϊόν που είναι διαφορετικό θα πρέπει να είναι και διαφορετικό στην εικόνα στο ράφι.

FCo10	Resources (material, social and cognitive ones) created and refined by the 6-year business in the food sector form the basis of a fluid communication with the environment be it creation of the whole value chain, relationships and RTIC. The E. works on initial plans but exploits chances that appear • by manufacturers for added value in production (the eco-image which further led to the Swiss Institute • emerging ideas e.g. the sauces production that led to the 3rd production line) and provision of space and procurement for more lines etc). There is a no strict plan but it evolves according to new born ideas and future envisioning.	A flexible use of existing resources (people, knowledge, systems, networks, organizational processes, etc) exploiting the interaction between 6-year experiences and ideas (a constructivist approach). *"For example, when we came up with the innovative olive package (which is a world-level innovation) we erected the fourth line*" : example of flexibility - FCo10 started the new production line after confronting the difficulties and challenges of the innovative packaging,	No special reference to try and error processes.
TCo1	Both internal and external information led to remodeling, try and error loops, new ideas: internal info in interaction with manufacturer led to the automatic settings adjustments and variable loading feature (innovative technology), Mother company and two customers applied RTIC on the resulting dyeing using the patent in order to establish the process. After a customer's request for an anti-smell product, TCo1 turned to Clariant which has produced a relevant certified product. Trying to process it, the engineers found out that the fabric should be processed in a different way. That led to some new equipment, while the final products were tested in Clariant's labs.	As evident by RTIC references TCi1 shows significant flexibility in reconsidering decisions, devoting resources and change directions. Flexibility is evident in the solution of technical problems as well Even the initial decisions of the Rs about the new SBU indicate their focus on flexibility.	Several try and error loops: e.g. for the perfect environmental conditions, water requirements, mixture phases, conventional equipment modifications, process modifications, material quantities, time and speed of the processes etc. The description by the two engineers Mr B and Mr G was long about the problems and the many try and error loops due to the fact that temperature, time of application and other parameters were complicated functions of other parameters such as the length and the velocity of the thermal stabilization machine, while treating very expensive raw material
TCo2	The very first plan of the business model is reworked in relation to unanticipated ideas such as the introduction of innovative products and design as core capability adding unique characteristics to the company's image, mission and strategies. RTIC comes from • suppliers through know how and materials, • customers (e.g. fire brigade specifications) and • new employees. Advancing new and mainly the knowledge resources of 1998 TCo2 turns to verticalization with further advances in technology proving the direct and excellent communication	Spontaneous respond to arising circumstances and ability to change regarding resources, structures and decisions. TCo2 had no core rigidities but had developed flexibility in seizing opportunities even if this demanded total restructure. *"We owned extended knowledge on clothing and knitting technology. Then we learnt how to handle with military standards. We wanted to differentiate. I mean when you have some advanced know-how and relevant experience you seek to develop competitive advantages. Then you have to find how. We tried to trace some milestones and people to cooperate to gain knowledge… material… techniques… Whatever we needed for our new vision…"*	KIE - Venturing is a period of continuous experimenting on materials, products, markets and efficient management systems. Experimentation and trial and error through a continual process of testing, permutation, and substitution of pre-existing objects leads to advanced products such as advanced products of high specifications, mass production for tender invitations to customization and design niche and the creation of new niches. *"It is not that easy to perform all the test, for instance aging tests; we do not have the proper know-how for that… We performed a significant series of tests"*

	of TCo2 with its environment.		
TCo3	*Engaging customers in testing new methods* RTIC not evident in interview	The 2 Es seize opportunities: when energy production under novel ways emerged and renewable energy sources looked promising the 2 Es apply the innovative one-piece dyeing production enhancing value by eco-production. Flexibility regards production difficulties solving, custom-made machinery, and even market approaching (contacting selected Greek firms that worked as sub-contractors for global fashion leaders).	Try and error loops permit the creation of novel treatment processes with conventional machinery that save energy, alter final results on products and add value. Experimenting regards mainly the quality, durability and repeatability under the innovative treatment (combination of eco-dyeing and one-piece dyeing) .It also regarded the functionality of the custom-made machinery.
TCo4[341]	Technology transfer mostly among the company and the manufacturers and suppliers but triggered mainly **by customers**. RTIC in the refinement of idea towards flexibility and innovation potential although the very initial purpose was production, quality and lead time improvements. It regarded • the institutional changes (China provided cheaper labor even than East Europe, 2000 was a decade of high value adding to special clothing targets - although that changed dramatically after 2006), • innovative raw material information and • changing customers' requirements	It is a case of a firm suffering from excesses of bureaucracy and liabilities of age (Weber, 1978). Flexibility was sought but not actually defined or specified. The former culture of investing in machine and high-technology production lines did not change in sufficient ways. However, TCo4 wanted to change: it was the first time that a leading US consultant company was hired for production and business model re-organization (NOTE: Not said in the interview but this was known through press and within the sector's news. Werner is the most famous consultant on textile and clothing organization subjects worldwide).	Try and error engaged at the founding process for *new applications for existing technology* (Baker and Nelson, 2005) in order to excel existing technology for innovative high-value products. Exploring and experimenting is embedded in the company's culture and revealed in all projects *("Then, we used to present innovative and highly differentiated products; demand was much higher than offer").* This is the company's strategy even today.
TCo5	RTIC appears in the stage of applying the method proposed by the Italian University: the problem of inventory management under the new method. This led to the co-operation with a Greek University and the development of the semi-automized system.	Existing resources have been flexibly used in order to fit to the new model's demand: from design policy to logistics; services provided include warehousing, industry-leading logistics information systems and inventory management.	Try and error regarded mainly the faultless application of the new method (in order to make the system work "*as a Swiss clock*")
TCo6	The final product was not initially intended (Txxxxx[342]) - started with compact technology and W-cotton to be used as raw material for compact yarns. RTIC led to this product: the investment in the new technology was enriched with the use of special cotton and turned to innovative technical yarns (the involvement of two German fiber manufacturers	A complex situation where flexibility is evident: many and expensive resources devoted to initially vague targets (the loan of about 30 million was too heavy and a trap) Flexible use of all resources: Innovative machinery leads to innovative material through many try and error processes - meanwhile other experiments are running in the existing SBUS such as the	Experimenting goes on for 2 years (compact technology), 3 years (Q cotton) and Txxxxx (5 years) in order to achieve desired visions and targets. Embedded experimental culture

[341] "Μετά την πυρκαγιά η επιχείρηση και ο ιδιοκτήτης πήρε την απόφαση να μεγαλώσει την παραγωγή και να την εκσυγχρονίσει επενδύοντας σε ότι καινούριο υπήρχε εκείνη την εποχή στην κλωστοϋφαντουργία – π.χ. με ράμες τελευταίας τεχνολογίας (μηχανήματα που χρειάζονται για τα ελαστομερή υφάσματα), να πάρει ειδικές βαφικές μηχανές για συνθετικά υφάσματα και ευαίσθητα υφάσματα και να τροποποιήσει και χωροταξικά την παραγωγική διαδικασία για να έχει μια πιο σωστή γραμμή παραγωγής. ….χρησιμοποιώντας και την εμπειρία από τα προηγούμενα 10 χρόνια γιατί είχαν γίνει κάποια λάθη. Η ιδέα του να επενδύσει στη γνώση ώστε να κερδίσει στο καινοτόμο, στην έρευνα ήταν θεωρώ ιδιαίτερα σημαντική." GD

[342] Name of the product

	was also a type of RTIC) Both formal (contracts) and informal (the results and the needed mutual agreements) ways involved.	production of compact yarn (2002) while working on Qcotton to present it in 2003 Organized project teams to avoid bureaucracy and other liabilities.	
TCo7	• A case with obvious signs of Improvisation. The initial idea of verticalization and differentiation is reworked as: knowledge and information comes from relevant chemical industries regarding innovative material, • the employment of Italian technicians to work on the vintage denim concept which in turn • gave rise to new plans regarding the development of a whole new culture (new in Greece and among the latest trends worldwide). Formal and informal ways of getting RTIC: contracts, expert hiring, external collaborations.	The E. owns the resources and uses them in the most flexible way: technical high-skilled personnel, Italian-educated and experienced designers, heavy investment in branding and promotion while securing innovative treatment technology and its success "secrets". Although the E. admits the importance of improvisation, the interview does not make it that evident	Not evident
TCo8	Not reported	Flexibility regards mainly the decision to change and react. Besides the significant experience on automatization and CAD-CAM systems TCo8 needs to change the production model under advanced ERP systems, apply mass customization and penetrate into the world of fashion. Each step includes improvisation since fashion industry is a creative industry and it is rather difficult for a large mainly technology based company to step into its world. *"Although we had heavily invested in automatization, the shift to design proved to be a highly demanding and resource intensive strategic movement that demanded constant changes in structures and knowledge. Thank God we are a flexible team!"* Flexibility regards mainly the adaptation of a designer-based corporate culture, with all subsequent changes needed. TCo8 managed to change successfully Not core bureaucratic rigidities mentioned	Exploring and experimenting is common: e.g. regarding ERP installation or the use of new materials: *"they promised results that were not evident in real production. Too much try-and-error. We had to change things again and again!"* Experimenting with designers and designs which would cost "enormous amounts on expensive fabrics" Experimenting with novel materials and so on *"Oh the first (ERP) systems! We were the guinea pigs!"*
TCo9	RTIC supported mainly the addition of unique features to novel products' creation, at all stages e.g. The creation of R&D basis discussions added information and caused changes RTIC mainly with customer engagement	Flexibility allows the better co-operation with the customers *"We gradually manage to organize the company better avoiding the initial mistakes. We improved. We managed to produce more novel products regarding design or new fabric properties or even novel fabrics".*	Not reported
TCo10	Real time information is valid mostly when referring to the phase of shoe manufacturing and marketing where there was some new piece of knowledge to be absorbed and further exploited. The E. admitted that it was quite different from the point of the designer's view.	Not reported	Continuous experimenting is due to the fact that his *"experience and culture had not exceed the stage of design before. I had to learn a lot regarding production and I think that I know everything now".*

Table A7: Provocative organizational competencies: Dimension of Improvisational capability

Dehlin (2008) describes provocative competence as the ability to create openings in space and time especially designed for creative activities.

	Absence of adequate routines	Low procedural memory	Minimal structures
WCo1	Start-up. No routines	No former procedures – avoidance of family practices. Family business working in a handicraft way	The firms starts with the E. his wife (an engineer) and two skilled workers to perform *"whatever I had in mind"* according to the E.
WCo2	Physical distance. No routines or scheduled programs	The E clearly states that new ventures are totally out of the mother company's culture: *"I see every new unit as unique. It is not proper to mix the old habit to a new firm. This is I prefer new staff; they are not stuck in the everyday routine of the mother company"*	The new investment is supported by new personnel that create the new venture's culture. There are only two Es.
WCo3	A new firm – no routines	No former common directions	Initial team quite big (5 people). This caused some disharmony and led to the withdrawal of one of them
WCo4	*"Old mindsets set you back! We did not want that!"*	The 2 Es "*wanted sth new*" so kept little from the old family plant. No practices and techniques from the old plant	They kept only 3 employees from the old plant in order to embed new culture. All employees are under 35 years old.
WCo5	The new E. entered the business with a tendency to change things by "taking the lead". No former routines due to weaknesses of the former entrepreneur.	There is not really much to constitute procedures	2 entrepreneurs – however no teamwork detected
WCo6	There exist routines	Not evident	Not evident
WCo7	No routines – no former existence	No procedural memory – no former existence	One entrepreneur
WCo8	The nascent entrepreneur advised his father to burn his own plant which however was one of the best firms in Macedonia at that time.	Completely new ideas even due to the novel :boxing concept" Creation of new culture, development of new processes	The E starts alone
WCo9	Mutual agreement among the members involved: *"We were only four… with good chemistry*[343]*. We would not stereotype, we ought to get out of the mould of mother-company, and we should cut through its red tape wherever possible. No one else should interfere. This was quite clear. We were well out of the group's routines and processes. We had to find the suitable raw material, we should form the mode of co-*	As in the "Absence of adequate routines" column (Mutual agreement among the members involved) Engagement of completely new staff, decentralization by the creation of new culture and development of new processes and new shifts	As described in the "Absence of adequate routines" column

[343] One of the four was the owner of the group indicating the personal involvement as described in bricolage capability. The others: (Mr G - for the extruders, Mr K- idea realization, Mr. T.- suppliers' approach).

	operation with USA; this had to be direct; no hierarchies; then we would lose communication and flexibility – for example in cases of trouble or when changes were en route… *Then the new venture was totally disconnected from the mother company's processes and routines. This fact helped us to establish the new plant within a very short time frame. Decision making was very fast, you know. When there is a large group and you want to do something new and innovative you have to take it out of the established way of thinking; this is the only way to oil the wheels of decision – making to make the whole system as easy as possible at every level. This was the founder's idea – to take the whole thing out of the system – I think it was very important for the new venture; he had done it again in the past…*"		
WCo10	It is the company's policy to use no routines when important changes take place. *"It is a mistake to bring the habits of the old company in the new"* It is also the strong unconventional personality of the E. Of course the only thing that won't change is the dedication to nature and the natural ways.	Engagement of completely new staff, decentralization by the creation of new culture and development of new processes and new shifts: *"Besides my partner, we rely on brand new executives. They bring new air, they are not transfixed in the every-day routine of the old company"*	
FCo1	A start-up well out of the family business (*"out of father's territory")* The discussion reveals moderate use of regulation and control with a tolerance of mistakes, a sense of urgency, promotion of experimentation and action all along the set up period. The case is an exceptional example where design and execution of the start-up converge and are largely indistinguishable	"*The plant is new and modern. We found no old mindset. We indented to set up the business this way; everything is new; the technology, the culture everything!"*	Three Es (brothers) with the two-member lab team in the beginning.
FCo2	*"Gambling on the result"*: There are no routines to follow - results shape the action to follow). High uncertainty both for technology and market and high risk investment due to many unknown parameters and high initial costs are important challenges.	New start-up. No procedural memory	The (initial) 5-member team have specific rules and roles: 2 for the production, one for the promotion, one for the finance and one for IT and the automation. Decisions are made by the whole team. Due to different scopes eventually the finance responsible leaves the firm. They are mutual friends, trust each other and have established a family culture with the rest employees. They work themselves in the firm, be there all daylong.

FCo3	No routines – no resemblance with former entrepreneurial activities	No procedural memory– no resemblance with former entrepreneurial activities	The 2 brothers are the Es and start with 2 employees. Roles and rules well defined from the very beginning. Trust established since the 2 employees were recommended by friends and have built the company's culture together with the 2 Es.
FCo4	There were no established routines before	The family "forgets" on purpose the "cottage industry" culture in order to move to industrial production and enter KIE. Creation of new culture and development of new processes and new shifts	The E. and his wife. According to their sayings they form an excellent team since they complement each others' thoughts
FCo5	As indicated by the review of the whole interview, FCo5 did not keep routines of the old plant.	The Es focus on the development of in-house research which directs the new firm in a completely different direction and strategy compared to the old company.	Roles and rules have been developed for research and manufacturing / teamwork exists. Informal codes are applied: "It is a matter of mutual trust and respect!" says Mr T underlining the existence of an informal secrecy code even with plant manufacturers. A team with strong ties devoted to the firm of both employees and researchers in most project. An "open door" policy referring to new ideas collection
FCo6	Physical distance It is mainly the Es deliberate wish to follow no routines or mother company's procedures in the new plant where all are organized to be different. There is a sense of urgency, promotion of experimentation and action: *"I think we went rather fast. It took us 3-4 years to formalize the initial idea, experiment, make the plant and improve the product. It was quite an adventure!"*	As in the "Absence of adequate routines" column Engagement of completely new staff, decentralization by the creation of new culture and development of new processes and new shifts	The managing group, P. cousins and their engineers co-operate with two local construction companies (main contributors), the engineers of the German company and partly of external collaborators.
FC7	The company gets completely out of normal processes *"If you want to innovate you don't rely on old"* . Due to very small size there are no routines difficult to slide over. Creativity with no need of really important budgets: : *"The innovative entrepreneur needs flexibility and imagination. Innovation is not only a laboratory result!"*	There is some procedural memory detected; the E. relies on his former methods and culture	The E. is responsible for all novelty and production while he has the overall control. His partner is mainly responsible for packaging and product promotion. They are friends and trust each other. They exercise a loose control but are very precise about the quality of production and the promotion of novelty. The E. has a team of 2-3 members that he trusts for all try and error. These people share the Es vision of innovating.
FCo8	Physical distance - no routines or procedural memory was engaged by the mother company. The Es consciously built the new venture on a totally novel concept (Mother company's competitive advantage was *traditionality* while FCo8 is based on innovation.	As in the "Absence of adequate routines" column Engagement of completely new staff, decentralization by the creation of new culture and development of new processes and new shifts	The Es invest on engineers; one can easily detect the important role of engineers in trying to fill the gap between vision and reality. Yet, strategic decisions are made by the Es who keep total control.

FCo9	A start-up; no former routines. The Es avoid the traditional form of their family business Direct response to unexpected problems and unexpected situations is evident (some of them have been reported above in other tables; e.g. first attempt failed but due to flexibility threat turned to opportunity.	Conditions of pressure, further stressed by the long experimentation period, enact spontaneity and creativity; fast re-orientation and problem solution. No procedural memory at all	Initial team composed of food technologists since the two Es have no relevant education. Individual initiative and collective actions are important.
FCo10	Start-up phase: No routines or procedural memory. Rules are broken (e.g. they win a prize for packaging before even having the product!), mistakes are made (e.g. with labels). KIE: Although a 6-year business, no routines were followed when starting the plant. New people were engaged in the venture, the plant was located in Agrinio (far from the company's headquarters - Athens). There is a time orientation and constraint since sales do not stop.	Start-up phase: No routines or procedural memory. KIE: not evident – personal opinion: there exists procedural memory	A clear distinctive line between marketing/administration and production. Major executives are at the Board of Directors and shareholders. Minimal structures are not evident; many members involved, regulations and controls are detected and found to be.
TCo1	TCo1 was developed completely out of mother company's "path" (a completely automized plant) Brake routines easily to try sth new: "We saw it in the trade show of Frankfurt. Then we decided to try to dye it -we stopped a production line and made several try and error efforts (note: both the Tencel as yarn and as fabric).	Not clearly stated but it is quite evident; e.g. directors are free to interrupt/disrupt processes in order to experiment. Engagement of completely new staff, decentralization by the creation of new culture and development of new processes	A strong executive team with a simple organizational structure. Mr R is the main driver and promoter of the concept, assisted by Mr E in ideas' formation. The direct ownership involvement and low formalization increases the speed of decision making. Clear, distinct roles for the 2 Es. but trust is well established. Friendship among Mr R and the two directors who are also free to interrupt/disrupt processes in order to experiment.
TCo2	physical distance *"No procedures or routines of the old company"* is precisely *one of the reasons of the restructuring.*	*"No procedures or routines of the old company"* is precisely *one of the reasons of the restructuring.* Engagement of completely new staff, decentralization by the creation of new culture and development of new processes and new shifts	The Es' team is small composed of family members. The new member of the Albania plant is carefully chosen.
TCo3	Physical distance / different culture Absence of culture and routines of the other two companies was attained by hiring a new team for all functions and a General Manager that was not involved in previous entrepreneurial activities of both companies.	Procedural memory was kept only in cases of cooperation among the different plants Engagement of completely new staff, decentralization by the creation of new culture and development of new processes and new shifts	Small team: the two Es and a General Manager that was not involved in previous entrepreneurial activities of both companies *but* is a close relative (sister) (trust). The technical directors appear to exercise decision power at the operational level. Concrete roles of the two separate innovative activities (bio-energy production and cloth dyeing). Although one company, the two Dpts are totally independent. There is certain

			teamwork supported by the relevant teams of the two other companies
TCo4	Difficult to totally ignore their formerly successful routines or avoid the procedural memories. The company does not manage to escape procedures and routines. Routines are established and followed mainly due to the company's stress on quality assurance even at the stage of founding.	As in the "Absence of adequate routines" column	The E is the only one to decide about strategic issues. Technical issues are discussed with the engineers and design ones with the designer team. Teamwork at all stages referring to operational level. Roles are well defined.
TCo5	In order to apply the new model TCo5 had to engage in unlearning activities to cast aside established routines in order to replace them with ones that ultimately resulted in superior value to their customers.	TCo5 develops mechanisms towards autonomy (this is the main characteristic of the new model). Procedural memory is detected especially in the culture of the design Dpt dominance (NOTE: no changes were reported to improve further the selected model)	Well defined roles and rules among main participants (new partners are trained and supported). Knowledge providers have a clear role but trust and teamwork is well established.
TCo6	No deviation from routines is detected / mentioned. Difficult to totally ignore their formerly successful routines or avoid the procedural memories. Creativity in machinery combination, resources, creation of new value chains. Spontaneous reactions to the ambiguity and uncertainty of the markets.	Low procedural memory regarding adaptation of new techniques and changes in order to reach targets. Engagement of completely new staff, and development of new processes and new shifts	There is a team who shares information and acts quite autonomously - defined roles in informal ways: *"Each member is autonomous to a large extent I would say. However, the team was to meet every day and even more often when problems emerged"* Teamwork established between members of the company and the German and Italian groups -trust comes from the entrepreneurs and is communicated to the rest members of the team. Minimal structures of "invisible controls", vision and concept building, information and knowledge flows
TCo7	One can detect many "deliberate efforts to interrupt habit patterns" (Barret, 1998) if one knows the culture of the relevant sector during 80s and 90s: subcontracting -cheap labor - jeans sewn even in basements, no design culture, no fashion production. This was the first company of Mr D. He gets out of this structure and uses flexibility, creativity and most of all incorporates knowledge and innovation in process and design in order to overcome problems, rigidities and deficiencies and change completely the Greek relevant landscape. *"You often meet the very value-adding secret on the way. Yes! Improvisation is an entrepreneurial team issue"*	Engagement of completely new staff, decentralization by the creation of new culture and development of new processes and new shifts. The E worked hard towards this direction; he conquers the principles, poses the challenges, curving the ways and lets execution and details to his personnel.	Decision making belongs to the E. who shapes roles and rules for all. He exercises strong leadership that inspires executives. The focus on denim value is well communicated both to employees and customers. Information is sharing at all levels, since the E. strongly supports that ideas can come from any place. Trust is important *"I sent my mechanical engineer to Italy. He studied the plant and we co-operated with the Italian I mentioned before. Technology was developed by him and the Italians…"*
TCo8	The new strategy and vision demanded low procedural memory and absence of adequate routines. In order to	Engagement of completely new staff, decentralization by the Purposeful creation of new culture and development of new	A team of 9 executives who represent all TCo8's Dpts decided on the new image of the company. 3 of them

	change from a mass production top technology and automatization industry to fashion industry the company builds on flexibility and creativity. Special training and consulting on culture changing. Still the company is too organized to get away from rigidities and ignore the formerly successful routines or avoid the procedural memories.	processes and new shifts	were members of the family that established the company. Important Dpt creation; Creative (R&D) Dpt. and ERP Dpt.
TCo9	Mutual agreement among the members involved It is a case where we can observe "deliberate efforts to interrupt habits" (Barret 1998). Plans expand for both radical (a new production model) and incremental (marketing) deviations to stretch to unfamiliar territories.	Low procedural memory -deliberately imposed - allowed flexibility and easiness to switch from old processes and mechanisms to new ones. Conditions of pressure and uncertainty are evident to those aware of the sector. Decentralization by the creation of new culture and development of new processes and new shifts	Although there is always a leader, all opinions and ideas are under consideration, accommodation and exploitation in an open network. Although not specified and narrow placed, there are priorities and objectives which show the company's strategy and draws directions in order to enact cross-functional and cross-project effective communication. Company trusts its executives and they can make use of their capabilities and ideas. Teamwork and trust have been reported by the interviewee: *"New fabric development, - at least according to our definition – is a complex process that demands co-operation…potential, capabilities and creative thinking is emancipated then. When we attempted the change we wanted this. Trust paid back"*
TCo10	No routines – start up – creative entrepreneur (designer)	No procedural memory	It is a case of a creative entrepreneur and an investor (a business angel). Well defined rules between the E. and the shoe contractor - the E. decides on designs and number of orders but the rest rely on manufacturer. Still rules are set for quality and production. (Later the E. will change shoe producers).

Table A8: Entrepreneurial Characteristics found to favor Improvisational Capability

	Constant trend to dissatisfaction (CTD)	**motivation**	**risk taking**
WCo1	Evident from all actions taken to establish the firm: e.g. as described in Table A7. Always in the search of the best and value adding. One decision leads to the creation of a new	achievement motivation Wish to surpass the success of family business but not *"play in the same ground"*	Risk regards the novel processes and products and the acceptance of the (small Greek) market. Risk regarded money as well (very limited budget)

	need.		
WCo2	*"Whatever becomes a success then it is not enough. If you are satisfied with it you are finished"*	Mixture of personal achievement and a strategic choice: an opportunity to be the only Greek MDF producer but also a "personal bet" to create something really "big" (the story with the German that underestimated the E. at an international trade show)	Risk regards mainly the success of the new product. The E. risks further his secret rather deliberately by presenting it to all interested.
WCo3	CTD appears in market expansion and product enrichment (e.g. internal door)	Strategic choice: the Es have seen the benefits of the Italian clusters	Risk regards mainly the success of the clustering and the high investment on the new production line for the modular kitchen production
WCo4	CTD is evident throughout the story; the Es do not rest on process innovation but search for alternative innovation	achievement motivation Wish to surpass the success of family business and stop being "traditional"	Risk regards mainly the new products. However, Es take care to eliminate danger and enhance potential markets
WCo5	CTD in the company's culture both due to existing problems as well as for entering new markets.	achievement motivation The son cannot maintain the firm and the newcomer has great expectations and believes strongly in his capabilities. He is eager to show his value and needs to create something on his own	High Risk regarded the product application (which actually failed due to a series of reasons…)
WCo6	CTD evident: constant investment on new possibilities and efforts to turn problems into opportunities	Mixture of personal achievement and a Purely strategic choice: The firm is a leader and invests in KIE in order to keep leadership worldwide.	Risks are eliminated by extremely careful strategic planning
WCo7	CTD partly evident: the E cares more about the proper technology transfer and the security of the Italian market.	Achievement motivation: the E is eager to create a sustainable business. Social milieu is very important for him	Ironically risk was quite low but the E could not respond to the challenge
WCo8	Strong CTD: spontaneous responds to emerging circumstances such as the emergence of corian, the interest of the Athens company on the development of a new kitchen program, the expansion with the innovative dyeing installation etc.	achievement motivation Strong wish to surpass the success of family business	High risks regarding the success of the new multi-machinery, the acceptance and appeal of the box concept in the market. According to our opinion the E. had alternatives in case of failure (which of course needed money)
WCo9	CTD applies a constant need for a future state articulation: adaptation to Greek and European reality, climate conditions, competitive products against Chinese ones, design etc	Strategic motivation: the firm targets novel direction within the woodworking and furniture sector	Risk regards mainly the product and the high amount of investment and partly the successful technology transfer. High risk investment which needed proper handling (NOTE: The product was almost unknown and not trusted by potential customers, see relevant research of Trigkas, Papadopoulos, Karagouni, 2009)
WCo10	CTD is proven by the variety of directions that are constantly improvised and improved and not only the use of different raw materials (concepts, ways of contracts with suppliers, promotion, adding value to products, etc). The E challenged himself: *"I had new ideas every day. We would abandon*	Mixture of personal achievement and a strategic choice. *"a way of living"* for the E but a need to expand business as well	The choice of the E. to "be totally unconventional" and engage a wider ecological and nature-friendly approach at a global basis regarding …mattresses of significantly high price.*"When I was talking about ecology and transparency, I received laughter. I did not compromise*

	some, we would restart…". CTD is embedded in the company's culture: *"I believe that we must see the reason of the existence of whatever exists in nature"*; examples such as the sea wrack, the stubble, the multi-use of the show room.		*even under the risk of prison"*.
FCo1	CTD reveals by the anxious search of alternative to innovation, the start of rapid NPD rates, and three heavy investments in very short time. It is embedded in firm's culture: e.g. the movement from olive to fruit (again traditional Greek products) and exotic raw material.	achievement motivation Strong wish to surpass the success of family business	Risk regards the acceptance of the products and the significant amount of money for the physical implementation (the plant). The Es eliminate risks by contacting world customers even before production and by working with the private label marketing strategy.
FCo2	Initial dissatisfaction of conventional cultivation turned to intensive one and then to hydroponics. It went on with choosing expensive and demanding technology and a constant elaboration of the arising plans (automated systems, only cucumber) improvement of appearence, packing transportation etc)	Achievement motivation: The Es bet on novelty and wish to highlight the value of innovation in cultivation and farming. Motivation becomes stronger after the bets of public servants in the subsidy office against their efforts.	Risk regards mainly processes; they are totally novel at least in Greece. There were two (first) years of production failure. Risk is also evident when we read about the bets of public servants in the subsidy office against the Es' efforts.
FCo3	Previous business activities reveal CTD which is also evident in the new venture -the Es never rest but seek improvements and progress. Improvisational actions are sometimes initiated by conditions of time pressure (they were fast copied by big relevant firms) or due to unexpected problems and knowledge gaps	Achievement motivation: the two brothers had already tried hard in conventional entrepreneurship and had failed. This was a bet for them as well. It became harder when two big poultry firms adapted their novel idea soon after the establishment of their firm.	Risk regards both products and processes. High uncertainty both for technology and market and significant danger to be copied by stronger and more relevant (poultry) firms (these firms had available raw material – i.e. eggs)
FCo4	CTD evident: the E produced an impressive number of novel products through machinery modifications and constant alterations in the firm's concept and the packages. This is embedded in firm's culture: A constant trend to dissatisfaction (*"almost 50% of my time is searching - and I don't refer to a working eight hour day…*" (Mrs K)	Achievement motivation: the whole family is engaged in the idea. They are all committees in ecology and organic food and believe strongly in the uniqueness of their idea.	The acceptance of the product recipes and the "semi-pharmaceutical" products was highly questionable. High uncertainty both for technology and market;
FCo5	CTD through the cultivation of constant differentiation even during the initial turn to unconventional wheat products. Although working on the gluten free flour, the new team (the company's research staff and the research staff of Dr K) started research on other emerging areas. It is a constant cycle for Mr T. besides difficulties and obstacles of the Greek entrepreneurial and scientific environment	Mixture of personal achievement and a strategic choice. "a series of personal bets" for the young generation that is eager to surpass the significant success of the former generation. On the other hand the creation of the second plant is a strategic "necessity" (for both generations)	High uncertainty both for the success of the R&D, the new findings during the gluten-free experimentation (e.g. against cancer) the technology developed and the market. High risk investment due to many unknown parameters and high initial costs are important challenges.
FCo6	CTD is strong - "*nothing to be wasted"* vision that applies not only to rice and pulses but the whole value chain. The Es act more than knowledge collectors, researchers and creators. The Es try to do most with the new investment *"I think we went rather fast. It took us 3-4 years to formalize the initial*	Mixture of personal achievement and a strategic choice. a family pride matter" Strong wish to surpass the success of family business	Heavy investment in novel (patented) technology and further focus on R&D. Risk regards mainly processes

	idea, experiment, make the plant and improve the product. It was quite an adventure!"		
FC7	CTD is evident and resulted to novel products and new markets. The E searched different directions to meet innovation and differentiation (reverse engineering to explore secrets, new processes, new products, alternative way of thinking)	Achievement motivation: the E. feels the need to expand the family business. Pride was evident	The E is very conscious in his KIE process. He is a fan of innovation culture but against high risks
FCo8	Start-up: CTD and flexibility is expressed by the successive addition of unique characteristics, production lines, improvements and re-arrangements. KIE: CTD evident: introduction of constant innovation and rapid NPD	Mixture of personal achievement and a strategic choice: A need to expand to milk besides cheese was the strategic part. On the other hand, the Es are eager in creating new successful companies. According to their sayings, they don't work for money.	High risk investment due to many unknown parameters and high initial costs. A bankrupted company, significant initial capital and the focus on a product whose acceptance was questionable at national market (high price for a bottle of milk)
FCo9	CTD directs fast re-orientation and problem solution. Individual initiative and collective actions are important. Rapid NPD and strategies to adapt firm's image and markets.	achievement motivation Strong wish to surpass the success of family business	Risk regards mainly the novel products. It regarded also the success of the production technologies applied, the acceptance of the international markets and the targeted consumers.
FCo10	CTD is revealed by the 3rd line which is added to future products and the flexibility to add more in case of innovation.	Mixture of personal achievement and a strategic choice. Strong wish to surpass the success of family (in politics) and the need to self-production and NPD as the strategic part	High uncertainty both for technology and international market and high risk investment due to many unknown parameters and high initial costs are important challenges.
TCo1	CTD: the Es do not rest on innovative production technology. They search for patents and further contracts to achieve innovation and leadership.	strategic motivation, due to institutional and demographic chances and the need of verticalization	Risks of novelties are eliminated due to the flexibility of the production technologies provided by the two Es.
TCo2	CTD is evident through all strategic moves: new model for better control, more flexibility and rapid decision making followed by contacts with companies of other sectors for knowhow -materials and knowledge towards the new vision (e.g. 2), the formation of the KI team, "attack to the market" with advanced products. KIE: CTD goes on: a sewing plant in Albania (as all do in those times) is not enough. It is combined with a customization line and then (again not enough) a special contract with Gore, an advanced logistics system, an opening to new markets (individual sports and casual), a different novel customer approach (besides B2C and e-commerce, the personal consulting service), design upgrade and a new innovation direction towards bullet proof accessories. Creativity is far than obvious	Mixture of personal achievement and a strategic choice: institutional and demographic reasons that drove fast changes in the sector, the need of flexibility. On the other hand, the two sons with significant educational background wish to expand to innovation (which however had been initiated by father) and they are eager to surpass the father's achievements.	Risk regards mainly the products; they are too special for just the Greek market and quite difficult to penetrate foreign markets. (However, the Es manage to do it)

TCo3	CTD drives improvements of processes: e.g. *"Yes! Machinery was novel but then it was just dyeing machinery. We wanted more. So we actually used them to make the difference. They were not invented for this "different". **We** gave them this ability. Modifications have also targeted new products or even raw material saving."*	Pure strategic motivation: the new venture can support the upstream move to the value chain for both firms while it can offer unique products and expand business entering the eco-market	High uncertainty both for production technology and international market. The Es create alternative to eliminate losses
TCo4	The trend of dissatisfaction is evident: the E goes on with heavy investments all those years ever till 2009, experiments, stretches to new areas (verticalization, differentiation, customer differentiated approaches etc)	strategic motivation: It regards mainly survival based on highly differentiated products	High risk investment due to many unknown parameters and high initial costs
TCo5	CTD: "*we indent to reach zero inventory"*.	Strategic motivation: the need to find new profitable ways of selling the products	Risk regards processes and the fact that the new model applied was purely theoretic.
TCo6	CTD: e.g. besides leadership and the general prosperity of the sector, the E seeks innovation and tries to find new niche markets. Target set to special products of high value to be the 70% of total production. Marketing Dpt prepares plans to enter countries out of EU while there was no actual necessity.	Strategic motivation: it regarded mainly differentiation and survival within the changing business sectoral ecosystem	High uncertainty for new technology, technology combinations and international market. Extremely high initial costs
TCo7	CTD is evident through the opportunities that Mr D. self-created, articulating the future state of leadership in denim. Verticalization led to innovative dyeing production technology, development of own culture and expansion to European countries.	Mixture of personal achievement and a strategic choice: need for verticalization but at the same time passion and a life's dream	Risks regard treatment processes and the establishment of the specific culture.
TCo8	CTD in the case of TCo8 does not constitute a personal trait but company's well-built ability: needs and targets arise after a well focused but not strictly and narrowly shaped strategy.	strategic choice for survival and adaptation to new fashion trends	High uncertainty both for technology and fashion market. High risk investment due to high initial costs and mass customization
TCo9	Not evident	strategic motivation: to adapt to customers' new requirements and changing trends	Risk investment due to many unknown parameters regarding mass customization and high initial costs
TCo10	CTD fuels creativity. A designer can never be satisfied! Flexibility in both organizing shoe manufacturing and atelier formation.	achievement motivation: a life dream	Moving from design to production of own design bears always extreme risks

Table A3-A9: Transcendental Capability - Definition

Firm	Innovation	Result (unique / familiar)	Mismatch (the created problem)	Indicative quotes

WCo1	Uniformity in veneer surfacing –design – repeatability – global markets	Yes/yes (better quality)	The E. challenged the following: a)Non-uniform veneer surfaces were totally accepted by customers: wood is a natural product; cannot be exactly repeated" b) veneer needs no design c) it serves only local markets	*I didn't want to do something that would make me a direct competitor of the family business. I was thinking of ecological products and different kind of cuts, which would eliminate waste and improve quality, but I had no idea how this could be achieved. On the other hand I strongly believe in the motto "stick to your knitting";* ***veneer uniformity was a dream by then****.*
WCo2	Innovative process in MDF production	Yes/yes (still MDF)	Initial target: the creation of the most modern MDF plant globally using mainly cutting edge machine technology- yet not enough; innovation was urgently needed Process innovation emerged at the erection stage and was communicated in the most unorthodox way.	*"It was actually a bet; to make the most innovative company worldwide."*[344] *"We changed the Greek market. We offered flexibility besides the big size of the company. It would be big.. and flexible.* *"I revealed my innovation to my competitors… It was my way to become known worldwide, since I invited the world leaders to see my patent".*
WCo3	Innovative production model a combination of Italian *distretti industriali* and modular design to cover distance disadvantages	Yes/yes (still kitchen cabinets)	Become member of an Italian furniture cluster. Distance between cluster member and the new venture gave birth to the development of modular design in kitchen production.	*"Think about us: a handful of craftsmen aspiring to imitate the Italians with almost nothing at hand. It was far from easy…"* *"Trying for the subsidy we had to confront a was: Who are you to kick out the Italian cabinet makers?. This is not the right behavior for the Greek state, is it?"*
WCo4	Innovative sawmill and innovative exploitation of biomass from wood and agricultural residues •	Yes/yes (still saw mill and the novel products easily accepted)	An innovative …. sawmill? How? Initially R&D project for the utilization of residues enables the entrepreneurs to realize their own innovative idea for novel eco-products *"but for knowledge the plant would be a conventional sawmill condemned to death"* (according to experts' opinions as heard in "Building with wood" seminar, 2010, Thessaloniki)	"*We were looking for differentiation and innovation. However, the fire accelerated our decisions. Radical innovation could wait. However, our new plant would be modern with the potential to produce high-value differentiated products and to innovate. The new saw mill would be well out of the usual structures; this was neither easy, nor cheap"*
WCo5	Use of lightweight paper honeycomb panels in furniture manufacturing	Yes/no (too pioneering in Greece)	Furniture production based on innovative material. The entrepreneurs were well ahead of their time (honeycomb furniture became popular after 2007 and first successful launching in international shows were in 2012)	*"I knew that that thing of manufacturing table surfaces was over. .. And then I thought of searching for something totally innovative. We started searching the panels to see what we could produce. And then we found the only person in Greece who used honeycomb for frames. Our idea thrilled him"*
WCo6	Innovative plywood processing (stitching) for higher quality products	Yes/yes (better quality)	A wish to enhance quality in a high-value product although it was not required by customers. Furthermore, by then there were no techniques for controlling stitching quality.	*"Our milestone was 2005, when it became clear that we would survive mainly with exports of high-value products and innovation –if possible- on flooring and sea plywood. …Our competitive advantage is quality –we produce the most expensive plywood worldwide – therefore the best plywood would have the best stitching ever"*

[344] The mismatch can be better understood if one sees the general framework; a craftsman, "with a pencil behind his ear" decided to do the most innovative plant worldwide…

WCo7	First to produce wood pellets in Greece (exploiting Italian patent)	Yes/ partly yes (not easily adopted)	Searching for wood-based innovation	*"An Italian friend had talked to me about that product long ago. In the beginning I had thought - No! Not in Greece! And how? Where? Then after the Olympics, people started talking more about energy savings and I knew it would succeed in Greece too".*
WCo8	Novel box-concept, CIM in kitchen industry in Greece with innovative multi-machinery	Yes/yes (still kitchen cabinets)	A mismatch between customized design-based furniture and parameterization in the furniture industry in Greece and only some pioneers in Europe.	*"In Italy distretti industrially have support the maximum specialization in manufacturing. In Germany mass production is combined with full automatization - both models are not suitable for Greece. But I was in Greece. I had to invest in total verticalization. Moreover, E I had to extend it on the assembly line in order to achieve more differentiation".* *"There is not much to do with kitchen furniture. Especially, when you are not big enough to play with electronics or famous enough to play with design"-* *"For me kitchen was not just another furniture piece. I saw the kitchen as a boxing concept and I tried to build around this concept. I had to invest in verticalization. This meant a completely different production line – Then I had to build the machinery as well…* *When I first talked about CNC, they made up a joke on how Germans called CNCs and potatoes! – this was their reaction!"*
WCo9	WPC production line - product's trademark	Yes/yes	An innovative wood –based material that would suit the trends towards sustainability and deforestation as well as the high prices of wood due to Chinese invasion / significant hesitation against established opinions for wood	*"In 2004, Mr A was approached (by the American innovators). He liked the new product but he was not interested since he knew there was no market in Greece by then. However, the very same year. Chinese created a shortage of natural wood. On the other hand our company had a significant amount of wood residues waste. The entrepreneur remembered the novelty and envisioned a new market in Greece and Europe. In the beginning there was no interest indeed!"*
WCo10	A totally ecological image around the company extending to unorthodox methods of marketing and R&D	Yes/yes (high quality existing products)	A business model that goes beyond anything known in the area of mattresses not only in Greece but at global level. Seemingly small things that add to the concept of innovation (e.g. the zip in the mattress)	*"A zip in the mattress? Algae to fill the mattress: people were laughing…"*
FCo1	Stuffed products with cheese -customization of tastes and addition of exotic agricultural products.	Yes/yes (good Greek tastes combined)	A wish to combine traditional Greek products in innovative ways. The creation of niche market without the power of publicity and brand name	"*Greece had olives and oil of excellent quality but no Greek had tried by then to produce high value products. Our first idea of staffed olives with feta cheese met significant implementation problems"*
FCo2	Use of hydroponics in cucumber cultivation.	Yes/yes (still cucumbers)	Ambition to apply theory in practice.	"*We were told that people working in the relevant subsidy service of the Region were betting about how soon we would bankrupt!... Now the TV channels and the newspapers come and ask about our ideas and methods, but then it was a really hard time for us!"*
FCo3	Pasteurized whole egg, yolk,	Yes/yes (easier use	The entrepreneurs transcend themselves in order to	*"We had in mind to do something innovative which would regard*

	egg albumin and relative products	of eggs)	create a venture based on coincidence (the right people at the right moment) and the fact that there were no competitors in Greece.	*massive catering. We had no idea what it would be"*
FCo4	chocolates with natural sweeteners for quasi - pharmaceutical use, organic products -first to propose chocolates in drugstores	Yes/yes (accepted by all target groups as high quality chocolates)	Initial target healthy chocolate (no sugar-organic ingredients) which soon turns to a question of semi-pharmaceutical products (a quite difficult problem for a very small firm).	*"But for something innovative, there is no point to add another conventional food company. You can bet that it won't survive, unless you can offer something not only different but exceptional as well. It's a matter of knowledge then…" (Mr K).*
FCo5	White wheat gluten free bread which would resemble normal conventional bread	Yes/yes (accepted by all target groups as high quality wheat-based products)	Target: differentiation in a ..."different way!". (Although in a traditional sector the E. imagined a clear technological orientation which is highly unconventional in the sector): first efforts to add properties to gluten-free wheat-based products make it tasty and keep it fresh after 24 hours. Final innovation proved to be much more knowledge-based than initial target.	*Our target was differentiation. We knew that conventional products would not allow the realization of our vision. Then a phone call turned our interest to gluten-free wheat-based products; by then all relevant products were tasteless and very hard.*
FCo6	Development of innovative parboiled rice patented process, knowhow and innovative technology: continuous cooking.	Yes/yes (still rice)	Production of high-value parboiled rice against the global competitor – initial innovation lead to a series of KI further innovative projects.	*"Some companies in Italy had tried to change parboiled rice process but without success". "While no-one would argue that rice is really rice, knowledge-intensive innovative concepts can argue about nutritional exception, innovative ways of preparation, novel mixtures, waste and by-products genius exploitation, eco-innovation or whatever. Of course all these presuppose knowledge, scientific involvement well outside the boarder of our sector, and experimentation. Still, ideas are a priori, since nothing exists before you imagine and invent them!"*
FC7	Innovative gourmet dairy products	Yes/yes (good Greek tastes combined)	The problem: find innovation in the extremely mature cheese sub-sector. In an effort to re-produce French gourmet cheese products, difficulties led to novel process methods and techniques, a patent and the creation of a totally new edge for differentiated products that later created a new company.	*"At that time there were only 450 cheese-makers out of a 1000 and they all produce traditional products….However, traditional products cannot promote you – they cannot advance your company no matter their high quality. In an international trade the foreign dealer won't be interested in your feta differences but in its price"*
FCo8	KI revitalizaton of a bankrupt company 2000 and innovative fruit juice	Yes/yes (milk of excellent quality and taste)	The problem: enter the market with innovation-how come in common milk with no R&D laboratory? The creation of "Selected Milk" as introductory	*"Who decides about the standards of fresh milk… or for the fruit juices? Who decides about the quality? The state had defined a standard of 100.000 TMF[345]. We asked ourselves what if we tried something better…*

[345] Total Microbial Flora Count

	production in 2004		innovation which became famous even abroad without being sold in foreign markets. Selected milk was based on new quality specifications set by the entrepreneurs challenging existing laws and specifications and packaging (innovative bottle line).	*how we could produce milk - in competitive ways of course - with 50.000 TMBC. We also produce milk with 10.000 TMBC. We actually did not take anything for granted!"*
FCo9	Production of gluten free snacks and food products based on cheese	Yes/yes (snacks accepted with enthusiasm by the target groups)	The problem: World-based innovative snacks *plus* Combine health issues with taste Snacks which could be perfect for a specific target group and for all market at the same time ***"Taste is a fundamental right for all, with no discriminations! Why not?"***	*"We knew it had to be in the bakery industry. We wanted to find something that it would be innovative, but at the same time not too far from the known staff, something that would have the potential to develop, differentiate and to be produced at industrial level. You know, craft production and industrial production are two totally different issues."* *"We did not want to be competitive, we wanted to be different. Most gluten-free products are tasteless, hard to bite and of bad quality. We saw the challenge; we should make gluten-free products of high nutritional value and exceptional taste".*
FCo10	High quality production of a range of authentic Greek Mediterranean products in the international markets	Yes/yes (good Greek tastes combined)	The idea is to bring the underestimated – by then – Greek products like olives and oil – onto the shelves of the foreign gourmet markets; that meant a total transformation of the humble products to innovation-baring "stars" (the mismatch)	*My start was rather unconventional; I started with branding and marketing – I almost created a brand identity with no product!"* *Keeping leadership meant that next to quality and branding we had to add all kinds of innovativeness and differentiation. The new plant should be able to serve this purpose.*
TCo1	Exploitation of cutting edge technology as the basis of working with innovative high-tech yarns, fabrics and innovative dyeing – finishing and treating elements	Yes /yes (B2B appreciated novelties)	A need to move upstream in the value chain but not in the conventional way: the idea is to become highly differentiated; Solution: become able to offer innovative services and develop technological capabilities to treat innovative material (existing and forthcoming)	*We wanted to verticalize; this was the main reason that we established the new firm. However, we wanted to return more than just a mere service of the mother company. The core idea was the ability to exploit innovation and patents regarding fabric finishing. In order to delineate the idea we contacted Clariant and machine manufacturers to plan the most modern and automized plant which could test (i.e. with pilot productions) novelties of chemical companies.*
TCo2	1998: Introduction of new products /flexible model 2004: introduction of a new product category the bulletproof vests and helmets and initialization of e-commerce and B2C.	Yes / yes (with some hesitation due to lack of trust in Greek products of the kind)	Demanding a share in the market of technical innovative fabrics, military- security- safety clothing and personal protective equipment against multinationals (with excellent R&D and a deep knowledge on the subject) seems an utopist's target for a small conventional sheet and uniform maker – the further development of flexible production (customization) enhanced differentiation even among	*"We owned extended knowledge on clothing and knitting technology. Then we learnt how to handle with military standards. We wanted to differentiate. I mean when you have some advanced know- how and relevant experience you seek to develop competitive advantages. Then you have to find how. We tried to trace some milestones and people to cooperate to gain knowledge… material… techniques.. whatever we needed for our new vision…"*

			global competitors	
TCo3	Innovative one and/or total piece dying with ecological processes and by combining the production and usage of biodiesel under green innovation.	Yes /yes (B2B appreciated novelties)	Green, flexible value-added dyeing services: *how?* A fine combination of eco-production of energy (among the pioneers in Greece) with the development of one-piece dyeing.	*It was just an idea due to the emergency of biomass use in Greece; we thought of combining the eco-production of energy needed to dye one piece per time with ecological colors. This is two innovation-based directions at the same time.*
TCo4	Exploitation of cutting edge technology for differentiation and high value products in finishing and treatment elements.	Yes /yes (B2B appreciated novelties) – yet downturn due to global changes	The mismatch lies in the unusual strategy of a firm belonging to a highly traditional sub-sector to turn to R&D. (One has to be familiar with the sector and in terms of the prosperity of the 90s to appreciate the mismatch) Differentiation based on knowledge and a strong ability to synthesize. Collaborative R&D for the production of innovation-based services and products to global fabric and clothing leaders.	"*We invested in knowledge. By then we were co-stars. We wanted to be the stars and we managed to become so. ….* *We always wanted to differentiate and we knew that we could do it due to the constantly upgrading know-how and the specialization. We wanted to invest on the potential to make real the impossible of the other relevant firms"*
TCo5	Development of a hybrid system of corporate and franchise sales shop incorporating	Yes /yes (B2B appreciated novelties)	An existing problem: Crisis and intense competition of international competitors (e.g. Zahra) created significant problems with franchisees – the novel business model developed by Bocconi University enhanced the design capability (the main competitive advantage of the firm) and solved the distribution problem. A need of complete exploitation of TCo5's design and production capability and clothes' collections avoiding problems of franchising and a bad image of the company.	*You know, according to relevant literature, if you want to fail in your business you adopt consignment.*
TCo6	Exploitation of cutting edge technology for differentiation and high value products and production of innovative products	Yes /yes (B2B appreciated novelties)	In search of innovation and differentiation on the triptych raw-material / machinery / human capital. *"It should be sth innovative with cutting edge technology"* BUT not in the area of technical textiles. This "but" sets a significant challenge	*"We actually did not know what we were looking for, but we were sure that it was the only way to redefine our existence in the sector and survive."*
TCo7	Exploitation of cutting edge technology on denim treatment, branding and fashion making	Yes/yes (fashion!)	The target: compete with the world leaders in jeans. Denim treatment based on innovative treatment production methods and the development of relevant branding *("I had to create my own culture around my own denim").* Initial reason was verticalization for economies of scale and a better control of the product but the E.	*"I wanted my final product to be at least comparable to the known jeans brands."* *"Our target was verticalization. But Mr D. wanted a differentiated product; I mean the vintage picture,* ***Vintage jeans*** *are meant to look old, broken in, yet cared for; by then there were not such innovations in Greece. We went to Italians and then to chemical companies which led the way. By that time such techniques were at the NPD stage in labs".*

			actually was dreaming of his own jeans "empire"	*"He would go many times in Italy (the mother of jeans fashion) and search for knowledge. He would visit denim producers and look for differentiation. He wanted to be similar to Levis. Jeans was all his life. He learned it step by step. …… At first we were working with Greek companies. Then we turned to Italians since they could engage us in the world of fashion. He became good friend with the CEO and he opened the way to Italian producers. We were very strong customers then… If you are that strong they help you with knowledge and ideas and help you make new contacts" (CEO of TCo7)*
TCo8	Design and mass customization production	Yes /yes (B2B appreciated novelties)	Bigger variety, flexibility and shorter life cycles against mass production and prior heavy investment on automatization (novel at Greek level against the global leaders such as Triumph with economies of scales and global markets) (not actually a transcending problem but surely a transcendent effort)	*"In 2000 the market messages indicated investments in design and differentiation. We started by searching for innovative fabrics. This was not enough. We shifted from mass production to design-based production and this meant a total restructure of our productive units and our strategies; we invested on knowledge and fashion and further mass customization which of course led to the depreciation of our extremely expensive automated production lines."* *"We had to get out of our every day routine and see things from a new point of view"* *"We needed a complete restructure - an in-depth restructure change of its traditional form".*
TCo9	R&D –based production model (from mass production to mass customization)	Yes /yes (B2B appreciated novelties)	It is a case where the firm did not cause or create a problem - the problem was market –driven: a need to offer a variety of innovative products to customers against the established status of mass production of a few indigo codes. However, the solution engaged KI-corporate venturing and innovative process methods	*It was obvious that the company should make a significant shift imposed by both the market and the global customers. Denim market started becoming more differentiated and demanding; it became fashion; women's fashion actually and it was progressing rapidly. Contrary to the mass production which had proven lucrative by then, Denim became highly complicated and R&D together with a flexible production process seemed to be rather a necessity"*
TCo10	Design - creative innovation (fashion industry)	Yes/yes (appreciated by the fashion ycles)	The phenomenon of designer – entrepreneur (in manufacturing) is quite rare[346]	*"One (i.e. a designer) cannot do everything; and I am referring to the entrepreneurial part. You cannot design ribbons and at the same time care about employer's contributions and checks!"*

[346] *There's a dearth of designer founders. Jessica Alter is the co-founder & CEO of Founder Dating, an online network for entrepreneurs to connect, share, and find co-founders.* http://www.wired.co.uk/news/archive/2013-08/16/designers-startups
Renzo Rosso, creator of Diesel, stated: "Fashion is inspiration, creativity and intuition. But it is also organization, strategy and management. These two apparently contrasting sets of elements have to come together to ensure the success of a business idea."

1: Knowledge sources and areas are reported when they play a core role in the new venture's life course; for example all firms must develop marketing and business management; however, some of the sampled firms have used marketing as a significant innovative media to build their competitive advantage

A4-A10. Transcendental conditions: dimension of Transcendental Capability

	TRANSCEDENTAL CONDITIONS			
Firm	**Panoramic ecosystem awareness** (A process of obtaining the "bird's view)	**Sense of spaciousness** (The ability to envisage conditions of business possibilities outside of known markets)	***The gap (1)***	***Level***
	Actors want to acknowledge the environment and reshape it through knowledge creation (Nonaka et al., 2001)	*"Space is essentially one; however, the general concept of spaces arises entirely from limitations" (Kant)*		
WCo1	The E. knows the entrepreneurial landscape on veneers at national level and the international technological developments. In order to start its business, he had made West Europe a wide "neighborhood": Germany and Austria for machinery and technology, Spain and Italy for raw materials and design.	The E. challenges established acceptance *of non uniform veneer surfaces.* Natural but uniform veneer surface creates *new space* for higher value and new applications.	SQS, NTQ	N
WCo2	The 25-year experience seeking knowledge through the impressive number of visits to factories and trade shows all over the world (mainly as a client) framed the "known". The E has an excellent knowledge on all levels (business, technology, socioeconomic and political). *"It took me about a decade to create and realize my vision"*	The E. creates space by defining the image of the MDF company he wants: "Bleeding edge" technology to support flexibility and innovation which would make the new plant famous around the world. Space regarded also the lack of national competition and the prosperity of 2000 to 2004.	SQS, NTQ	G
WCo3	A case where Es are interested only in regional and national market. They know it very well and identify the gap and the weaknesses of the high costs of importing Italian kitchen furniture. Previous 10 year experience and the rather strong networks with Italy enable the formation and support of the idea as well as the potential benefits of its implementation.	Space is sought in quality and prestige issues within a regional and national framework. Space is also to be found in the knowledge of the way the Italian traditional clusters (*distretti industriali*) worked (note: this is not self-evident for the majority of the furniture manufacturers in Greece)	NRP	N
WCo4	The Es know the business landscape on wood processing - sawn timber at regional and national level. They watch the international developments in technology and the market trends.	The Es envision the potential of innovation towards ecology, quality, productivity increase, and novel products. They are conscious of the power of knowledge in space creation within their sector.	NMS	N
WCo5	The E. has a clear view of the business ecosystem and knows that a conventional company in the size of the present one will not survive.	The E. consciously tries to create new space and searches for novel material or processes. He finds honeycomb, an innovative material, not used by the furniture industry till then.	NUIM	N
WCo6	A clear view of the whole value chain from tree supplier to final	The Es detect spaciousness in their sector and the existing markets without feeling the need to	SQS,	G

	consumers at global level. Leaders at national level and among the best worldwide. Knowledge springs from their long term activation in the sector, their positioning and success.	stretch out of it. Quality advance seems to be ideal for space creation, since the firm operates in the upper segment of the plywood market worldwide.	NTQ	
WCo7	A case of rather weak knowledge of strengths and weaknesses and limited cognition of space.	The "unknown" thrills but it appears to be wrongly approached. The interviewee exposed the impotence to widen ranges and scopes while trying to create new opportunities; lack of scientific knowledge, reluctance and fear to get out of national borders or pay for further research were some of the weak points mentioned.	NMS	N
WCo8	PEA mainly due to E's involvement in the multinationals' culture and production parameters (experience), family company and PhD studies. (Family relevant firm was a leading one in Greece). It is a case where academic knowledge on industrial design economics and computer programming outweighs sectoral experience.	Knowledge and creativity play a significant role. It was the E's sense of spaciousness that defined the width and the quality of knowledge to seek, resources required and combinations made. Space is sought in differentiation of the production process and design.	NRP	N
WCo9	A spherical knowledge of the specific sector, affiliated sectors and relevant knowledge bases. Story since 1980 reveals a deep knowledge of all the spectrum of furniture sector on both solid and non-solid wood (e.g. MDF) , dominance in Greek market and an aggressive development in other markets.	The case story reveals a strong tendency towards gap creation (pioneer in element systems, soft forming, modular and then knock down furniture etc) or gap identification (e.g. extension to kitchen, office furniture etc), foresee IKEA danger etc which denotes a strong sense of spaciousness. A problem of wood price combined with the waste that costs about 50000 Euros to transport brings up the innovative WPC idea -discussed in a trade fair 2 years ago. The E. foresees a new "space" for new markets besides the problem solution and the initially "hostile" environment (He believes in training)	SQS, NTQ; NUIM	E
WCo10	A true cosmopolitan (the E. has lived and adventured in many countries and speaks 8 languages), widely educated (from physical education and sport science to economics and journalism) and an already successful entrepreneur in Greece with a global view and specific views on nature and well being. He has developed a spherical knowledge of the sector, affiliated sectors and relevant knowledge bases. He admits that collecting knowledge by travelling and meeting people is very important. Story since 1989 reveals HSEB around knowledge ("*We would visit relevant plants and trade shows, read whatever referred to mattresses, we contacted specialists and universities, in order to answer our questions"*) and innovation (*"Twenty years ago I was talking about ecology and transparency and all mattress manufacturers were laughing at me*").	The E. has found spaciousness within the meaning of truly living with nature and innovate with and for it - his concepts are differentiated and totally novel even for the ecologists and relevant fans (e.g. mass industrial but ecological production) at both local and global level. Natural living is combined with healthy living and the strong commitment to this combination produces innovation.	NMS	G
FCo1	Growing in a Europe's leading company of the food sector for more than 30 years (among the 5 biggest in the world in its sub-sector), studies on food marketing in the leading university on the relevant subject globally, a lot of travelling and a natural talent on taste combinations have built a strong PEA and have created a strong cognition of space in the saturated and mature food sector.	The Es observed new trends and the spring of globalization and noticed the poor use of Greek traditional products. They envisaged the creation of niche markets for products that answer to specific needs such as easy to eat delicatessen incorporating a concept of Mediterranean healthy diet; , They knew that they would have to overcome core rigidities on innovation and market creation. Turning to global markets and suppliers is an expression of their view of globalization. The catalyst for FCo1 innovative activity seems to be market opportunities that from one point of view are shaped from the company but from another point of view they are out there ready to be	NT	G

		exploited by innovative and active entrepreneurs.		
FCo2	There is a high PEA at least at national level and referring to the agricultural sector. Limited cognition of space regarding the entrepreneurial part; interviewees exposed their impotence to widen ranges and scopes while trying to create new opportunities; significant deficiencies in scientific knowledge, reluctance and fear to get out of national borders or pay for further research were some of the weak points mentioned.	Spaciousness refers mostly to adding value to agricultural products (hydroponics produces products of better quality, productivity and is friendlier to environment). Ecology and nutrition trends encouraged their choices. The fact that they were followed by a significant number of imitators justified their choices.. Being farmers, they chose to stay in the sector and establish an innovative firm taking all the risks that national institutional factors pose (In Greece, by then at least, there was a rather negative governmental attitude e.g. hesitation in subsidizing such activities and no compensations for damages)	NRP	N
FCo3	One cannot claim that PEA on the food sector exists; however PEA regarded common practice in a very specific area with national range however. The two brothers where "in business" for more than 10 years and were all that time in search of an opportunity. They surely developed high cognitive capabilities afterwards.	Spaciousness came from their experience as restaurant owners; space was sought on the basis that food sector can offer unique opportunities. Selecting the novel egg process was more a matter of lack (the friend that mentioned the problem while eating at the restaurant). It is a case of Copernicus imitation - they reversed the point of view and saw the problem of using fresh eggs (as it was done by then).	SQS, NTQ, NR	N
FCo4	A partial knowledge of the food sector and a better knowledge of special chocolate product production since big Greek or semi-Greek companies do not produce such products (massive production does not allow it) and imported products were easy to be monitored. Experience from former business, a lot of study on chocolate literature (and other products such as sweeteners, natural substances and herbs), a further introduction in market analysis (when the son entered the company) was later combined with medical consultancy on diabetes (initially). The case reveals a gradual improvement of PEA which expanded well outside pure chocolate and well outside local boarders. ***Note:*** When the author analyzed the case (in 2011) the company was facing the crisis as well since it sold only in the Greek market. However, in 2011, the young entrepreneur (the son) combined the introduction of new product with exports. Today (END 2014), 15% of its production is exported. http://www.marketingweek.gr/default.asp?pid=9&la=1&arId=53515	The Es "see" spaciousness initially based on "home - made" pure products, which was a trend during the 2000 decade in food sector; Greece by then was overwhelmed by "traditional" and biological food workshops and micro plants. This trend is translated by FCo4 into KIE based innovative business and spaciousness is located in differentiated knowledge-based biological products for niche markets in mass production. The Es see patterns where for the majority there weren't any; e.g. for big companies such products are not feasible due to their production lines - small and micro companies were not specifically chocolate makers and worked on a different basis (it is quite different to make good quality chocolate as a confectionary). The idea was almost immediately expanded to a series of products for specific target groups (diabetics- gluten-free products) because the Es saw this gap too. *"But for something innovative, there is no point to add another conventional food company. You can bet that it won't survive, unless you can offer something not only different but exceptional as well. It's a matter of knowledge then…" (Mr K).*	NT	N
FCo5	A strong attitude towards knowledge exploitation and built of cognitive capabilities, and a conscious and strategic positioning towards searching for idea creation defined the width and the quality of sources to seek, resources required and combinations made (see the story). A panoramic view of inter-sectoral industry potential set out for high inspirations (biofunctional -connection to medical world) that came from complex data retrieved by multiple sources (internet, research, experiments etc) and alternative directions and	Spaciousness was connected to science from the very beginning since the Es based their future vision and strategy in R&D (e.g. preparation of an R&D team, seeking out of strict sectoral, spatial or modal limits, in order to create new opportunities). This company started a new era on food technology in Greece. Previous experiences and a strong starting knowledge pool secured the idea support.	NT, NR	G

	surpassed the mere defensive attitudes of survival through common strategies (price, locality, biological). Focus on contribution (***Note:*** the author was shocked by the story with Nikolas).			
FCo6	The company had already a well established position among rice producers. Being in the market for almost half a century, FCo6 had located existing market niches well suited to the changing life style and the every-day food trends which were connected to rice and relevant products. They have invested in developing a significant knowledge pool on all issues in regard of their activities (e.g. market knowledge, human capital, development of laboratory etc). PEA is very strong and the firm supports its maintenance at that high level.	The new generation needed a success in order to assure the first generation that they can trust them and furthermore enter an area- new also to them. They wanted to reserve their leadership and at the same time be reinvented in order to suit to the new entrepreneurial international landscape. Space was sought within the needs of special categories such as consumer groups that take care of their nutrition, working people who cannot devote too much time to cook (and this has to do both with quick –cooking rice and the semi-prepared food and specialties).). The most promising area was (according to the interviewee, the market niche of catering, which used yellow rice (the only parboiled by then) - yet they added unique characteristics to get ahead. They have succeeded in creating space for new (direct or indirect) products and novel niche markets based on rice and pulses (horizontally with new food combinations that suit different customers' needs and vertically with cospecialized products in intra-sectoral areas (Pharmacy, chemistry, construction materials, biotechnology etc) .	SQS, NTQ	E
FCo7	The E. has self created PEA not because of his firm's strength and size but because he himself had realized that this is the only way to differentiate. The entrepreneur has a deep knowledge of all the sectoral knowledge (from the sheep breeding to the dairy market in Greece, Europe and USA at least). *"These ideas own their birth in my travels abroad and my visits to several farms and producers mainly in USA, France England and Germany". ... In Greece our sector comprises of many micro, traditional, highly introversive, old technology cheese-makers and 5-6 big ones who are too big to think of such innovation as I was thinking about - their innovations turn around package, logistics and low fat"*. He further is conscious on the need to invest on knowledge in order to become differentiated.	The E. consciously wants to get out of the limited known (markets and plain traditional cheese-making knowledge) for the unlimited unknown where he seeks spaciousness. He believes in market creation (entice the customers ' "latent needs and desires"). He does not abandon the existing arena but has a deeper need of stretching to unknown territory. *"I tried to find ways to escape homogenization…. I believe that the producer plays the lead and not the consumer. The consumer will buy what is offered; however the producer must guess the tacit desires; the consumer cannot define expectations – this is my task. It is the ability to anticipate the customer's untold desire".* The E. sought space in differentiated production (giving unique characteristics to existing products) and the creation of novel gourmet dairy products.	NT	N
FCo8	Being in the dairy market since childhood, PEA is strong regarding national market (later in 2009 FCo8 contested shares in American and European markets justifying the importance of global PEA). It regards markets, all value chain activities, equipment and raw material suppliers. There is a significant lack of scientific knowledge but the Es cover it with an impressive number of hired scientists.	The E. own strong sense of spaciousness due to their high-level of PEA. FCo8 was established on the fact that by then, there were only 3 big milk companies in Greece and fresh milk was not a competitive product for foreign companies (they started to cover regional needs in fresh milk). However, they sought space in achieving significant (existing) market shares; this lead to the questioning of milk quality standards- the creation of selected milk highly «differentiated» fresh milk which supported the company taking the lion's share.	SQS, NTQ, NR	N
FCo9	The relevant entrepreneurial milieu and studies abroad have supported a tendency of creating a broader view of the markets and inter-sectoral possibilities at global level. We cannot claim a strong existing PEA (regarding global trends) from the very beginning-	Very conscious cognition of space: the Es seek deliberately space through innovation and globalization: they define the area where they seek space, i.e. the bakery industry and they prefer to enter foreign markets. They also invest in combinations of materials and tastes.	NT, NR	G

	however there is a consciousness about getting out and over of the established sectoral conditions and **a gradual building of PEA** (failures and mistakes assisted it as well as an intense search of global markets when the Es define their idea on cheese-based snacks). *"After the first idea we travelled a lot, we visited trade shows all over the world, we cross-checked the innovativeness of our idea not only in the trade shows and internet but we visited in person big super market chains and local markets. You see if we found something similar it could not be a radical innovation.*	*Comment of the author:* The usual non KIEr would either follow the well-trodden path of pellet production or energy production to exploit the wood residues or, if ever bothering to deal with WPC (why risking an unknown market?), they would prefer to buy the ready technology with no deepening in it and depending totally by the American company. The product would be usually sold as raw material in cheap price to some multinational or European company. The first alternative is today used by most big sawdust producers (either furniture manufacturing or wood processing)		
FCo10	In the very beginning (1995), the E. was a "man of the world" "with some entrepreneurial experience (own own company in overseas shipping services and experience in international investment company) and a strong educational background (Law in Kensington University, Maritime Studies in business School of Economics). PEA on food industry and relevant markets did not exist. However, 1995 did not seem to require KIE. In the following 6 years, the E built a very strong PEA of the broader food industry at global level. He travels a lot, has engaged an impressive number of people that are experts in specific areas, gains recognition and can foresee new niches since he is the one to direct the new born market of high-value, gourmet and luxury branded products.	In the very beginning, spaciousness is "offered" to him by a person who has a panoramic view of the specific subsector. Corporate KIE is based on the developed transcendental conditions : space is sought (and established) within innovative activities of a technological tone, following the building of the modern plant (e.g. carbon-free (pioneer), water footprint (pioneer), snack pack (world innovation), etc) Spaciousness refers now both to markets (as before) and entrepreneurial activities as well as to the range of the company's enveloping due to the benefits of Globalization. The choices justify the sense of spaciousness; FCo10 has soon earned a strong positioning in foreign markets due to the innovative promotion, concept and awards.	NT	G
TCo1	Excellent Knowledge of the wider sectoral space in Greece and Europe. A strong view on global markets, trends and inter-sectoral industry potential due to an almost vertical value chain (from yarn to final consumer) and a presence in Greece and Europe. Long-year experience, strong networks and a strong knowledge pool (on both technological and market areas) support a high-level PEA.	Space is sought in the translation of the need of verticalization (by adding a dyeing plant) in an opportunity to move up the value stream chain. Sense of spaciousness defined the width and the quality of sources to seek; i.e. from machinery and automatization to patents and customers, resources required: human -the engineers, a new building, money, supplementary novelties e.g. energy consumption, water recycling; and combinations made.	SQS, NTQ, NT	N
TCo2	PEA here exceeds the initial market and sub-sector of TCo2 (production of bed linen). TCo2 developed the "bird's view" in Greek and European markets and had sensed the threat of the Asian counterparts against mass production in the T&C industry (*In the early 90's the international sector evolution pointed to a clear message: traditional productive activity was delocalized to eastern countries with low labor costs)* when majority of the Greek sectoral entrepreneurs did not. There is further process of collecting knowledge and information on special functions and technologies such as fire-protection, antiballistic technology and relevant innovative materials, a process of building relations to such material developers, selection of	*FIRST Corporate venturing (1998):* The old generation finds space in the markets of the health and army sectors by participating in tenders for public procurement in Greece and abroad (mostly Italy). It turns from conventional to technology and knowledge-based. *Second KI-Corporate venturing (2004):* The successful transition from conventional to technology advanced production and the developed relationships with the leading advanced material suppliers leads to the formation of new "space": the creation of a sub-sector new in Greece with no direct competitors based on collaborative R&D and flexibility. Space was also formed due to the location of emerging trends for clothing of special purpose with high demand specifications and a trend and growing interest for products of personal safety (mainly in Europe). Verticalization offered autonomy, new advanced products, customization.	NUIM	N

	knowledge and information on clothing specifications regarding protection issues and potential customers in Europe and neighbor Asian countries.			
TCo3	Both Es are almost at the peak of their success as European Es (both companies have been more than once among the 300 best in Greece). Excellent Cognition of wide sectoral space in Greece and Europe leads to conscious efforts to widen ranges and scopes. Previous experiences and successes, global networks and a strong knowledge pool (on both technological and market areas at least as European level) of two different areas (linen and jeans and apparel) have build a high level of PEA in the areas of clothing and dyeing .	Spaciousness arises by the Es' easiness to move out of their sub-sectoral limits and the needs that they create due to continuous KI efforts and research. Space was found in the activity of dyeing: "The new plant would treat the products that could not be supplied by the two (innovative) dying plants of the two firms and where dyeing services would be of extremely high-value added". The emergency of renewable energy production and use advanced the ecologic nature of the new dyeing plant and supported (economically) the one-piece dyeing.	SQS, NTQ, NT	N
TCo4	Being a supplier of strong multinational companies for almost 10 years and having incorporated a restless spirit in company the E. has created a high-level of PEA through TCo4's DCs such as knowing markets, trends and technologies ever since mid 90's. The company had strong (market and technology) sensing capabilities, NPD and networking that supported the improvement of PEA. Still, it was not possible to predict the resigning of the giant apparel manufacturers to China's cheap options and the deep recession of the Greek economy.	The E. saw "gaps" and opportunities in technology-based innovations regarding high-value added clothing and specific requirements such as for athletic clothing markets and tried a complete restructured to that segment (Note: Although the investments did not give back as they should, the company due to its shift to non-conventional knowledge intensive strategy is still alive with satisfactory course within the crisis both of the sector at a worldwide level and the Greek severe crisis).	SQS, NTQ	G
TCo5	Being an established company since 1978 with exports and a strong brand name, TCo5 had developed DCs that allowed for market and technology sensing, design (a strong design department with 10 designers) and an opening to knowledge providers (consultants, universities). Therefore, at the time of KI-corporate venturing, the firm owned a high-level PEA regarding children's clothing markets and the whole value chain including logistics.	Spaciousness in this case regards an effort to solve problems within the context of the forthcoming crisis (which the E. had predicted): "We knew that the franchisees could not buy… We did not want our design department to lose its value"). Although space here does not regard a novel product or a niche market, it created a new system, caused a total restructure of the company and offered a survival alternative.	NT	N
TCo6	TCo6 has been long one of the leading Greek textile companies with strong export activity. Being a conventional cotton spinning mill till 1998, the firm had developed DCs such as significant international market and technology sensing, deep knowledge of all mechanisms (raw material, machinery, and developments), networking and collaborations. PEA was based on sensing as well as the passion of the entrepreneurs to stress to other related issues such as ecology, cotton cultivation, technology upgrading and so on.	The entrepreneurs had foreseen the need for innovation as well as the growing trend towards ecology in order to create new markets. They have further invested in eco-cotton and energy efficiency. Space then is sought in the potential of innovation based on the triptych ecology-technology-R&D. The innovative products would be of very specialized specifications and of high-value, customized for high-end European markets. In Europe, at the same time, space was sought in technical textiles. Today there are very few relevant firms in Austria and Italy, and other two in Greece. The company was characterized as sectoral innovation leader by Leheyda et. al (2008) and by Innova project (2006-2008).	NMS, NT	G

TCo7	An excellent example to delineate transcendental conditions. The E. has actually worked hard for PEA creation:gained deep experience and success in the subcontracting sector for more than 10 years while he co-owned a jeans trading company and sold (other company's) jeans all over Greece. Started his own manufacturing and was occupied in the denim culture by the Italian suppliers (*see Details).He worked on building a reputation as jeans producer but in parallel he wanted to learn everything about the denim culture. He surpassed the mere defensive attitudes of survival through common strategies and was inspired by from complex data retrieved by multiple sources and alternative directions (technology, design, branding, logistics, sales networks, marketing) to build his own international brand.	The E. cultivated the sense of spaciousness gradually as evident by the case study description and by the narration of PEA (left column of this table). He found Space in branded denim culture based on innovative treatment and posed a beginning, It surprises the fact that he dared to start such a business confronting the giants such as Levis and Calvin Klein's or the Italian masters; of denim fashion and he finally succeeded. *"Denim fashion was still in its origins"*	NUIM, NT	G
TCo8	A well established company in its sector at national (and European) level. Deep knowledge of cotton white underwear. Strong in committing money and human capital to activities that add value to products. A company that had invested heavily in automatization and mass production; thus PEA regarding mainly such type of technologies was quite significant at the time of corporate venturing decision. Furthermore, PEA regarding markets and trends was of high quality. However, the firm had to develop awareness regarding design, fashion, relevant production methodologies and promotion methods quite urgently, since such matters were not an issue of DCs before. The case study is a fine example of a company that had developed DCs and competitive advantages but had to develop DECs (and here transcendental conditions) for KIE.	Sense of Spaciousness was cultivated mainly due to need than expansion or other type of strategy. Space was sought in the intersection of following big international competitors (Triumph) in design while adapting the emerging mass customization to achieve the flexibility needed for small markets such as the Greek one. Fashion and creativity is quite difficult to follow when there are no big markets to justify large volumes of production.	NT	G
TCo9	A well established company - well known all over the world (upper segment of the market), among the 3 best in Europe for many years (It was the core denim supplier of Levis from 1975 to2005 (30 years) which collaborated on design and R&D issues with TC10. This supported the development of dynamic capabilities such as market and technology sensing, NPD and collaborations. This supported the existence of high-level PEA in time of KIE decision.	Spaciousness due to globally leading customers and their changing needs and due to proper global market monitoring. Space was sought in faster product cycles and mass customization to satisfy customers.	NT	G
TCo10	20 years of criticizing designers and fashion facts have developed the ability to sense entrepreneurial spaciousness. PEA regards mainly fashion, designers, market channels, fabrics, design, global trends and less entrepreneurial issues or production. However, the E.	The entrepreneur starts from the gap he notices with customized shoes (to establish the brand and his own mark in the "fashion land") and then turns to fashion clothes. According to his sayings he was always deeply convinced that his designs would be successful and did not stop searching for a business angel although many times he was deeply disappointed because of rejection.	-	G

	is aware of these issues too, to a lesser extent.	*"I felt this gap in the Greek market as well as a gap regarding the imported shoos and the Greek design. Since I was in the fashion market for a long – long time, I knew that the prestige of the 50s and the 60s' handmade fashion such as Salone di Sklia and Mouriadis was missing in 2002. When I opened the business I knew that this was a niche market".*		

(1) SQS, NTQ : Stricter quality standards or new translation of quality
NMS: New market segmentations such as, innovative products focusing on ecology
NUIM: novel uses of innovative novel material:
NT: New trends (at various directions)
NR New rules in production or other functions of the firm, raising established limitations such as, FCo2, TCo3, TCo5, TCo8, TCo9

(2) Levels: National/European /Global

A11. Transcendental synthesis: dimension of Transcendental Capability

	TRANSCEDENTAL SYNTHESIS (TS)			***Type of TS***
Firm	**Receptivity (R) and Spontaneity (S)**	**Judgment**	***Type of judgment P: Personal C:collective***	
WCo1	R: The problems and deficiencies in veneer processing and final products which were totally accepted by customers ("wood is wood" - "it's a natural product, so it cannot be exactly repeated") Conventional production: large volumes of craft methods. Receptivity regarded many sources" existing market and production methods, international trade shows, internet, suppliers, customers, decorators and architects S: Need for flexibility, development of design, exploitation of eco-friendliness The idea: innovative processing to form niche markets challenging the established opinion of non-uniform surfaces	There was only one competitor in Greece who however did not produce that quality and was a mass producer, new idea not directly against family business. Scarce resources: Money limitations affect initial targets and limit range of activities. Limited technology: The discovery of pieces of desired technology and people and companies to help him empower and add to the initial idea.	Personal	2
WCo2	Receptivity and spontaneity is being developed all along the years that the entrepreneur is doing business. The entrepreneur created a vision to establish a modern ("bleeding edge" technology), highly automized but at the same time flexible plant producing conventional	Besides the strong desire, the E. made no move as long as Pindos existed (the E. was the main customer). The bankruptcy of Pindos left Greece with no local MDF producer. A local plant could be competitive against imports due to high transportation costs, production and the need for verticalization (the	P	2

	and innovative products in innovative ways regarding production, energy consumption etc For that reason, he was collecting knowledge and experience on a constant basis for 25 years. *"I used to visit modern plants abroad and after the visit I would note down what caught my interest. I visited all the important trade shows. I had long discussions, I read a lot, I tried to analyze what I had seen. I was building significant experience. I would study and then I would evaluate.. Yes! Exactly! I tried to know everything from tree to the final products and their uses as well as all technology and know-how. This is why I am so close to Dr Nt. (note: Professor of the WFDT Dpt). I have been collecting knowledge and as a furniture-maker, i.e. the customer, I started upside-down and I became the supplier!"* This is a case of receptivity by all possible data sources, the creation of the manifold based on separate pieces and times of knowledge and other resources and the architecture of its building. S: *"We thought the benefits of less transportation costs enough. But not Mr A.; the product had to be a loss leader…. He did not know exactly what*" (Mother Company's General Director)	Greek market needs 400.000 m3 and produces 130.000 m3). The E. took also advantage of the vigorous signs of growth of the building sector, due to a general climate of prosperity in Greece of 2000 and the Olympic games of 2004, as well as the quite favorable conditions of buying the bankrupted MDF manufacturing plant. Judgment is exercised in all stages: selection of the best in the world, unconventional lay-outs (e.g. the buffers), and the need for something unique in the processing Competitiveness in enhanced by flexibility, differentiation, variety and innovation which is communicated in an unorthodox way in order to make the company famous worldwide and according to the E enhance chances of networking and market penetration. (Acts of synthesis take place a priori, not in the empirical time–series but rather added to experience). Some teleology has been detected		
WCo3	R: expensive transport of bulky furniture ("*We realized that the fine Italian massive cabinet doors were too expensive mainly due the transportation costs, transportation companies do not charge quality but cubic meters")*, the status of the Italian name, the weaknesses of Greek kitchen production system (no matches of pieces produced by different manufacturers, no respect to appropriability), weakness of total verticalization, realization of the power of Italian distretti industriali, market messages, SWATCHs way, manufacturers information: a rich manifold of data received by the Es due to their cognitive capacity and a tendency to creativity. S: Replace Italian- made middle class kitchen furniture with furniture with an Italian signature in order to lower costs, because of strong probability of being accepted, the tendency of the market to accept cheaper "Italian made" product. Spontaneity expressed by three building blocks: entering the Italian cluster, modifying production needs, selecting and installing relevant technology applying modularity.	Judgment stopped initial tendency to total verticalization (too expensive and no such knowledge experience - existence of competitors). Distance obstacles created question on that led to the birth of a new business model and the adaptation of modular design to kitchen production processes. Judgment was further refined with discussions with cluster members on distance problems and TEI on modularity (PSR) as well as due to constrains to overcome (money, plot, time, distance, suited technology, market entrance). Scarce resources: Money limitations affect initial targets and limit range of activities. Limited technology: the Es need to develop novel production technologies	C	4
WCo4	R: regards the potentialities of wood (science direction), information on new equipment and processes (technology), markets and trends (ecology, secondary uses, waste management, ecology), quality and	Judgment forms the priority and sequence of investments - first the plant and sawn timber production (fully modernized) due to the fire and then innovative products (necessity versus dream) due to the possibility of the subsidies for innovation.	C	3

	certification - a multifaceted manifold of observation and information. S: translation of received manifold in innovative products (gluelam) and innovations in the production line). - Innovativeness in sawmill: Sounds strange for Greek business environment especially after the fire.	Institutional environment is also favorable for such investments. Processing innovations were actually answers to the need to efficiently process smaller diameter logs and productivity increase Selection of cooperation at all levels was a result of judgmental processes too: "You know what you want but you don't know if and who can do it for you. Therefore we always asked: Is this company's know-how suitable for us? Can it support our requirements?" Restrictions are also imposed by the decision for the new firm's image (e.g. ecological image = restrictions to composite material producing).		
WCo5	R.: conscious search for novelties in table manufacturing besides design. Focus on innovative raw material (weakness)-the Es miss the point that the honeycomb supporter had lost a fortune in his effort to promote it in Greece for a series of technical and market reasons, which they neglect while they should confront. S: identified gap by a multifaceted information process (customers, wood processors, designers) but not well "translated". A fine idea but poorly implemented.	It is an exemplary case of hyper-optimism and strategic disorientation. Weak Judgment: the Es see only the advantages of the innovative material and the fact that there was no competitor in Greece (the main introducer of the material, Rehau, entered the Greek market in 2008). Constraints regarding supplementary material and market approach appear not to have become issues of judgment in the implementation of the idea (?the Greek *"ela more"* authentic mentality???). For example, Promotion was abandoned to *"two very good friends who tried to promote our product through their very good clientele - I mean craftsmen.."* Judgmental decisions regarded money (request for subsidies on innovation), acquisition of material know-how, machinery and process technology (the man who lost his fortune and WFDT Dpt). It was surely a niche market for Greece and partly in Europe since honeycomb was not used for furniture in Europe by then	P	5
WCo6	R: messages sent by their own production e.g. the weakness of the plywood production system, a need for more control of raw material and efficiency improvement were creatively combined to external messages of the need of new products (e.g. the engineering parquet, improvement and guarantee of durability) and a new strategy. The weaknesses of the Greek market together with the development of new technologies offered the potential to create new needs for novel characteristics, uses and more complementarities. S: Receptivity combined to knowledge and long experience on *okume* wood, plywood processes, conventional technology and market supported the spontaneous creation of novel strategy formation regarding *value adding though innovation (the first raw idea for the total company reformation)*. Core elements of the new strategy: innovation, quality-based niche market creation and NPD in order to strengthen its presence abroad. Focus on marine plywood excellent surface and quality globally.	WCo6 *chose to devote* significant financial capital ("*we chose the most expensive way"*), *chose to invest* on high quality standards ("*for us quality is the spearhead of our strategy. We produce the most expensive marine plywood*[347] *in the world*") *invested time and money* to find and apply the innovative technology (*"innovative technology is rather treacherous, but we knew that and we chose that")* . Judgment regards the business model, customers' reaction (the company estimated that customers would pay for the new product (experience, good relationships, and former contacts? – it was not specified besides our question))- the communication of the new achievements, money limitations (the company does not want to get loans or subsidies), technology selection. The idea was supported by no common and conventional technology. A positive evolvement, i.e. the innovative suitable technology which was proposed by an old and reliable global supplier and the fact that the estimated budget was within company's limits supported the idea.	P	2

[347] Marine plywood is an expensive, water-resistant grade that is more tightly constructed and glued than ordinary plywood.

WCo7	R: the emergence of renewable energy, the existence of sufficient raw material, the acknowledgement of the application of the Italian innovative technology in Greece S: provision of the alternative solution of biomass production Lack of strong vision	Hyper-optimism and strategic disorientation observed. It appears that judgment was never executed. The E. adopted an innovative idea and rested in the support of the Italian technology providers and the fact that he was the first to introduce the pellets. *The idea was almost immediately adopted by a number of other entrepreneurs and better exploited. Hard consequences for the founder.*	P	5
WCo8	KI business concept of boxing is entirely a priori TS. A well developed capability of receptivity (that turns later to an embedded sensing capability) which collects a manifold of data from many resources and at the same time compares them and makes fruitful translations (spontaneity): information and experience of father's healthy company prior and after studies and work in the USA, industrial engineering and culture of the two multinationals *("both companies had well-developed NPD Dpts, market and technology research"*), mapping of the traditional / old-fashioned /inefficient way of Greek furniture companies, cultures, machinery, systems, image, the first view of CNC (not at work). S: All above compose a challenge for the young E. who translates them to a novel concept he called "boxing" (spontaneity) which is realized mainly by machine innovation (*"I told them (i.e. the machine manufacturers): I don't want you to tell me what you have, I want you to hear what I dream and tell me if you can do it. I am willing to pay whatever you ask"*) and a novel production system that combines mass production and the flexibility that a company within the small Greek market needs (productive TS). The E. "*built around the idea*". He prepared the "building blocks" of technology invention, production model creation, links and connection of all functions, alterations throughout the value chain (programming, design, logistics etc) around the concept of "boxing" which was first translated in "one post manufacturing" = parameterization (spontaneity)	All actions of TS (i.e. comparison, evaluation, selection, combination) comprise judgment which can be characterized strong and active if connected with the time speed of decisions and the rapid changes and novelties introduced. WCo8 was found within an era that markets favored such investments; a ready to consume market and a high income economy, relative alluring subsidies and the emerging and flourishing industry of CNC machinery. *"The time I decided to establish my own business, there was an extraordinary growth rate of the Greek market which assisted my growth. I derived in 10 years the benefits that a 40-year-old company would normally derive in 30".* "*Subsidies were of great help!. I used 3-4 PEP, whatever I could find and apply for.. Also as a young entrepreneur".* Furthermore, he was sure of the existence of a ready clientele and capital (mother supports the son). Technology and time constraints become often reasons for judgment. *"We had also thought of curve CNC production but we had to omit it due to my commitment to start production in due time and enter the market as planned".* In general, constraints are set by the E himself (e.g. the boxing concept and quality issues), the characteristics of the market he wants to enter (e.g. the E. competed in the expensive imported kitchen furniture area), technology limitations and time constraints. Comparisons set as standards of excellence in judgmental decisions are best practices of companies the E admires and respects (e.g. culture and policies of the Bostonian multinationals, design of the two Italian leaders).	P	1
WCo9	The company has developed receptivity based on its DCs but the combination of receptivity and spontaneity belongs to the few executives and mainly the E.: information collected that synthesizes the problem, WPC studied and right decision taken to buy the technology, knowledge created by the prepared team and decisions on the new product communication and use based on transferring knowledge to customer (this is possible due to prior knowledge and experience). WCo9 exploited wood shortage and relative price crisis, as well as the growing trend towards ecology.	Judgment is externally stimulated by raw unstructured sensory data as inputs (threats (prices) and needs (waste), info (by Strandex executives) and data on WPC difficulties and market signals. It is exercised by a team of four executives. Accepting and rejecting (e.g. through market research, problems of existing European WPC) etc a well structured synthetic act is denoted. e.g. "*We should run a market research at least in the European market, since we should invest in large-scale production and become strong players in Europe. … The positive results indicated a significant market in Europe for such product of 4th generation. Discussions were really exhaustive since we discussed on*	C	2

	Here one can detect the capacity of the knower - a "knowledge operator" who works at the intersection between science, technology, innovation and markets. Although reproductive, TS leads to novel possibilities that enhance value and entice the customer. WPC production is novel for Greek and European environment. WPC conquers a place in Greek and European market as differentiated, quality ecologic material.	*something we actually did not know"* (CEO). Institutional setting is favorable: wood shortage and price crisis, trend towards ecologic products, favorable market conditions in Greece and Europe. Availability of raw material (which otherwise the company pays to remove) in combination that wood becomes more precious (in quantity and price). The solution offers technology with less turbulence with the assurance of a technology company that can guarantee the R&D (difficult for a furniture company) while it can take off company's aspirations since the company owns a culture of learning and technology transfer, a trend toward innovation and an excellence to communicate novel products to markets. Money spent for further market research, product cannibalization, discussions and travels in USA.		
WCo10	An excellent case of TS: receptivity: The E. observes the nature "*You start with the knowledge you have conquered and by looking... Nature tells you everything. We used reeds but they made noise"* and turns to spontaneity *"And then it is the idea in the back space of your head. You may not even have the impression that it is there; when you notice something it will emerge; now we use 17 types of raw material and they are all 100% natural…".* *"It was just the fact that I ran into that Hollander with the pillows; he was the ground for me to create my future, to find my way; the seeds for my firm had already been captured!"* The E. wants to build a corporate image that will provide a unique identity and will be tautological to pure ecology and nature. He admits that transcendental thinking "is his whole life" - (*NOTE:* his new concept hotels and the image promotion are such examples). He has traveled a lot and collected ideas on issues interesting to him. *A priori* synthesis is evident in product and production methods and the whole business model: Knowledge mechanisms that result to innovative products / processes (and concepts) are aroused by incentives which either lead alone to the concept genesis: i.e. use of natural material which need extensive and innovative treatment – or "*I built no factory chimneys" "We wanted to waste nothing!*"). The amorphous collected knowledge mass (from travels, questions asked etc) produced: a novel concept ("concept –hotels"), innovative messages to consumers, a different way of employee and customer treatment.	A core question for the E.: How can a small insignificant mattress company make the difference in foreign markets where Greek products are treated in a negative way? Judgment regards terms of compatibility with the laws of nature, -e.g., the exclusion of certain materials, the aim of the E. to export (quality, transparency, pure ecology). Much travelling and experimentation not only with materials but also with processes, concepts and models. No consulting of the established views -just creating even if the world laughs at him. Judgment comes mainly from external constraints which however do not discourage (e.g. natural constraints and institutional settings at different cultures and countries). It also comes from experience and existing knowledge that permits comparisons and combinations: *"Knowledge pre-exists inside us; it is stored inside us and then it comes out. Even in a case of an instant happening we react by what exists inside us waiting to be externalized. For me, if something exists in nature, there is a certain reason for its existence.. I start without hesitation; Doing so, I realize that it is my own self telling me do this, do that…"* The E, is consciously personally involved: *"If you just think of investing money, you loose of course... You must have a personal view about -not exactly- only about what you have in mind, be there, have the total control, create and cause the movement of the distinct pieces. That's why I am not afraid. I make my own idea - the object bares my signature".*	P[348]	1

[348] "*If you just think of investing money, you loose of course... You must have a personal view about -not exactly- only about what you have in mind, be there, have the total control, create and cause the movement of the distinct pieces. That's why I am not afraid. I make my own idea - the object bares my signature" (The Entrepreneur)*

	The E. ascribes his combinatory synthesis capacity to his equal love for nature and entrepreneurial risk as well as the realization for need creation through expectation fulfillment. As an American journalist puts it: "Combining human and environmental sensitivity (Note: i.e. receptivity) with profitability needed not only a strong and persistent will, but also a great deal of imagination, open-mindedness and research (i.e. spontaneity)".			
FCo1	The Es develop consciously R: they watch the external environment (micro and macro environment, industries and markets, globalization), they translate facts and prospects (e.g. while Rumanians and Pollens have quite the same agriculture, work would be more expensive on Greece – i.e. conventional products would not be competitive), they "re-engineer" parallel products (such as (olives stuffed with garlic, red pepper and almond) to create a concept; they follow Cappellin and Wink's (2009) suggestion: "the combination of the three basic colors: red, green and blue, creates all other colors, thus the pre-existing pieces of knowledge, whether combined in an original way, give origin to new knowledge". S: For the E. the "three colors" are Greek pure olives-feta-peppers. – original ways of combining the above tastes was identified as a gap of high-value added products at global markets R. regards properties of raw materials, national tastes, cultures and market laws. – S. engages external knowledge (eg. food technology, mechanical engineering, design), drives to self -legislation (there was not even a name for the products (*"The authorities could not understand that it was something completely novel which could not be named "pickle" – it was not! We had to teach them what to check for!"*)	**Judgment:** initially, the Es take into consideration the internal environment of the family company (cognitive properties, capabilities, resources etc). The initial idea is rather abstract - no common know how, no relative processes, no markets or indications of products acceptance. ***Decisions and Choices:*** of the type and properties of the Greek raw materials (in the beginning), of the foreign markets to start (and exclusion of the Greek market), the percentage of conventional and novel production, the private label choice, the combinations, the comprehension of design in the value chain, the lab results, the abundance of capital assets, the decision of at least 50% of basic high-quality olive-based products, the "parallel markets" judgment (many tastes and concepts and the stronger ones to survive) that becomes company's policy later. ***Further decisions*** based on the familiarity and acceptance of the individual ingredients (olives-cheese) all over the world (*acquiesces grounded on experiences*), and the familiarity of foreign consumers to packaged food. ***Judgment*** regards also a) solutions to technical problems (e.g. with the modifiers and starches), the exploitation of waste etc uncovering entirely new concepts b) strategy issues"; e.g. no verticalized processes, just in time procedures, contract-based orders, zero stock etc. "*We had a) the idea, b) questions on how to sell, c) how to communicate it to customers, d) how to produce it –which was further the most difficult problem to solve".* One can detect the interactivity between concepts and tangibles, a constant try and error process and a fast entrance to markets. After FCo1, a new market on traditional gourmet staffed products appeared which is flourishing today under several business concepts (about 6 companies entered the new niche market about the same period, with similar products adapting the *antipasti* name for them).	P	1
FCo2	High level of receptivity - the Es are affected by data (conventional agriculture and a need to escape it, new trends, relevant technology etc) which are transferred and exploited out of the tight existing established frameworks (of Greek agriculture) at a rather spontaneous way (without considering constraints as real problems). The Es observe good practice cases (from Holland), trends towards	It is a case that justifies Proust; the Es did not discover sth new but they saw it under their own eyes (in a different way). It was a need to turn to differentiated cultivations tracking the subsector of vegetables due to experience of former conventional cultivation. Judgmental decisions regard money (very expensive installation), technology-based knowledge (atomized and controlled environment), new skills for farmers (e.g. self -promotion without middlemen). High risk and	P	2

	healthier products and demands for less water consumption in Thessaly. They embrace "the unknown" production method (no integrated knowledge on production, institutional constraints, no clear view of the final product and the method's capabilities), which is rather exceptional if one thinks of the mentality of the Greek agricultural sector. The Es devote money and time to search for the idea and reach hydroponics. They spend resources in order to trace the "right conditions and circumstances" and become familiar with the novel method. In this case it is not the novelty of the idea but the courage to adopt it and be the first to realize it besides its knowledge intensiveness.	unstable situations. The lack of adequate financial and human capital, difficulties in financing and inadequate knowledge providers seem to direct judgmental processes. Many try and error processes to plant the seeds. Several failures, some deviations, but acceptance by local markets and a contribution to a new ecosystem in Greece (the firm has often got the attention of press since then).		
FCo3	R: searching for a sustainable business idea: market "*We saw that you could find 5 people in a restaurant or catering business that would only break eggs*"), required knowledge, suppliers, controls, health issues and similar. Money spent to visit Italy, get familiar to egg pasteurization and find ways to establish a plant that could satisfy Greek specificities. S: It is not a case of creativity but of gap identification and a well organized effort to transfer technology and adapt to national conditions of the novelty.	Judgment regarded the interpretation of the information gathered; the Es have to make risky fast decisions with imperfect data and great uncertainty (a business plan for subsidy, a loan, invest on plot and building, abandon the existing business). Decisions for top modern automized process with emphasis on quality controls and fast deliveries. Justification of the selected idea was based on institutional support (a relevant law for egg powder forbiddance, the fact that there were no Greek competitors while imported volumes should be large ones and most relevant businesses could not afford them, the significant amount of labor costs to break the eggs, the use of Greek eggs.	P	3
FCo4	R: The E observes the markets; health and ecology issues send messages. He observes the potential of natural sweeteners and the potential of using the Greek herbal treasures in chocolate products. Information on technical and health issues are derived by experts, internet, and trade shows and regards chocolate-based differentiated products, sources, tastes. S: the E resembles Copernicus; he takes the position of consumers of specific targets (diabetics, children). The idea is translated by using experience and other knowledge sources (e.g. aspartam and manitol used=artificial, search for natural = 1st choice stevia -too infant stage of research, fructose, not used but to biscuits - use it ; how to enhance taste ("*I tasted a foreign chocolate for diabetics and I spitted it!*" How to produce in a mass way? (mixture refinement, alterations, equipment and production technology, suppliers, networking, emerging targets etc) and how to reach customers (the first to sell the product in drugstores). Money spent in contacts, try and error processes, necessary small	(Limited) market research, taste of competitive (imported) products and try-and-error efforts form the first judgmental decisions. Money limitations, laws regarding pharmaceutical products, ecological limitations limited networking and distribution difficulties form objects for decision making for the novel idea application. Judgments regarding the product are supported by pilot-users (regarding mostly flavor, appearance, and tolerance (e.g. by diabetics) Judgment regarded also the fact that there were no direct competitors, the niche market was not feasible for leaders (ION etc) (teleology helps?. First successful mixture with acceptable taste and feedback of handmade fructose chocolates supports the continuing of the KI undertaking.	P	4

	scale equipment and free distribution to customers. "*It is quite strange, but when you are interested in something, your eyes open and see whatever is relevant to it. And you wonder-how come Have I not thought of it before?"*			
FCo5	An excellent combination of receptivity and spontaneity (info - data - concept -knowledge - ways to encircle knowledge and translate vision to reality). R: A tendency to search for differentiation. Sub-sector messages are well received and interpreted- there is no future though conventional production. A loose piece of information (the telephone) created the idea of replacing the existing imported gluten-free wheat bread. FCo5 combined info, knowledge, networks. One can detect the capacity of the knower - a "knowledge operator" who works at the intersection between science, technology, Innovation and markets. Mr T saw a whole new market in the sector of special diet categories The new products are prior to experience: Biofunctional foods are opening prospering markets and a potential to grow as far as the innovative imagination of the researchers goes, since these niche markets are at an infant level. "*There is an endless list of innovative ideas in my head. It is impossible to catch up with all of them but some of them! –Yes, I will!"* (Dr K., closing the interview). Money spent in try and error processes and procurement of special ingredients, further market research, and product cannibalization. The concept goes beyond simplistic solutions, enters the sphere of high value knowledge intensive and special products.	***Judgment*** is externally stimulated by raw unstructured sensory data as inputs (demands, science, possibilities) and includes the justification of the chosen competitive advantage (i.e. of the first mover, exploiting market opportunities in a preemptive fashion, redefining where and how the competitive game is played in the field of bio-functional foods).An increasing market of consumers with celiac disease who dislike imported products due to their crumbling texture, poor color and other post-baking quality defects. Favorable Institutional setting such as the new EU health claims regulations (" …[functional food] products have found the room to blossom, targeting adults, especially those with particular problems, such as women suffering osteoporosis and men with high blood pressure, which is a good basis to the development of health and wellness products in the forecast period." (Euromonitor)) ***Judgmental decisions mentioned:*** The selected niche markets present high barriers for Greek companies, while the concentration on specific tastes prohibits relevant foreign products. The decision to develop R&D with a University (supported by the company's well built culture of learning, innovation and technology transfer). The support of the patients' association. Further plans for the necessity of the product to the market ("familiar - looking" products such as cakes and relevant information and training - adaptation to Greek and European environment, fast market entry, business environment modification). The informal routine of the company of ideas assimilation (the questionnaire routine) leads and later becomes expression of sensing - seizing DCs.	C	1
FCo6	In this case the process of innovation that led to the new plant is both market-driven and capability-driven. The new generation believes in the need of a scientific orientation of the company both in the primary and secondary direction. R. and S. regard a total overturn of established concepts on rice. The Es foresee the importance of research and scientific knowledge in a rather underestimated area of agricultural products. *"Although we talk about innovative methods rice is rice, a traditional product, and one won't change one's tastes easily." (Mr KP).* TS is here a result of DCs; the structured coordination of constantly knowing the external environment (micro and macro environment, industries and markets) and work on the internal environment of the company (cognitive properties, capabilities, resources etc) defined the	One can see ***judgment*** in its most pure extension: economic profitability to the uncertainty of entering science into rice production. It reflects the internal structures of FCo6 and refers mainly to productivity, top quality, consistency and further image building. Here again judgment is exercised by both the agents and the market. The Es prepared the ground (scientific personnel, lab, contacts and links to scientific world) and collected knowledge and ways to materialize dreams and visions. Synthesis allows the agents' a priori knowledge (technologically superior parboiled at same cooking time as the competitors with addition of unique quality characteristics due to scientific and combinatory knowledge and skills) to enter into existing concepts (of processes, consumer tastes, technology) and providing them with contents that they would otherwise lack. ***Justification:*** The lack of parboiled quick cooking rice "made in Europe" combined with the idea of novel production methods (after a brainstorming and	C	2

	concept of TS (mostly of the reproductive type) in terms of creativity and innovativeness. *"We produced the number one –technologically and with the patent – rice worldwide, a Greek novelty. By then there were only the US imports and an Italian one of a quite different know-how" (Besides the Uncle Ben's technology and a number of patents since 1987 which were not all commercialized, till then some companies in Italy had tried to change parboiled rice process but without success).*	certain research of the core team) to minimize the disadvantages of the existing production methods, suit the local types of rice better and especially the white rice which was the weak point of Uncle Ben's. The strategic position of Macedonia, combined with the need of increasing production and the entrance to bulk rice (e.g. for catering). The need to change the company's strategy towards innovation and R&D. Adding advantages: minimize energy and water consumption. The strong relationships with leading manufacturers. The ability to enter several EU programs in order to move towards. The result is the construction of the fully automized, modern state of the art plant with patented rice technology gaining objectiveness through lab tests, market tests, problem solving and target setting.		
FCo7	FCo7 seeks differentiation among about 450 (out of 1000 in the 90s) other similar companies in Greece and a significant number of imported products. It is a case of exceptional receptivity that the E develops deliberately. He collects a manifold of knowledge and information around the world by posing questions (e.g. "What are the secrets of the French chevre?"). The E. has been actually collecting pieces of information and knowledge even since he was studying philosophy (in Crete) which he used even later (references when he talks about tsalafouti and melityros). He studies, observes (e.g. the importance of goat milk in USA regarding health issues), connects new data and info with experience and further study and creates possible solutions to the problem he has set with a gradual passage from imitation to innovation (chevre imitation with adaptation to Greek conditions of production methods - characteristics). Money committed for visiting trade shows in USA and Europe and a long stay there (it is important that father was just a usual cheese maker) S: international trade products and trends conscious observation and a search among traditional dairy products lead to the creation of novel ways of differentiation; such as innovative methods to tsalafouti production, patent (No.1006092) in goat cheese mass ripening. An excellent example of TS in both reproductive and productive ways, where one can recognize the capacity of the owner and of combinatory synthesis where the a priori inborn knowledge of the E. enters into feasible novel concepts. After partial combinatory synthesis (chevre imitation), *a priori* synthesis led to innovation.	***Judgment*** is exercised during the whole path to creation:what to promote - what to reject or to combine whether it is knowledge, research and experimentation or strategic positioning, to what extend (resources), physical constrains, needs for resources. ***Constrains*** that affect decision making: money, market penetration, physical laws, health claims. Judgment resulted in landing the novelty softly within company's organization without significant alterations to plant processes or promotion ways (no dramatic changes). ***Reengineering*** was used consciously *"Before you advance to creative writing you study how to copy; this is a personal satisfaction since you can make yourself what initially seemed impossible. Now, if you manage to do something much better or even something completely different, then this is progress!"* The E. used a kind of leveraging of the new knowledge he gained in order to prepare some place to blast off into a new business ecosystem made by him and ruled by him (which is not necessary a big ecosystem but a promising one) *"Novelties help the business being differentiated and create new ways to enter the national and global markets. Think about melityros…" (Note:*However, some years later the E established a new plant for only innovative products)	P	4
FCo8	***Strong receptivity capacities.*** Although working in a local environment, the 3 Es have developed a high capacity of receiving	***Judgmental decisions*** challenge standards and conventional culture and appearance. A major decision was the «*expansion to milk"* which "*will take our*	P	2

	data such as quality demands, different concept approach, strong name, constant NPD. (This capability is then embedded in the organization by developing sensing and seizing routines). They turn the ability to constantly scan the environment and work on their venture's internal environment in a capability of high integrity. Data and information came by the markets, the scanning of the regional environment, information on milk production at national level and the fame of the (later) acquired company. The Es had an integrated picture of what they knew really well: nature of milk and products, milk producers, cheese market at European level, milk at regional level and from the very beginning they posed the questions on what to do to differentiate in the fresh milk market. S: *"The important thing is to do sth that the market research cannot see"*. The Es imagined novel possibilities with the potential to surprise based on quality, taste, appearance, combining technologies and other points in the value chain (e.g. raw material supply), deploying and enriching resources and capabilities (e.g. production technology, promotion, packing etc) The Es self legislated (*"Behind good there is always the better. We started by the 50000 OVC instead of 100000 that are the specifications"*). The Es transcend experience by seeing the same things under a different way (Proust's discovery). Still it is a bet that if it fails it will bear the whole venture down.	*company further at regional level"*. ***Selected ways of success:*** better quality and differentiation (the question was how?). Initially, the Es invest huge amounts without having a concrete plan in mind (too early in the decision making process) based mainly on the success of the cheese company they owned by then. They made decisions on: Integrated management system for milk providers, half TMF (knowledge required), higher hygiene levels (equipment required), advanced know how (technology and human capital needed), upgraded appearance (innovative technology acquired by heavy investment). Reasoning that supported these decisions: the ability to find the technologies they needed, the proximity to milk producers and their excellent relations with them (where the other two big milk firms (2 families actually) lagged behind. In order to differentiate and penetrate existing markets, a KI concept was built around taste, technology and appearance. Towards this triplet the Es moved to the acquisition of know-how, human capital, investments on equipment in an improvising way, and all through bricolage. "*Knowledge is expensive and we buy it"*. It is interesting that the Es questioned the existing established culture and market and challenged /provoked it, bearing a certain degree of teleology. Their offer for the bankrupted company was 70% higher than the 2nd candidate. Huge amounts of money and other resources committed, almost no organized environment scanning as part of the strategic planning process, and a significant number and type of constraints to overcome (e.g. resources, technology, difficult market penetration which turned later to fierce competition and many cases of *colpo basso*).		
FCo9	High Receptivity due to the cognitive properties and perceptions of the Es. Gradually developed mechanisms to process data as valuable information from almost all parts of the value chain: raw material, processes, experimentation, manufacturing, market positioning, branding and combine them with relevant resources: contacts, experience, existing technologist. S: patented products and the building of the relative concept and ways of communicating it. *"Our initial idea did not emerge from zero. We had to make combinations, to develop them and differentiate again and again. Then our findings should be able to be produced massively; it is quite different to prepare in the lab and then to produce massively"*. *A priori knowledge* enters in several ways: the modulation of the	***Judgment*** builds on the need to establish a company of completely differentiated products within the bread-making sector (due to existing knowledge and resources) enacting the possibility of finding such products among the conventional ones. ***Judgmental decisions mentioned***: snacks are potential products, due to easy acceptance of consumers (especially if it were to present a completely different suggestion). Gluten-free products can become tasty (experimentation and try-and-error processes). Target consumers form a lucrative market but products should appeal to all groups. Strong communication strategy: *"We invested heavily in marketing in order to create a strong brand; this would be the carriers of the value added in the future. Competitive gluten-free products had names that referred to pharmaceutical products. Ours would be tasty and all consumers could buy it"*. Choice of plant location (Kilkis for subsidies). Decision for patents They devote money and other resources to form product ideas with no market	C	1

	product's essence itself, the positioning and the flexibility to change directions and reshape the above concepts. Knowledge mechanisms entail briefing, try and error processes, incorporation of existing but scattered knowledge and information in novel ways, creation of culture and communication codes in terms of activating the mechanisms of comparisons to other products and diverse combinations e.g. of health-nutrition-taste. In this case sometimes things go wrong but mistakes are treated as sources of knowledge and there is a direct and fast reorientation due to high flexibility.	research while the idea seems too abstract to shape a vision. Initial communication strategy failed. The failure posed the need of rebranding, re-orienting target groups and in parallel reshaping products' appearance and accompanying culture. The name of company changed later as well.		
FCo10	R: The message and advice of the *guru* which led to long and persistent observation in gourmet markets (mainly in England and USA) and a conscious observation of the roles and functions of expensive food channels. S: effort translated as a creative presentation of Greek agricultural products to English S/M shelves in order to form the concept of sharing in a very delicate way. Value is added through innovative image building and culture creation combined to product or process novelties and strong (marketing innovation). The promoting message is gourmet products that offer a differentiated experience (e.g. the "sharing" concept). Spontaneity is evident when the E. poses and bets on time constraints is evident.	***Judgment*** poses rules on quality, appearance, way of promotion, building of a strong distribution networks and acquirement of a certain position in the market. Judgmental decisions mentioned: money commitment to prepare the packing, image and culture (even participation in an international contest with no product actually!), contacts with S/Ms for expensive product lines, investing in innovative marketing ("food socialization concept") and culture building (instead of brand building). This calls for knowledge on many different directions (design, promotion, network building etc). It took almost 5 years and a relevant number of failures to turn to own production.	C (P-author's opinion)	1
FCo10 (2005)	Receptivity is exercised by locating collateral characteristics and needs of target groups (e.g. environmental care = carbon free and water saving), healthier ways of living, easy-to-prepare, natural tastes S: Based on a prior knowledge and experience of the sector info is translated to Unique Selling Propositions realized through production and organization processes with the potential to surprise. *"The point was the ability to be flexible in order to develop new products and our ideas on a constant basis."* TS appears as a simultaneously bottom-up and top-down information processing capacity along the value chain. TS does not refer to the products or the processes themselves but to the fact that the result encourages the formation of embedded systems of knowledge, open innovation and cospecialization management (as the case's course proves). It is TS that underlies the ability to identify needs and opportunities to invest in cospecialization and complimentary assets. *Quotes of Cappellin and Wink, (2009) and M. Proust are proven real in this*	***Judgment*** comes mainly by <u>the market</u>, since needs and gaps have been identified (by DCs the previous years). *"Other companies entered the niche market we had created. We should become pioneers once again in order to keep our leading position", "New trends imposed the need for eco-friendly production, sound messages of healthiness, and besides the concept of the "traditional Greek" we should deliver innovation as well. These requirements showed us the direction we should follow"* Several problems (such as quality balances) direct decisions to the need of production control. *"Leadership requires top standards, constant quality, variety, surprise through new different products, innovation. Therefore it was also a question of flexibility in a constant evolution of products and ideas. If an idea is good enough we will find a way to make it real".* Uncertainty is limited (regarding the plant decision) since it is based on the need of quality consistency and a better control, there is no money limitation or any relevant risks. Controlling production enhances the ability to innovate. The institutional setting was perfect-FCo10 was doing fine abroad, Greek market was	C *("Collaborators' role is very important. FCO10 relies on their experience, their education and their skills")*	

	case.	ready due to a turn to healthy nutrition, chefs started being important. Investor found, clear objectives grounded mainly on experiences (quotes of Capellin and Proust again). Assumptions for the acceptance of the market regarding new products and novel characteristics. Equipment manufacturers are not difficult to find since Mr K is deeply involved in the sector and well known in the relevant markets. Specialists in the sector were sought and hired.		
TCo1	Initial idea: move upstream the value chain through verticalization. R.: Critical observation and experience in the sector led to collection of many requirements (from leading yarn and fabric manufacturers and their patents or innovative supplementary systems).which asked for solutions Receptivity extends out of the strict sectoral limits providing a manifold of knowledge and info from textile engineering, process and machinery engineering, chemistry, ICT and marketing, chemical industry, yarn technology etc). S: *A priori* knowledge gave birth to new possibilities (e,g, tencell treatment) and novel processing. Knowledge combination (e.g. procedural knowledge such as knowledge on finishing – dyeing and treating processes followed by advanced quality control).and cooperation with manufacturers became innovative process technology: (a) *innovative machinery* with, the automatic settings adjustments and variable loading feature as main characteristics which was launched at ITMA after two years, and (b) color and chemicals preparation for automatic mixture and feed (the "chemi-color kitchen" as the chemical engineer had named it. Managers are charged with the task of collecting information in international trade shows by all possible means (*"We talk to customers, with engineers of our suppliers, correspond with other chemical companies, search internet and experiment. Sometimes we won't leave our office until very late. But that is being creative, or not?*" MD) (Note: beginning of sensing process).	***Judgment*** is enhanced by the integrated knowledge of both E. on finishing activities globally. A two way approach: a) cutting edge technology able to satisfy innovative fabrics by the mother company and other customers and b) innovative finishing features able to offer differentiation to clothing companies. ***Judgmental decisions:*** combine the need of verticalization, and of capturing value and a strong belief in innovation –expansion to innovative fabric treatment, no other competitors (teleology - the most modern at least in Europe), existence of customers with high value products, add value to mother company's products, existing market ready to correspond to value added products, improve company's name, patent idea, a big knowledge pool on technical and process matters, start by becoming pilot users of patented material, flexibility instead of plain automatization, production capacity able to satisfy both the mother company and other clients (50%/50'%). Many trial and error efforts (mostly process innovations). ***Rules established*** are: compatibility with the existing technology, value -adding results, long lasting competitive advantages (the knowledge synthesis of the process is judged as an important part of it)	P but them work was broken in clear parts: technical, process, method, market for the team members - links well established	2
TCo2 (1998)	R.: results from sensing and regards a) the opportunity arising from European norms regarding self-protection, and the upcoming opportunity from relevant European norms regarding self-protection that would become obligatory , b) the European standards and relevant technology evolvement, c) the messages of the shift of fabric and linen production to Asian countries, d) the advances and innovations of the chemical industry e) specific needs of specific markets (army, fire brigade, police) S.: challenges due to the upcoming crisis in the textile industry turned	Demanding a share in the market of technical innovative fabrics, military-security- safety clothing and personal protective equipment against multinationals with excellent R&D and a deep knowledge on the subject sounds like a **utopian target** for a small conventional sheet and uniform maker. The Es ground the reasons for their idea ***(justification):*** a) a need to run away from mass conventional production due to the shift of production to Asian markets, b) an arising need for safety clothes among national services and at an individual level, c) the emergence of specifications for the relevant clothing (a fine institutional setting) d) the existence of resources of knowledge (scientific due to	P	2

	to opportunity to invest in new productive and organizational methods at the same time entering in new fields of the textile industry. The Es developed a series of new products based on technical textiles. They started with flame retardant wearing apparel. *A total reformation of the old sheet (and later plain uniform maker) to a pioneering innovative company which is still unique in Greec*e (the only Greek company that specializes in the development and manufacture of high-performance textile products for the defense and safety).	studies, human capital, experience, physical capital, social and business capital), e) moving for labor-intensive to knowledge-intensive ***Judgmental decisions:*** the significant necessity for knowledge and R&D department with the relevant quality controls; investing money for the reorganization of the whole productive process; networking with global leading chemical industries like Du Pont; addition of a design and a control team; reverse engineering. Decision regard the whole value chain: selection of new technology based suppliers, complementarities such as research and control labs all over Europe, production reorganization, design development and CIM integration, new customer approaches.		
TCo2 (2004)	R.: the Es have developed DCs; sensing the market, the individual customer, the technical side (i.e. suppliers, specifications), trends and social messages reactivate entrepreneurial receptivity – the need for a complete restructure. S.: Es focus on key concepts such as radical innovation -design - customization – service; market and suppliers are provided with novel innovative products, and the development of the ability to adapt products to the order of one (individual design).	The growing interest in self-protection products and the successful entrance in the relevant market in 1998 led the Es move forward developing new product categories using new materials and targeting niche markets where there was no production in Greece, competing with imported products (development of competitive advantages). ***Judgment*** is exercised mainly in terms of integration, quality and value adding. The most significant problem was to differentiate from big international relative companies. Initial decision was mostly towards verticalization in order to lower costs and have competitive prices, together with more flexibility. Yet, *a priori knowledge* leads to new concepts of customization ("*We have seen how demanding customers are. They want such products to fit exactly their own needs. This is not easy to be done by massive producers."*). Judgmental decisions: a plant for flexible customized innovative products; location- Albania, pilot tests of research, innovative technology and know- how developed in Attica, advanced knowledge and use of logistics, e-commerce and marketing while upgrading design and organizational skills. Some products take a rather long time to earn a share in the market but TCo2 surely changed the Greek business ecosystem on protection clothing products while it added to the general sub-sectoral landscape with both product and model innovations.	P	
TCo3	R&S are again emerging from DCs which become distinct during and after the decision of the new venture - receiving messages from a broader ecosystem: e.g. Renewable energy emergence and significance, added value in one-piece dyeing by developing further novel discoloring techniques ("*The concept roots are in Italy, but many processes have been developed by us"*), ecology in a broader view, bleaching techniques for denim. Both Es are well aware of all developments at national and European level at least. S: The combination of a totally ecological production of one-piece, non-uniform dyeing is pioneering at least in Greece.	Strong and active types of judgments to reach final targets (ways of developing relevant technology, of connecting to core business, combination of innovative activites and support of the existing knowledge pool etc). ***Judgmental decisions:*** the Es are among the pioneers in the biodiesel energy technologies in Greece (followed the plant in Kilkis which produced only biodiesel – TCo3 was the first to use biodiesel for its core business. Other 10 companies followed regarding biodiesel till 2011). The relevant institutional setting favors such investments. The twofold character of the new venture supports the eco-image of the new business. ***Justification:*** existing global market ready to pay high prices, general positive	P (both entrepreneurs) –support by the team members	5

	Note: DCs nourish the idea of new core competencies in order to build new long term competitive advantages.	attitude, existing basic knowledge, new plant next to the other two plants, initially subsidized due to the biodiesel installation.		
TCo4	R.: many messages and data due to DCs (from the market, the customers, the developments in raw materials and equipment, the need of R&D and design etc) S: decision to invest on equipment which could support innovation elsewhere produced. "*We invested in the 'impossible' of the other firms. Our aim was the ability to offer to customers more advanced products than the ones they asked for."* The KIE venturing was established based on the decision to "*slide over the oncoming crisis by offering exclusive products and services not possible to be offered by the labor cheap Chinese industry".* Still, developments were worse: the Chinese industry was eventually the one to form even the giant global manufacturers which adjusted production to massive suppliers.	Conventional treatment is transferred to China: need of differentiation in order to enhance value and keep precious customers (leading sports and fashion firms). A fire applied the reason for KIE. ***Judgmental decisions:*** Business streamlining, automatization, critical quality and production efficiency (shorter delivery times) for global customers – flexibility (being fast in fulfilling orders) in combination with ability to offer quality assurance and certain specific treatment characteristics. Cultivation of the ability of innovative treatments and development of new fabric characteristics as the Technical fabrics of high performance for active-wear that have special characteristics, specialized yarns or additional finishes, such as hydrophylic - hydrophobic properties, and further innovation till today – all are not common capabilities in the relevant sector. Important but fast decisions are made under a great uncertainty. Uncertainty is due to the changing business ecosystem (China), customers' hesitance against former acceptance of value adding and their response and a rather hostile and vulnerable national environment.	C (However, the E. the main decision maker)	5
TCo5	R.: it regards mainly mechanisms of elaborating the problems of both corporate shops and franchise in regard of the external environment (the crisis and the forthcoming long term market crunches), the search of KI-solutions in seminars and academia and the specificities of the value chain from fabric and design to the final customer. Spontaneity corresponds to the novel business model idea shaping under the advice and monitoring of an academic institution with logistics and network management to become the core of the model. TCo5 invests in selecting information and knowledge, circumstances and obstacles (e.g. law, trade inconsistencies etc) defined and checked. Major knowledge source is the seminar and the acquaintance with the professors of the leading University ("*We were quite uncomfortable; we did not know what we could do; this was solved by the University"*)	The problem-reason for KIE: *"we would prepare a collection of 600 models and the franchisees would choose only the ones they liked, based on personal views and subjective grounds. Moreover, franchise could not help in case the customer wanted to change the present for example in another city. On the other hand maintain our own network of shops meant many trouble; e.g with personnel and expenses.."* in combination with the institutional setting (crisis, problematic sector) and the rapid negative developments. Major judgment can be the advice and monitoring of the academic institution. Money devoted to consulting and initialization. Improvisation and bricolage engaged in order to surpass difficulties and new options. Pilot applications short due to the overwhelming developments in the global market. Building blocks: internet-continuous contact (always on-line), inventory control, developed logistics, network building, new terms, Governance issues - power imbalances, management manuals.	P	4
TCo6	R: Entrepreneurs start seeking information and knowledge targeting innovative products of high value added for the EU market. DCs have delineated certain directions; R. now regards the potential of collaborations among major machine suppliers and raw material suppliers, hints of potential innovative developments by retrieving and preparing manifolds of scattered data to form pioneering	***Judgmental decisions on:*** targets (triptych raw material-equipment-trained personnel); competitiveness through production cost reduction, innovativeness and new markets. Entry in stock market, request for a very high loan. The ITMA international show in Paris justifies decisions; spontaneity supports contacts and plans with manufacturers and fiber producers ***Rules set***: e.g. Ecology, combination of innovative elements and characteristics,	P	4

	concepts. S.: two basic architectural blocks i.e. the technology combination direction and the advanced raw material direction. Each of them breaks to smaller pieces (e.g. ginning mill take over, new specifications, new cultivation methods, training, and compatibility with the new spinning technology. Q-cotton with compact technology is an excellent example of TS. The whole spinning mill is a result of the entrepreneurs' *a priori* knowledge to enter into the above mentioned concept and provide them with contents that they would otherwise lack (technologies, markets, perspectives)	no product that can be produce in conventional spinning mill (e.g. the products of the second German company), advanced cotton cultivation and new international markets. The loan is approved; cooperation starts under the best conditions, novel products enter the market after 2 years.		
TCo7	The vision:"*be equal to global leaders at national level at least*". The E. had a very clear picture of what he wanted - the difficulty was in answering the "how" question. The ways of the big competitors are prohibitive for the micro Greek company. The E. is aware of the gap between his reality and the global leaders; he invests money and time in order to search (mainly) Italy for technology and knowhow and Greece for initial market. He received a manifold of data-info-knowledge (see in bricolage) and combined them to specify the target: *"Jeans' added value springs from de-coloring. We invested in it and achieved significant performances"*. … under certain limitations such as money (*"Jeans branding abroad means much-much money!*"), human capital (*"Italians were the only ones with experience"*), capacity, know-how ("*Fashion denim coloring was a quite demanding technique. We hired the Italians who had worked in Japan and gave us innovations on jeans abrading"*) etc in novel ways to produce KIE. S.: The dyeing plant will be a springboard to enter the world of the big ones - it combines technical and practical knowledge with other areas such as fashion and design, branding and market networking. The E. believes in the power of a priori concepts ("*We must ask what the customers will dream in the future")*	***Judgment*** bridges concepts and ideas by difficult and fast decisions under the uncertainty of reaching high targets: process technology to follow, flexibility in production, how to combine it with design to gain maximum advantage, how much to risk (investing in branding- and branding knowledge had to be obtained as well), how much to invest, which market to conquer, the best way to obtain knowledge and know how etc. ***Judgmental decisions:*** verticalization (with the denim treatment plant that offers the main competitive advantage since treatment is denim's culture after the recession of 90's); networks, market channels, financial issues ***Justification:*** <u>The market is ready</u>: after a recession of the early 90s all over the world, denim is back and too expensive and yet young people -the main target - buy them; exiting national market and channels, no other Greek competitor, positive market climate. Cautious steps are taken to proceed with concept realization (know-how acquired in an effective way - modest start from known markets, avoidance of famous designers besides the lure of leadership). After try and error within the limits of the treatment process, designing and communicating the new image, the E. created his new business ecosystem that turned to be the most favorable for a Greek clothing industry after 2000. *"Even today jeans belong to the European producers; it is a value adding product, it is fashion and mainly due to treatment methods. Fabric is important; I mean it must look more vintage as time passes. Treatment processes are still Europe's competitive advantage. This technology cannot be properly transferred to Asia"*	P	2
TCo8	The company engages "out of the box" thinking (*"We should get out of our every-day routines, see our company under a new prism. Besides statistics and research, we must have the ability to see ahead and behind the facts of the moment that affect thoughts and crises"*). Receptivity here coincides with sensing and seizing processes (*"We*	The sectoral crisis and the new fashion trends are the main reasons for KIE. Although based on a strongly automized (and very-very expensive) mass production technology, company risks transformation to a flexible fashion company with no path dependency in design. TCo8 builds its new ecosystem trying to adjust advantages of relevant multinationals into the scale of a medium	C	2

	had our eyes and our ears open to any information and market message"); it does not appear that there is any personal / entrepreneurial approach. Best practices are captured. S. captures the need to turn to fashion (*"Up to 2000 we had focused on productivity; heavy investments and expensive consultants in production. Then the image of the company was totally changed… If we did not do it (i.e. the restructuring), we would not exist today")*, necessary steps and mechanisms of realization and combinations in order to "transfer" a large and rather slow-moving and rigid organization towards flexibility. Creativity stretched to new business, production and sales models not necessarily novel but harmonically combined. Complementarities with other companies' acquisitions, new markets (men's shocks, lingerie), co-operations and new trademarks.	company that competes in a small market. ***Rules*** are set on the basis of shifting to a fashion underwear firm and the ways to promote the new image and the products. Constraints impose limitations: size (e.g. no subsidy due to size, expensive labor costs), insufficient sources (e.g. designers to hire), markets (small national market, many counterparts in both expensive and cheap products), constraints by the expensive existing machinery etc. ***Judgments*** refer to target groups (mainly young and teens), design (development of a relevant department and contacts with famous designers) and flexibility (mass customization). Money is heavily invested instead of the big risk due to very strong international competitors, and the existing expensive machinery being depreciated. Once networks, channels and focal resources have been found TS produces the first outline of the concept which will be many times reshaped through bricolage and improvisation. Exploration and experimentation on sometimes totally novel concepts (e.g. ERP establishing, innovative material pilot using etc) *"By this shift we invested in new knowledge in areas well out of our usual routines; fashion design, chemistry issues, modernization in the administrative and commercial part of the business. A long road to follow the multinationals without the abundance in human and financial capital and other luxuries… It is a very expensive story not yet completed after so many years…"*		
TCo9	Receptivity and spontaneity are not evident here in their basic forms. It is more a learning capability: global leading customers request R&D establishment (learning from the customer); together they develop the NPD Dpt focused on the forthcoming demands (equipment, management, response to customers, and development of new fibers with suppliers). Although not pioneering, R&D creation constitutes a novelty in 2000 for the subsector, with no examples or best practices since, till 2003, the entire sector worked with a single number of codes (usually less than 5 - mass production). Novel concept of mass customization[349] is then developed to combine demands with R&D The combination of R&D Dpt with the relevant management model proved to be the main competitive advantage of the firm within the context of the world crisis of the T&C sector.	***Justification:*** The main request was the ability to increase variety and novelty in products *"Each customer started asking for NPD according to his specific demands and specifications. They all wanted a wider range of fabric samples"*. Furthermore, denim starts becoming a dominant fashion in women a fact that totally alters the denim market (in 2000). ***Judgmental decisions*** on a) the feasibility of the firm restructuring since there was a significant amount of money to be devoted to equipment modernization (more than 60 million Euros), b) human resources on NPD. Restructuring requires a holistic change of strategy and capabilities (mass customization, flexibility, new equipment, logistics, and new marketing and customer service methods and approaches *"Besides the technical knowledge, we had to learn new approaches to satisfy our customers whether they are the firms that will manufacture the fabric or the final branded business to sell complete clothing").* The necessity of the strategic choice is soon justified since it is the only denim producer left in Greece and among the 3 strongest ones in Europe so far. Together with the Italian and Turkish leaders TCo9 alters the relevant ecosystem	P	4

[349] MASS customization first mentioned in early 90s by Stan Davis in his book Future Perfect, was applied in an excellent way by the company including the skills and capabilities refered here. In 1995 mass customization was still treated as an oxymoron.

		introducing mass customization (now entering the meta-customization era (every customer = multiple markets). Customers want different offerings at different times under different circumstances.		
TCo10	R: highly developed; it regards almost everything *"I travel a lot in exhibitions in Greece and abroad, I have my eyes open and at everything; from movies to journals, I listen to music; everything is inspiration… I could watch the market dying; big stores like Mouriadis, Salon Sklia…"* and turns to creativity. He activates TS through the concept of customized shoes - a new idea drawn from the past, the planning of the whole business (e.g. atelier appearance, contracting the shoe maker -for customized production, marketing, packaging, smart promotion and customer approach). The E. introduces a "classic with a twist" trend starting with retro shoes.	The focal point of Judgment is expectations that turn to "value for money" concepts Justification: the existing knowledge and designer's talent, the objectivity of the market gap, the fact that the E was already known to fashion cycles and was supported by the relevant press (a strong advantage). Discussions and the beginning of the co-operation between the E and the shoe maker pause obstacles to surpass and limitations to the initial dream of *heute couture* and *pre-a-porte*. Financial, human and physical constraints.	P	4

(2) Types of Transcendental Synthesis

1: Productive and well exploited TS (strong TS)
2: Reproductive and well exploited TS (strong TS)
3: Productive but not properly exploited (Moderate TS)
4: Reproductive TS but moderately exploited (moderate TS)
5: Reproductive TS and poorly exploited (Poor, weak TS)

A12. Entrepreneurial Characteristics which favor Transcendental Capability

	Deepened Conviction (DC)	**Intuition** **"Intuition is difficult to describe but easy to recognize".**	**The need for achievement.**
WCo1	Based on former experience in the sub-sector. The E. believes in the in the motto "stick to your knitting"	Just evident ("Intuition is difficult to describe but easy to recognize")	In the eyes of the family (succeed within the sub-sector, surpass family's image but do not be a direct competitor)
WCo2	DC comes from the success the E. had enjoyed by then, his strong positioning in the Greek and Balkan market, contacts and visits to the world leading companies - initially as a customer (creating PEA and a world view as well), the flourishing economy by then, individually easiness to invest, strong personality and commitment to initial vision.	"Actually you cannot always justify why you are doing what you are doing…" "I disagreed with him. But yet, I don't know. It is a special gift " (WCo2's CEO for the E.) "He would not agree with the rest. He insisted on demanding a higher subsidy. Perhaps if he had agreed, WCo2 would not exist today." (Group's general director)	"I am a patriot and support localism. I prefer the Greek products…I was the best customer of the firm… So when P. shut down, I felt a stab in the heart and I thought it would be a crime to lose the only MDF producer in Greece. It should open And it should be in Greek hands…. Then I called the Ministry of Economics and I said I would buy it". «In 1983, in Interzum (international trade show in Koln) I was scorned by a German .I promised myself that I will become

			somebody that competition abroad will respect"
WCo3	Previous 10 year experience and the rather strong networks with Italy	Not evident	"When we decided to kick Italy out of Greece regarding the middle-class kitchen cabinets…" "The business was set up targeting to kick out the Italian cabinets of the economy class".
WCo4	DC due to the growing trend towards quality and ecology as well as ecologic composite materials, the support of WFDT Dept and the K-cluster	Intuition is recognized mainly when the E. talks about the innovative products	Mainly the ecology view (a need to exploit the wood residues in an eco-way, biomass and energy)
WCo5	DC starts by the fact that the E found a strong technical knowledge pool (here we detect some teleology - since he could do more without it, e.g. contact Rehau), conditions were perfect (chipboard had made its cycle in 90s -there was no direct competitor (Rehau got interested in Greek market in 2008)	Not evident	An aspiration to be a pioneer in the Greek furniture sector regarding the innovative material (teleology again detected).
WCo6	DC springs from the long term activation in the sector, the firm's positioning, success and acceptance.	Intuition is mainly evident in the strategic choices – what to leave and what to focus on. It is also detected when the E. talks about their investments against the fashion in European relevant manufacturers at that time.	The Es believe strongly in their role in the enhancement of high quality on a natural product and the importance of this to quality value added markets.
WCo7	Not evident	Not evident	Not evident
WCo8	Father's company and his good course in the sector (entrepreneurial milieu), educational background, multinational's experience and personal abilities and characteristics combined with a strong basis on industrial design, economics and programming	"I believed in my point of view for the role of the kitchen cabinets; I built around this idea. Later both N. and D (big kitchen manufacturers) asked for my help…."	"A well known stock company asked me to take over the derivatives which were in their origins in Greece by then and it was my area of specialization. I turned it down because I preferred to stay in the family business" "I managed to upgrade the markets and not overrun them!"
WCo9	DC due to the deep knowledge on both solid and non-solid wood (e.g. MDF) the dominance in Greek market and an aggressive development in other markets. Former experience and talent in gap creation (pioneer in element systems, soft forming, modular and then knock down furniture etc) and gap identification (e.g. extension to kitchen, office furniture etc).	"Mr A. "saw" a new market and its potential. He had that instinct; form an idea and believe in it. His ideas never target only the solution of a problem but the creation of an opportunity as well. However, he believes that customers have to be trained in order to understand the value of the new offer to them.	Not evident (Note: maybe due to the fact that the E. was not interviewed – I believe he would give several reasons for his choices)
WCo10	DC by various directions: success so far ("I risk now but it is not dangerous; I never lied; not in the danger of shut down in the beginning or of going to prison; why should I compromise now?), deep faith in nature, the Es' exceptional character and passion)	Intuition here regards in several ways the capacity of seeing things in a way which afterwards proves to be true, even though it cannot be established at the moment: "when I talked about ecology and transparency, everybody laughed"	"I cared for transparency and real ecology in mattresses. I wanted my customers to literally sleep in nature. My message is to return to nature"
FCo1	DC springs from the fact that both feta and olives are globally accepted and there is a tradition on Greek origins. But DC comes	The choices made regarding the combinations justified the impressions of the Es on the tastes	Mainly in the eyes of the family: succeed within the sub-sector, surpass family's image but do not be direct competitors. It was

	also from their spherical knowledge of the sector and the support the Es have (entrepreneurial milieu)	that Europeans would love.	quite difficult since family firm among the best in its kind at global level.
FCo2	DC comes from the fact that they have long experience as farmers and the fact that once they would prepare the plant, they would have a stable production with better characteristics and "clearer" products.	Intuition is recognized mainly when the E. talks about his strong belief on the future of agriculture in Greece	"Greenhouses: I do believe that this is the future of rural farming. I am a 4th generation farmer and I wanted to make a step beyond the conventional ways of land cultivation which, as we see, today it is rather in a tragic situation".
FCo3	DC: "There were no other Greek competitor at that time" and the fact that "the right people appeared at the right moment"	Not evident	Not evident
FCo4	DC: the passion with chocolate, the former business experience and the success of the first chocolates (as a confectionary).	Intuition is evident in the initial choices of target markets, transparency in packaging (it appears that transparency is an ecology issue if we relate it to the WCo10 case) and the effort to make an industrial and not a handicraft plant.	A commitment to a) offer real chocolate, b) a commitment to biological products and ecology c) a wish to offer tasty chocolate products for special groups (diabetics, celiac disease)
FCo5	Previous experiences in the food sector (conventional activities), the development of a strong starting knowledge pool and the existence of adequate financial capital.	It is a case where "Intuition is difficult to describe but easy to recognize". However, it was evident through the whole interview	Focus on contribution to specific groups (celiac disease, cancer) (I was shocked by the story with Nikolas). This company started a new era on food technology in Greece.
FCo6	The company, being in the market for almost half a century had already a well established position among rice producers, had located existing market niches and had developed strong relationships with leading manufacturers	The new generation believes in the need of a scientific orientation of the company both in the primary sector (producers) and the technological direction. Innovation (in rice?) would be the key to success in the future.	The new generation needed a success in order to assure the first generation that they can trust them
FC7	DC comes from the E's wide knowledge on milk and experience of feta cheese sector and dairy sector in general. We would add his exceptional receptivity.	A strong wish to differentiate – experiments lead to products that justify the E's choices.	The E. believes that he is responsible for the products offered: 'The consumers alone cannot define what they expect-this is our job to do".
FCo8	DP due to former success, the Es' character, long experience, the sales increase, the success of entering big S/M chains. Teleology is also detected	FCo8 is a life bet for the two brothers (I should ascribe some teleology here). Believing fanatically that they choice is right, they offer a price 70% higher than the second candidate buyer	"My brother and I, myself, did not actually work for the money then (note: after the first plant in Trikala). It is the joy of creation, the desire to create nice products…We built the factory to give jobs to people, to create wealth inside Greece"
FCo9	DC comes from a spherical knowledge of the sub-sector, the educational background and the support the Es have (entrepreneurial milieu) "The combination of the old generation's experience and the dynamism of the young".	Intuition is evident throughout the interview; the Es appear to use even mistakes for their own benefit.	Mainly in the eyes of the family: succeed within the sub-sector, surpass family's image, export.
FCo10	DC due to background, already important entrepreneurial activities and E's ability to find easy the way to a strong S/M chain (in England). Easiness to contact other important chains and find promotional channels (a cosmopolitan), abundance of financial resources, success, experience, awards.	Intuition is evident when the E starts without real products, in the extremely high investments in order to gain unique characteristics (climate neutral), in the establishment of extra production lines for new innovations etc.	The advance of the underestimated Greek products (olives, oil) to high-value branded gourmet products abroad. A significant contribution to Greek primary sector. We would add a further need to prove to family that success could not come only through the political arena.

TCo1	Previous experiences and successes, strong networks and a strong starting knowledge pool (on both technological and market areas) secure and justify the deepened conviction of both Es for the success of the new venture	Intuition regards mainly the forthcoming rapid developments of the sector. The Es seem to foresee ways to escape crisis.	While the main reason was verticalization, the new facilities were designed to offer special services to Greek clothing business which otherwise should be sought abroad.
TCo2	DC comes from the strong sensing capability, the involvement in public tenders and a relationship to that clothing subsector, M.S.s studies and father's experience. The successful transition from conventional to technology advanced production strengthened DC as well as the strong relationships with the leading advanced material suppliers that have entered a level of higher trust.	"We started fireproof special clothing in 2004; yet it was only in 2007 that the fires made the Municipalities more sensitive; companies and banks followed with sponsorships. This was the first step in the technology-based products" Intuition is evident in many of the reported activities.	In the eyes of the family; keep the well-established firm healthy and excel it in difficult times. "I was only 24, I had not joined the army yet and I was abroad. I called by father from the hotel – there were no mobiles yet – and I told him that I had bought a new machine" Furthermore, the need to survive and the need for recognition regarding the experimenting culture of the older son.
TCo3	DC: Both Es are almost at the peak of their success as European Es (both companies have been more than once among the 300 best in Greece).	Value-added is sought in extremely specialized services with an ecological background. The Es appear to have a very clear picture of the future in the T&C industry at global level.	Leading global customers of value-added products (DIESEL, VERSAGE, CAVALLI) and a contribution to ecology.
TCo4	The excellent course of the firm; from a small plant, into one of the 10 best of its sector at European level in 1998. "We created everything from zero!"	"I had personally experienced all the stages; my experience was huge! Well, I had a thing with technologies, and I cannot say that it worked out well, since I have invested vast amounts which did not pay back!"	"By then we were co-stars in R&D; we were the ones to apply others' research. We wanted to become the stars and we did it! Today we own two patents."
TCo5	DC due to the successive course of the company, the constant developing of it (e.g. addition of a design department, advancement of logistics, transfer of production to China), existing financial and human resources and the firm's open attitude (brand awareness 90% since 2002).	Trusting the foreign university??	Mainly a need to survive the crisis and to exploit the strong Design Department
TCo6	DC due to previous experiences and successes, strong networks, a strong R&D Dpt since 1992, a pilot spinning laboratory and knowledge. One of the leading firms of the sector at European level with national awards and global recognition.	"We actually did not know what we were looking for, but we were sure that it was the only way to redefine our existence in the sector and survive." The E. manages meetings among European machine manufacturers to speed up innovations. TCo6 invests in ecology at a time that there was no such issue for cotton producers predicting the increase of global sensitivity towards eco-textiles, clean energy forms and natural raw materials.	Being among the few pioneers with high-value added products while the majority produces the conventional carded, combed and blended yarns, TCo6 wants to keep leadership and confront the forthcoming global crisis of the sector. A further effort to keep its personnel
TCo7	DC comes from the E,'s love for denim, his deep involvement in the denim world, the strong networks and the previous success in getting ahead by having his own production instead of just being a subcontractor.	"You have to question yourself what the customer dreams". "He was always a step before the others" (Technical Director for the E.)	"I wanted to invest in design and quality; I wanted my final product to be at least comparable to the known jeans brands.

	NOTE: If Hans Hinterhuber (1992) wanted to prove his theory on the special relationship between the entrepreneurial vision and the person (*"entrepreneurial ideas are an expression of one's own life and professional experience"*), he could use this E. as an example.	"The effort of Mr D. appeared to be a utopia. And yet, he succeeded. Vintage treatment is difficult and he is the only one to do it in Greece" (Economic Director)	
TCo8	DC as a company characteristic and not a personal trait based mainly on its excellence, leading position at national level, the cutting edge technology, strong networks and a rich pool of resources of all kinds.	Intuition does not refer to the venturing but mainly to the creation and sustainable development of unique fashion "There are hundreds of design proposals. You have to choose the ones that make the difference. This is quite hard when you have to compete against a Triumph."	Survival. "The motive for the restructuring?" "The trends and strategies of the large firms abroad. You either follow or shut down. The only pioneering is how forward looking you ar, for your products to be accepted"
TCo9	DC due to long term success, customers' suggestions, strong business so far, existing resources and capabilities. A well established company - well known all over the world (upper segment of the market), among the 3 best in Europe for many years	"Denim became a women's fashion. Denim fabrics started becoming complicated and were results of R&D and good marketing".	"The firm had to make a shift imposed by the market and the foreign customers".
TCo10	According to the E's sayings he was always deeply convinced that his designs would be successful and did not stop searching for a business angel although many times he was deeply disappointed because of rejection.	Fashion needs intuition.	Recognition as designer, acceptance at international fashion cycles, fame. "My clients say that my atelier is an oasis in the fashion world"

A13. Dynamic capabilities: Sensing capabilities

	Technology sensing	**Market sensing**	**NPD capability**	**Networking / participation in collaborations**
WCo1	Regular visits to machinery and raw material suppliers for information and training Constant cooperation with TEI, machinery veneer and glue suppliers Twice a year visits at the two most important international shows (machinery and raw materials) and attendance of foreign veneer and fleece suppliers seminars.	Regular meetings with designers all over Greece for new trends, customer feedback, internet use Trends monitoring through internet and TEI reports Competitor monitoring (the one regional one and imports)	Regular experiments (try and error) with new material and alternative processes (incremental) (*improvisation and TC)*. Several combinations of equipment potential and new material (NPD) to produce new products New designs presented in a yearly basis	Meetings focused on development issues with designers and the participation of TEI are regularly arranged *(bricolage)*. Processes for co-operation on projects (architects, developers)
WCo2	Routines on selecting knowledge and new technology (long lasting relationships -real time interactions) (*bricolage*)	Regular market research by company's team. Special market research abroad. Managers are committed to manipulate all	Informal mechanisms for collecting information and knowledge and then prepare dynamic collages that drive to NPD.	Constant cooperation with TEI and leading global suppliers Joint projects on innovative technologies

	meetings / trial and error (experimenting). The E. is constantly kept informed on all developments in wood technology by two wood technologists of the company and TEI experts. -all Departments follow the rule of gathering information (directly or indirectly relevant) both bottom up and up-down. Information is diffused in regular Dpt meetings visits to most important international shows (machinery and final products) every year. Visits to leading manufacturing companies worldwide with a team of engineers	existing resources (such a routine led to the development of gases' technology instead of polluting the air, the exploitation of residues, the production of fireproof and water-resistant MDF, etc) in order to create new market needs (e.g. the last 2 products have not been used by the Greek furniture sector yet). Competitors benchmarking, mainly trends monitoring through trade shows, internet and TEI reports.	try and error processes: *"We discuss our suppliers' novelties in the trade shows; they tell us their innovations and we decide if we can become their pilot users.* (CEO) Regular production of innovative processes and new products: laminated and flooring products, total recycling of gases for use in drying process etc. Business opportunities of both external (e.g. a new product in a trade show, a gap identified in the market) or internal (e.g. an executive's idea on energy saving by using wood residues) are ordered and inter - related in time. New concepts are formed by using tacit and explicit knowledge (*"All ideas are carefully collected by executives and then when the spark comes (let's say a relative subsidy law for energy saving or a project declining, they compose their pool - adding what is missing"* the E.) Business ideas need either satisfy already company's set rules (strategy, long and short-term targets, company's ten main values) or thrill the entrepreneur (then no rule is needed).	even with competitors *"We co-operates with our foreign competitors, since benefits were mutual*" The E.)
WCo3	New technologies monitored mainly through cluster information Routines on selecting information on developments by all suppliers' and complementators' novelties but selection through the lens of Greek trends. Cluster information is vital	Regular discussions with their customers (kitchen agents) about the trends they detect in the Greek market. Several declinations from European and Italian trends (material, colour, design). *"We keep personal contact with our customers; we need to know what is going to sell the following season"* Regular Internet research and trade shows visits but not on a formal basis. Cluster information (their share refers to Greek market and expenses)	New design and experimentation on novel material	Besides cluster members, informal contacts with experts of TEI Larissa and informal contacts with acquaintances from the cluster.
WCo4	All year: focus on collecting information and knowledge mainly by customers, TEI, machine suppliers (*bricolage*) Twice a year visits and participation in trade shows. Industry innovation tracked mostly by TEI providers and internet sources (as well as	Contacts with main customers, visits and arranged contacts at relevant trade shows, contacts with architectural companies (after 2008), TEI market research.	NPD based on design, equipment potential and innovative knowhow. Meetings on idea promotion usually after trade shows - participation of TEI. Regular experiments (try and error) with new technology, alternative processes (quality - efficiency improvements), Informal processes of manipulating all possible	Formal and informal contacts with TEI on a constant basis, machinery and glue suppliers for NPD purposes. Partnership in relevant research clusters (K-cluster, Bioclus) Partnership in complemented activities (e.g. with Wooden frames manufacturers

	relevant portals) - mainly refers to machinery.		resources (waste, energy, small wooden pieces) and all skills (e.g. design, technical knowledge) for NPD towards new market niches. (Green entrepreneurship)	association)
WCo5	Efforts to tap supplier and complementor innovation through CEO's contacts : rather weak (the same Greek company was both supplier and customer), Visits to the supplementary material companies (for both processing e.g. glues and erecting e.g special joints) - on a problem-solving basis. Internet -journals and national trade shows Occasional contact with TEI Larissa. ***No systematic work***	The company tries to enter existing market segments (kitchen furniture and shops fittings and exhibition stand constructions) and replace mainly plasterboard -most important processes= participation in trade shows, personal contacts, information through TEI experts and sectoral magazine editors. Gap identification (e.g. partitions in basic constructions, for sound and thermal isolation No systematic work *"Estimations are purely intuitional; internet and journals, designer suggestions. We supposed that we were following the right direction"*	On a problem-solving basis: R&D 2003-2005 refers to product formation - try and error. 2005 contract to a big wood processing company for further improvement with no success. 2006 - 2008 2 research programs with TEI Larissa (process of patenting). 2008-2009 experimentation on special constructions and further elaboration (mostly with TEI). Company's policy "sth new each year".	R&D mostly in cooperation with TEI based on research programs (improvements, new applications, better process methods, new markets). Collaboration with customers
WCo6	Customers, suppliers and trade fairs the main information sources and opportunity drivers. Routines on selecting information on developments by all supplier and complementator novelties mainly through trade fairs and supplier information. Strategic decision on new directions mainly after trade shows "*Every May we go to Italy and Germany; this is our main information source on novel technologies. We have located needs, problems and opportunities in our plant and seek to find solutions. There is also regular info by technology providers. Then, on regular meeting we decide what to buy, where to invest."* The firm regards competitor watching as very important *"You have to know your competitor even better than your own company":* In Greece, one competitor.	Processes including customer cooperation (satisfaction of their innovative needs). Both agents and the Es themselves are always next to (big) customers, watch their developments and satisfy their needs. E,g, customers in Holland will be twice visited by the E and 4 times in a year by the company's agent there. Even the trend towards ecology was a customer's request (FC certification).	Meetings focused on development issues (ideas can be bottom -up (e.g. from workers) or can come from environment scanning. Internal R&D limited to process technology in applying innovative material or trying new processes (mostly try and error). Development of modern lab in order to test new products in-house (e.g. for tension). The company uses reverse engineering	Networking mainly with suppliers in international trade shows - now the company turns to TEI
WCo7	Technology progress provided by the Italian technology provider	Not provided	N/A. The E. mentioned that the product was too new to need NPD	Partial collaboration with TEI

WCo8	Probe of innovative elements (such as kitchen mechanisms and materials), and novel technology details to enhance value. *"We invest heavily in new products, innovative raw material, mechanisms, and the innovative combinations in general.* Such processes are considered as vital by the E and are embedded in company's culture. The E himself searches for innovative materials, combinations and relevant designs e.g. *"I was the first to bring Egger melamine in Greece"*, first to use corian etc Information mainly through sectoral journal information and informal benchmarking. Sectoral studies and national forums (My note: The relevant Greek market has mainly foreign competitors - Italian firms and 2-3 Greek ones especially in the area of N. Greece)	Processes of customer feedback and market-shift recognition: "What sells in Greece most, which design, what material in order to create our very own designs". ICAP data are combined with other sectoral studies and sectoral journals monitoring European trends and regular visits to the two largest international trade shows, benchmarking and best practices adapted by three leading Italian kitchen manufacturers.	The E. loves being a pioneer in both supplier and complementor innovations. The design team is responsible for these processes. Inspirations in innovative design mostly from 3 leading Italian kitchen design companies. The firm has a "Creative Department" where processes focus mainly on novel and creative design, and innovative material selection. There is also minor research on process technology focusing to solve problems (e.g. the inefficiency of the finish Dpt) or improve certain processes (*"We never stop research on technology – I am personally involved in this part; it is the policy and the culture of the company to be always ahead regarding technology evolution"*). Annual basis of NPD introduction. *"FCo8's image is supported by the excellence in selecting and combining novelty in our new designs"*.	Raw and supplementary material suppliers and B2B customers such as architects and decorators. Collaborations extend from appliances manufacturers to decoration journals. The entrepreneur is a member of many associations. The E seeks cooperation with Universities and relevant institutes.
WCo9	Mostly through trade shows and suppliers. TEI provides also new knowledge. Company has made a series of acquisitions in order to appropriate their knowhow.	Market research and customer surveys, trade fairs, fashion, cooperation with famous designers, relevant events On-going industry benchmarking and market research. Attending industry workshops, seminars and trade shows. Competitor monitoring: *"FCo9's policy is to monitor its competitors. We usually are the first to react. We were the first to counteract to IKEA before the company's entrance in the Greek market"*.	Annual budget for R&D - technical Dpt responsible; *"a 5% of the turnover is devoted to R&D; if for better market condition, we would have increased it"*. Try and error processes used. Regular processes for new designs (special NPD team), processes for horizontal integration at strategic and operational level (e.g. my personal contact and TEI contact with the Dpt and its Director)	Regular cooperation with TEI of Thessaly Research papers on specific industry matters (in the general sense - not only furniture). International trade fairs and conferences Collaboration with technology transfer company
WCo10	The R&D Office has the responsibility of evaluating information relative to new technologies and stakeholders' innovative ideas. Science and Technology information and knowledge is collected regarding a range of subjects (e.g. medicine, ecology, energy, raw materials etc) formally or informally. All the above information is recorded and analyzed by the statistics office of the	FCo10's policy is the creation of needs and expectations of potential customers. However there is regular market research, questionnaires, and complaint management Personal contacts made at the annual in-house conferences and seminars. A monthly cooperation with stakeholders (e.g. a monthly report of corporate shops all over the world*)* It promotes a CSR culture by	The company has a formal process of NPD and handling of innovative ideas.	To promote and support its culture of sustainability, F10 has established partnerships with individuals, social teams, external organizations and professional bodies in Greece and abroad. Co-operation with institutions and University to collect information and develop innovation (e.g. in 2011 cooperation with a team of John Hopkins University on sleep (holistic health

	company and taken into account in order to plan the company's strategy. In association with the Head of the sustainability office, a report is compiled involving several issues such as alternative sources of energy, recycling methods, and any suggestions regarding FCo10's contribution to environmental protection (e.g. the Board of Directors decided to use gas for the factory and to use gas powered engines for the company's cars. This was a proposal of the R&D office in order to reduce pollution). Idea brainstorming at all levels for the establishment of new terminology. New technologies are a focal point for the company.	recognizing the contribution of everyone that has been actively involved in the development of the company.		program). Projects can be at official or non-official level. Examples are partnerships with the University of Thrace, the Athens University of Economics, the University of Munster in Germany, EFQM, Cambridge University, UNESCO, WWF, United Nations, CSR Euro-chambers in Brussels.. FCo10 is also a donator to many of these organizations Close cooperation with suppliers and complementors all over the world through TQM in terms of EFQM.
FCo1	No Processes to Tap Developments in Exogenous Science and Technology. Some monitoring of packaging technologies: The company sets specifications and sometimes participates in the development of new product (e.g. the innovative plastic bag), transparent labels, design of beakers and labels etc Other sources: international trade fairs, internet	Market monitoring is one of the main tasks of the E., who observes taste habits of foreign markets, uses his imagination and observation competences to come up with new ideas and new combinations of taste every year. Targets: foreign groups who seek special tastes, singles, high and low incomes. Participation at international trade fairs, search through internet and super markets all over the world. The E. travels a lot all over the world to try local tastes and get engaged to different alimentary habits. *Note: a highly individual process executed only by the E.*	R&D (around 2% of turnover) corresponds mainly to new product development. Three people are involved in this process, one chemist and two of the owners (the CEO and the production manager). The idea comes up and then experimentation starts through trial and error until they end up with a new product which has the characteristics required. This process may involve trial for many recipes before ending up with two or three new products. The company develops around 10 new products per year which are presented every September to customers (individual visits) According to the E. 3 out of 10 products succeed.	Cooperation with the packaging company and with a food technology expert.
FCo2	Occasional meetings with packaging supplier to improve packaging – cooperation with automation companies on more advanced monitoring and management of the plant. Technology sources: internet, trade fairs, exhibitions, conferences, scientific and business journals.	No formal processes. The Es watch trends through internet, trade fairs, exhibitions, conferences, scientific and business journals.	Experimenting on quality and appearance plays a decisive role. No other processes for NPD.	Cooperation with experts (University and consultant) on novel seed varieties and process improvements Cooperation with automation and packaging companies

FCo3	No formal processes: **i**nternet, scientific and business journals, monitoring of Greek competitors, contacts with Dpt of Vetinary, European relevant products imitation (e.g. omelet, packaging)	internet, direct contacts to customers	Try and error processes in cooperation with Dpt of vetinary of Thessaly. Improvements on processes and packages. No formal policy. Follow-up with new products (sugared whole egg, salted whole egg, omelette), production increase and further refinements	Contacts with Dpt of Vetinary - have entered 2 research projects so far
FCo4	Visits in trade shows, extensive and systematic use of internet, imported products cannibalization, competitor products monitoring. Regular Contacts with specific University Dpts (plant and food technology, biotechnology)	Market research all over Greece- Personal contacts with confectioners, drugstores and their clients in Athens and Corinth territory	Meetings on discussing all new info and knowledge acquired. Selection for promoting and/or putting on-the self ideas (e.g. research for chocolate for teenagers which is judged as too expensive at present). In-house try and error on mixtures, new recipes. Try and error loops with customer involvement and interaction, business plans for all new products.	Networking with experts of University of Thessaly and TEI of food technology (Athens) t
FCo5	Monitoring of food industry innovation in the biofunctional food section through conferences, papers, new products and international new technology analyses (regarding such products). No direct competitor benchmarking although some observation of existing products and study of relevant literature. Chemical industry suppliers contacting, Universities (see networking column), science papers	Market sensing includes regular market research in Greece, monitoring of international trends on bio-functional foods for new market niches and customer needs. The firm has developed a feedback process which involves seminars for targeted patients, collaboration, and target-specific questionnaires	Well-organized R&D Dpt.:try and error method used. Regular meetings of executives on development issues e.g. 1) improvements; "*The company works further on the new products in order to find ways to make them last longer and be acceptable in super market chains"*. 2) alternative solutions *"the feed back cake is not easy to carry for athletes, so the company prepares bars and biscuits with all further research that has to be done on durability and conservation"* 3) new R&D *"we contact clinical research on the effects of these innovative foods, since they have proved to be well tolerated by cancer patients"* (NOTE: The fact that every opportunity has an object and in turn becomes the object of another opportunity supports the dynamic capability of reconfiguration and starts anew the sensing process).	Formal and informal linkages to chemical industry and labs, manufacturing companies, cooperation with pharmaceutical companies in marketing, knowledge exchange on a constant basis with a Greek automation company, collaboration efforts with other food firms for alternative products (e.g. cookies) Establishment of a stable and continuous cooperation with the Department of Biotechnology of the University of Thessaly - formal sources are research projects and the spin off. In 209-2010 FCo5 and Dr K prepared a business plan for a modern laboratory on pharmaceutical products (biological controls, anticancer, anti-diabetic). Besides Uni. of Biotechnology and the spin-off, formal linkages with specialized laboratories for all new products testing, such as a lab for allergens in Crete, a lab in an American University (a link of Dr K), linkages with the medical world especially for the new research projects (e.g. a clinical research on cancer patients in the

				Diavalkaniko Hospital of Thessaloniki)
FCo6	Routines on selecting knowledge and new technology information exploiting long lasting relationships with suppliers and Academia. Collaboration in projects usually set by FCo6: e.g. packaging -suppliers, agricultural production management - complementors, knowledge exchange with automation and control systems. Farmers bring information or specific knowledge. Competitors benchmarking refers mostly to products (one main competitor from USA on technology and Italian ones on tastes and concepts) mainly trends monitoring through machinery trade shows, manufacturers, internet and Academic reports Large international shows are significant sources for machinery and final products every year, Other sources: literature review, joint research projects on innovative technologies, best practices by other (different) companies (e.g. zero emissions was seen as a competitive advantage in another (irrelevant industry) and was adopted).	Regular market research by company's team. Special market research abroad. The company has developed market research routines with target groups (e.g. working women, delivery substitutes or even people who do not eat rice) and trends roadmaps (e.g. the increase of food deliveries in Greece target the need for a very fast product which will be better than the just cooked delivery). FCo6 participates in the two most important food fairs worldwide, ANUGA in Cologne and SIAL Paris which are global business platforms. The market research provides the information needed for latent consumer desires, which according to Mr KP is the best. *"When you suspect a need you can create a result. Of course you may change the initial idea more than once. All this way comprises knowledge, research as well as imagination"*.	A five-member executive team (3 Es and 2 chemical engineers with PhD) headed by one of the entrepreneurs and enriched by external consultant and scientific teams. Routines on exploiting knowledge and info: trial and error (experimenting) -The company spends about 0.6% of its annual turnover on expenditures for innovation activities. All new projects are primary ideas of the 3 cousins and the chemical engineers which are then discussed with relevant University departments. Many R&D self-funded projects and research projects in cooperation with Universities and Institutes Investments in laboratory equipment, systems application, production model novelties. ***Focus of environmental friendly processes***: "*nothing to be wasted"* (e.g. kernel's husk, rice by-products, the ash of husk burning (chemical industry, Pharmacy- Pharmacognosy) - this research has led to two high value added products for pharmaceutical companies and food production companies in the area of bio-functional foods and with γ-rizanol as a basis) automatization etc. ***Aggressive NPD: S***pecialties, GAP and IFA, novel risottos, " *..their technology is unbelievable!*" ***Innovation routine (informal but established):*** The company gets information which can come from the academic world, the suppliers (e.g. the farmers), the market which leads to new ideas or by research problems that are discussed with Scientific World in order to exploit resources or solve problems, new ideas which derive from technology and science advances as well as the very wishes and desires of the innovation team. Each new research project is adding value to product portfolio and promotes product innovation and new fields of application. Through brainstorming, the core team decides which	Constant and close cooperation with Universities:(NTUA, Thessaly, Un. of Western Greece), BIC of Patras etc and various Dpts (e.g. Geoponics, Pharmaceutics), and worldwide leading suppliers. The company's policy is to work on as many research projects as possible in cooperation with Universities. Links overcome simple co-operation (eg Mr KP is a member of Un. of W. Greece, an active member of the Chamber, the Green Aim etc. In 2010 they entered the research in the field of bio-functional food products (on rice and pulses). This research is extended to hyper-enriched rice for special groups (children, athletes), bio-functional foods based on γ-rizanol , pharmaceutics and the chemical industry (advanced and high-added materials from rice husk ash).

			ideas will be presented and supported at the Board meetings. They must thrill the team (*"We want to innovate and I think we ought it to people to innovate. We want to be pioneers at least at the European level. Of course we produce many ideas but most of them stay on the shelf. An idea is not good enough unless it thrills us, unless it makes us say Oh my God. That's unbelievable!"* (the E.)). The selected new ideas are assimilated and exploited by forming the needed parameters and when the company gets the desired results it goes on by creating the preconditions for new information. According to Mr KP this cycle, the innovative culture that nourishes the constant quest of the totally new and exciting creates the competitive advantage of differentiation and leads FCo6 ahead of the other sector companies (with some worldwide successes and patents. Some ideas need long lasting research: e.g. after 6 years of research FCo6 invented and developed a process method and technology on a process that reduces the cooking time of brown and wild rice from 45–50 min to 10 min and this is a global success of top innovative technology and knowhow, since the latest method offered a cooking time of 20 min (USDAARS Southern Regional Research Center, Dr Guraya) and did not produce high nutritional quality4). Sometimes products are exposed to market before final stage (in a try-and error process) in cooperation with customers. e.g. the E. narrates how they prepared an intermediate product before research completion in order to test it. *"We went on negotiations with a super market chain who accepted to put that product on their shelves as private label under their name"*.	
FC7	No formal processes: Regular literature review, internet, international trade shows, observation Sectoral knowledge gained mainly mouth to	Culture and taste observation (*"When we saw the Cretans to eat graviera with honey, we were inspired to produce melityros. Japanese loved this novel product; their food culture*	A focus on NPD on a yearly basis. Mostly observation and try and error processes: *"We started it and we had to waste too much product in order to reach perfection. We experimented a lot –*	Networking is limited to machinery and packaging suppliers.

	mouth through suppliers, retailers and customers	*turns around sweet and sour tastes"*). Company's strategy is "to produce new products and let them be tested by real market" ("We participate in international trade shows and present our products; then we note the reactions of different groups: women, elderly, young. I strongly believe that the product will attract the consumers and not vice versa… Consumers alone cannot define their wishes and tastes"). Customer's feedback (partly by the franchisees)	*try and error, the outcome I mean. Quality controls were carried out in a laboratory in Larissa and this meant delays as well. This year we wasted 500 kg of the product" (NOTE:* "4 seasons cheese" was not yet in the market at the time of the interview (2010). New products are in-house designed and produced - processes, technology, design, and packaging.	
FCo8	Close cooperation with suppliers: e.g. with the packaging company for the production of the innovative milk bottle). Selection of leaders to develop and transfer technology. A significant team of engineers who are in charge of knowledge and technology selection mainly through cooperation with leading companies: suppliers, manufacturers, process technologists), visits of international shows and study of relevant literature An informal but regular monitoring and benchmarking of competitors at national level and best practices at European level.	Super market shelves and contacts to suppliers are the main means for market sensing. A close monitoring of complaints that is then analyzed and translated mainly about quality standards. Company's target groups are *"thinking consumers*" and strategy regards "value for money" products (not low price strategy) The Es do not encourage market research but innovative thinking. Yet, they monitor ***social and consumer conditions*** (*"For example when we noticed that the new way of living does not allow for much time devoted to food shopping (especially in Athens and Thessaloniki), we invested in products of longer life*'.), ***best practices around Europe*** (*"We saw that Europe started to sell this micro-filtered milk. … we invested in it too"*) adding to technology and special competitive advantages	R&D meetings on projects with members of all SBUs. Ideas oriented to consumer needs. Innovation and aggressive NPD (e.g. different types of milk, yogurt, juice etc), novel process technologies (that offer higher value for money, innovative packaging) and new markets (e.g. juices, Kefir, biological products etc). Sometimes innovation is beyond accepted data and Es encounter difficulties with bureaucracy *("there was no legal framework for the microfiltered milk. We had no way to describe it. EFET forces us to name it "of high pasteurization which was a lie; they forces us write lies"*)	Common experiments with machine manufacturers: e.g. "*we co-operated with a Swedish company; after 1.5 year we managed to produce the product we wanted in machinery which was designed for other purposes"* Networking regards mainly machinery and packaging suppliers, and quality control laboratories.
FCo9	International trade shows, technology literature research, patent searching, participation in research projects (with Universities and research institutes)	Purchase of ready-to-buy research studies on general subjects (e.g. gluten, nutrition trends etc), results of projects on tastes and trends of a country assigned to special research groups of the specific country, Euromonitor on a regular basis, feedback by the quality system relevant routines (customers are companies as	Initially a high R&D budget (10% of turnover). A policy of constant Technology research and patenting, Aggressive NPD processes through individual studies and efforts, co-operation with clients and technology firms, suppliers, food research institutes. Patents (of both products and processes), and new	FCo9 networks with clients, research institutes and technology companies. Many of them are found in trade shows or through internet and are then visited by the Es. The firm has a formal procedure for the contract: formation of an analytic briefing, MDA to sign, a trade contract to sign (e.g.

		well), The Es watch themselves target markets abroad.	trademarks at regular intervals.	that FCo9 is the exclusive producer) Indicative collaboration: FCo9 is the innovator and the producer – an American firm is the customer and funder of the industrial production – an English R&D institute is the co-operator regarding specific parts of the research. The firm has been approached by University Dpts for research co-operation In 2011 The Piraeus-TANEO Capital Fund" (PTCF) venture capital fund acquired a holding in the firm.
FCo10	Not discussed	Not discussed	FCo10 is committed to the generation and application of new ideas and skills to produce new products, processes and services. A10's definition on innovation "*making life a little bit better and a little bit easier"*. To maintain the long-term competitive advantage, FCo10 is constantly challenging to offer products with meaningful differentiation in terms of health and nutritional benefits, packaging, texture, taste and sensory signature. The company has developed a routine based on the motive "***Need-listen/open up - create value"***. On that basis, there are regular executive meetings to present ideas selected by a constant monitoring and other parts' proposals. Some of them are then developed either by co-operation with Universities or other stakeholders or by the company alone (1). Company's strategy relies on constant innovation at all directions: NPD, total innovation, reinvention (retro-innovation; oxymelo), process innovation (e.g. carbon -neutral, water footprint), marketing and culture innovation (2) etc. (1) Indicatively: 1st carbon neutral olive oil in the world (Swiss Research Institute), 1st carbon neutral	Strong networking and collaboration capability. Collaborations and complementarities all along the value chain (from raw material suppliers to distributors, design, promotion events) - mainly creator of niche markets. Indicatively: Co- operation with the Swiss organization "my climate", A joint venture 50/50, with K Cooperative, the 1st private company and a cooperative, co-operation with an American chef Co-operation with Universities and organizations (e.g. NTUA, ETAT, University of Cyprus), research projects Co-opearation with traditional oil-press Products due to collaboration with other producers such as organic cookies, fish roe and ice cream with olive oil.

			consumer product in Greece, 1st Carbon Neutral Olives in the world. 1st olive oil range in the world to calculate its water footprint (University of Crete). *Snack Pack olives:* R&D based innovation, 2.5 years, co-operation with The Laboratory of Chemistry and Food Technology, NTUA (2) Marketing innovation: the *meze* concept (food sharing) which was soon followed by OPE with *kerasma.* The *proprietary sauces* was a further marketing innovation.	
TCo1	International trade shows, technology literature research, patent searching, individual studies and efforts, participation in research projects and European programs, participation in many technological and entrepreneurial associations, company visits. The company gathers information mainly through the innovations presented in the main tradeshows of the sector, as well as the related companies (chemical industry, textile and fabric industry and machinery) which leads to innovative ideas. Technology sensing regards mainly knowledge and information by machine and textile manufacturers, chemical industry and regular benchmarking in dyeing plants in Greece, Switzerland and Austria	Mr E (the German partner). is responsible for target market identification in Europe and Mr R (the Greek partner) for Greece. Mainly customer contacts and trade shows on a regular basis. Encouraged co-operation with customers and experimenting on customers' requests: "*Sometimes they tell us what they have found in a trade show or have heard and we try to do it. Then it is us that we call the suppliers and ask for materials and know-how"*	The company's strategy is the introduction of new methods and products every two years. Internal R&D depends on patent applications (process oriented), product and process improvements as well as quality controls although there is some innovation as well (1). Every new project starts with targets posted on the lab walls. All observed or suspected misfits and deficiencies are marked. Tolerance of mistakes (*"Mistakes may lead to new ideas"* Mr R). Meetings are held in order to evaluate new ideas (if it is a customer request, the customer is present as well) (1) e.g. a) the application of a new process patented by Clariant and invented by a Greek scientist (Kyriazis) about anti smell properties – first to use at least in Europe, b) a special process using aloe-vera developed by the company's scientific personnel in order to make the fabric extremely soft, c) the finishing and dyeing of Lyocel (fabric made of wood) – an Austrian product first introduced in the world's largest sector exhibition in Frankfurt Trade Show 2003, d) anti – peeling, a rapidly developing process e) trial production of several innovative chemical products in cooperation with chemical industries	Cooperation on a regular basis mainly with raw material and chemical suppliers (T1 is a candidate for pilot uses)
TCo2	Technology innovations drive technology	Informal efforts to capture market dynamism:	TCo2 has a strategy of constantly introducing new	The company became a member of the

	and mainly innovation of TCo2; co-operation with lead material producers is significant for technology sensing. Leading technical consultants (from Israel -a leader in defensive systems) are use to gain technological knowledge and information. Regular participation in relevant trade shows (e.g. Defense, Firefighters, Rescuers, Police etc), social media and internet sources use, close contacts with relevant institutions. According to the E. some research projects didn't result to a specific product, but they gave instead the opportunity to the people involved to acquire knowledge and gain valuable experience.	close monitoring of Greek public services like army and police, trend towards voluntarism, changing customer needs (e.g. wishes for more individual products, a turn to design), the growing interest towards EU standards and specifications and the emergence of new niche markets (e.g. hunters, dogs, health and sports sectors, casuals). The company's policy is to listen to these specific needs as they may represent new commercial opportunities (messages can come even from individuals that ask for unique solutions or certain specifications such as regulations in the context of EU, referring to working conditions (e.g. in big industrial units), marked the upcoming needs in terms of protective garments. TCo2 has developed the ability to sense such opportunities and changes According to the E. it is very important to sense the sophisticated "needs" of both bodies (e.g. the specification of army or fire brigade) and of contemporary consumers; For example new generations are also interested to the design of special garments and not only to the functional characteristics. *"We follow their comments in social media and their blogs. We are really interested".* TCo2's team are able to respond to these very specific needs in terms of product characteristics and have established direct links to the market with e-commerce and B2C.	products for the Greek and foreign market and invests to innovative products for niche markets stretching to areas out of the textiles sector (Recent innovations -at least for the Greek market- were the bullet-proof vest for large size, the bullet-proof helmet and a special flame retardant and radiation protective mask). The company spends approximately 2%-5% of turnover per year in R&D. NPD team: the two entrepreneurs, the quality control manager, the CAD designer and the production manager. The development of new products is based on R&D that is realized internally (e.g. the special mask) and sometimes in cooperation with technical consultants and experts on the specific item to be developed. Partners are selected after decision on certain knowledge and technology needs of the project: *"At the planning stage we analyze the phases and the agents we need to co-operate with at each stage"* Many projects are in cooperation with suppliers and international quality control labs. Reverse engineering and technology conjunction and complementarities are also engaged' e.g. *"We had the knowhow from EM and we were able to develop the product which is now certified with EN471"*	Nomex Quality Partner System and certified manufacturer by DuPont for special fabrics and garments - a main purpose was to be the first to tap any of their relative innovations. Co-partnerships with suppliers and complementors (leaders in their field) who search for "local partners" – Long lasting, close relationships, based on trust and respect (and not price), support the priority and exclusivity of TCo2 to pilot use novelties (e.g. DuPont για το Nomex, Gore for Gore-tex etc). Networking with national organizations such as Universities or research centers, initially weak; it gets stronger: now TCo2 cooperates with Clothing Textile & Fibre Technology Development Company (CLOTEFI) and Universities. They participate in national and international research projects; e.g. STRIDE initiative together with CLOTEFI and the University of Patras; European pre-competitive research program related to anti-bacterial fabrics; Now on a nanotechnology project However, the E. complaints that these programs refer to research out of their NPD agenda since there is a problem of different timing and objectives, at least when the company is mostly interested in commercial output.
TCo3	International shows on colors and relevant trends - experience and knowhow of the Es' other companies (not firm-level specific activities)	Market sensing due to close relations with customers (among which famous fashion houses (DIESEL, VERSAGE, CAVALLI), international shows, fashion monitoring. The two Es companies' information *("There is much information flow from TCo7 regarding the international trends and the valuable*	TCo3 develops in-house R&D in two directions: pilot use of innovative colors and treatments of leading suppliers and new designs on color treatment. That can be either after customer's demand and the usual policy is the presentation of 3 solutions (creative innovation) or on a regular basis to prepare a portfolio of design concepts called "internal	Close co-operations on pilot uses (a policy mainly of TCo1) due to the very good and long-lasting relations of the 2 Es (mainly trust). Most collaboration with material providers from Italy. It appears that there is no further collaboration with University

		feedback of the significant customers; they will send their models and this is also a way of market information")	projects" by TCo3. Time needed usually ranges from 15 days to 3 months. Try and error is the usual method. Internal projects are prepared twice a year for the two annual collections. New technologies refer mainly to new colors and treatments or new fabrics and enter the company through suppliers, customers and trade shows. No dedicated budget for R&D -mainly labor hours (materials are coming free when for pilot using) (1). ***NPD Method:*** laboratory -pilot production - production. Sometimes reverse engineering is engaged with alterations from mass chemical treatment to physical color one-piece treatment. (1) *"NPD starts with innovative material (which is usual in other dyeing plants as well) but it goes further regarding the mixture, the identical conditions and their handling; i.e. the recipe. Much try-and-error but we manage to present novel proposals to our customers on a six-month basis".*	
TCo4	A steady information flow: International trade shows (TCo4 was also participating), machine and equipment manufacturers, chemical providers. Cooperation with ETAKEI. Qualified partner in R&D network, laboratory co-operation. A constant investment on innovative technology even during difficult periods (*"I love novel technologies. Just consider that even in 2008 we invested around 1,5 million and in 2009 almost 2 million in novel technologies!"*).	Close relations with Customers (requests / proposals to high value customers e.g. Adidas, Levis, Hilfiger) - regular meetings for new ideas (innovation to final cloth a combination of all value chain innovations), All branded cloth makers were customers worldwide (stopped 2007-08). Today there is a more aggressive market monitoring but with less success to important customers feeling rather weak and unable to manage specific investments. International fairs on design and technology matters. Widening of customers scale based on products that cannot be produced in low labor cost countries. A continuous offer of innovative products to selected customers	In-house R&D in cooperation with raw material suppliers (yarn, chemicals) mainly after customers' request but also in the NPD logic. Tailor made products and solutions are TCo4's field of specialty. A well educated team to plan and organize R&D (about 15 engineers). R&D department is the core of the business. R&D group is focused on creative fabric innovations, targeted fabric and collections adapted to the high-end market's needs (1). Processes range from collecting information on cutting edge technology to running one of the most modern labs in Europe Development processes with stakeholders. Design team creates unique designs on a season basis. Collaborations with external European designers along with the research, the information and the ideas that T4's creative team daily brings forward, function as a springboard for	Cooperation with ETAKEI. Qualified partner in R&D network Meetings of heads of all departments with supplier representatives (yarn and colour suppliers Du pont, Dystar, Bayer), Collaborations of Design Dpt with customers' designers (stopped in 2007-08) and external European designers. Many cooperative projects (e.g. with Du pont on lycra matters-1). Visits and discussions with equipment manufacturers

			creating and constantly updating TCo4's four main fabric collections (fashion, second skin, easy-wear, hi-tech).Even in today's difficult conditions R&D goes on with innovative fibers development (about 5 projects per year) (1) *"We search and discover the key directions and play with fashion trends in order to develop expressive fabrics created to inspire and engineered to perform".*	
TCo5	There was no discussion on "hard" technology, i.e. machinery or equipment. Thus, here "technology sensing" is translated as "fashion and trends" sensing. Co-operation with the fashion schools of France and Italy (they but their "books" i.e. the new fashion trends), international fashion shows, individual research at national level, direct and indirect competitor benchmarking Monitoring of fabric designer work.	Visits to international trade shows and study of relevant literature (mainly fashion). No customer feedback Market research though ready to buy reports regarding preferences of customers in Greece.	R&D is translated into creative design: Well organized creative Dpt since 1997 with 10 designers//modelists New collection twice a year based on international trends and industry information and knowledge.	Co-operation with Bocconi University (twice) and University of Pireus (again twice) Contact companies for logistics and product management
TCo6	Regular meetings with suppliers on new products and technological novelties (long lasting relationships). Visits to the two most important international machinery and equipment trade shows	Sectoral market research each year on national -European and world level. Research on special markets (e.g. children, athletes, fashion, and underwear). Processes for trends selection: visits and discussions with potential future clients Relevant world fashion shows	Established R&D department since 1992, research on new products after client's request. Budget of about 0.6% is devoted but refers only to fees of external consultants not to materials or personnel Occasionally, joint research on new products	Informal contacts with the relevant University in Aachen on a personal basis (the E..) Networking with suppliers of raw material who are leaders in fiber research (e.g. last product - Edelweis). Networking with machinery manufacturers
TCo7	New technologies come from trade shows (mainly on fashion matters) and suppliers (material, jeans and recipes). *"Suppliers bring knowledge and experience as well"* Company lately joined some research projects (RFID technology, Innovation Pole of Thessaly) Main complementors are denim and treatment material suppliers (including recipe providers). There is a constant contact with suppliers since twice a year companies have to expose	International trends monitoring is of maximum importance. 10 people work on constant info selection plus salesmen (their age is considered important (25-30) in order to achieve a very close monitoring of target groups. (They had started with 2 people in Florence). Statistics used. Feedback also collected by the networks. Micro and macro environment monitoring. Trends' changes of young people due to crisis discussed	R&D by a 4-member team (3 from Bocconi University and one from a fashion college in Athens) who use collected market information R&D mostly on fashion which in denim case includes technology as well; e.g. new techniques on wrinkles and special fraying techniques or even cuts; they won't open after use! *"Consumers cannot imagine how much jeans change!"* R&D therefore stretches to process methods such as new recipes' applications. …	Networking and collaborations arranged mainly during international trade shows - networking *"In such places we find the agents we need; we seek networking to enter new markets"* However, collaborations regards mainly suppliers and manufacturers. Acquisition of an Italian branded firm to enter the Italian market (and then the English one).

	new season collections. Distance is a major problem according to the E. Benchmarking on fashions, techniques and raw material used by jeans leaders (e.g. piece-dying, vintage, fashion denim) with an instant interaction to follow with no delays (*"Our strategy is to be with the leaders; to stand shoulder to shoulder with the best!"*). Monitoring of industry innovation (on production management, promotion, sales networks, robotization) by co-operations with the leaders (mainly Italian), networking, trade show visits (twice a year in Japan and USA), and the design team (Italy-Greece).			
TCo8	Mostly with the international trade shows. Knowledge and innovation linkages due to common suppliers of innovative material (e.g. Laces and rubbers) -before 2000 the company was a leader in all relevant technologies and automatization. A close following of logistics technology which is very important in mass customization. The company follows also advances in industrial design (it is not an *atelieur* according to CEO)	A close monitoring of design, fashion and trends: International fashion shows, relevant fashion journals, active involvement as presenters, market research on local and international trends, constant material updating. Fashion monitoring also by contracting European underwear designers. New collections have to be designed 18 months before market entrance (they are sampled 8 months before season) The company seeks new markets	A dynamic and well organized NPD Dpt with 8 designers/ modelists. R&D in industrial design, relevant technology and new materials (e.g. fiber technology) within extremely short product cycles. R&D budget 8% plus an amount allocated in the production costs. A fashion centered company after 2000.	Close contacts with laboratories (e.g. ETAKEI), fiber, fabric and supplementary material innovators. Collaboration with foreign designers (contracts per collection)
TCo9	Top international machinery and technology trade fairs, relevant conferences and scientific events, internet and sectoral journals. *"We seek all relevant science and try to exploit findings"* Information and knowledge by co-projects with institutes or by former contacts with Dpts where executives were students Routines on competitor novelties in the market and financial data. Knowledge and innovation linkages due to common suppliers of innovative material (machinery, material). Informal linkages	A close monitoring of the denim developments at global basis. Customer (formal or informal) information, organized visits to customers to detect new and latent demands and hopes (with observation, discussions, suggestions)	A well organized R&D Dpt. since 1999. R&D about 1.5-2% of the total cost. NPD twice a year. Although there is an R&D budget, expenses are usually bigger since a part "is lost" in the production costs. A wide range of experimentations on fabrics and treatment as well as co-projects on novel fiber use. Joint -Project developments, sometimes with exclusivity agreements of six-month or annual duration. New fabric proposals twice a year to existing customers (while attracting new customers as well). Novel proposals are presented at trade fairs.	Limited co -operation with Academia research programs (1 and lately on nanotechnology). Research projects mainly in collaboration with suppliers (e.g. much collaboration with Dyestar), use of innovative products and complementarities (e.g. using innovative fiber or processes for stretching).

	with suppliers and customers; e.g. "A customer may even bring us a novel fabric made by an Italian competitor or narrate us the novel properties of an innovation prepared by the competitor; of course that means that our customer has his own reasons to do so… perhaps he trusts us more and wants us to make that fabric for him… The same goes with machine suppliers; they will tell us the latest deals of strong competitors			
TCo10	Not discussed	International fashion shows and fairs, relevant fashion journals *("I think I have the biggest fashion journal collection in Greece!")*, active involvement in the world of fashion industry, study of international trends, updating of fabrics. *"I travel a lot in fashion shows and fairs abroad, I have my eyes open, I watch everything regarding art, I listen to music, I watch the movie, everything is inspiration"*	R&D means design.(Idea generation capability, McKelvie & Davidsson, 2006; "most product innovation refers to fashion design" (Faust, 2005)) Ideation / inspiration / experimentation Twice a year for winter and summer collection. (New geographical markets search (Russia, USA etc)) Experimentation on fabrics, colors and composing. Prototypes by selected sewers and shoe makers.	Networking mainly in the world of fashion (publicity and fashion channels)

A14. Dynamic capabilities: Seizing capabilities

	Selection of the physical technology	**Design of the business model**	**Recruitment of human capital**	**Access to capital (other than private)**
WCo1	The E. invests every year on novel syntheses of existing and innovative raw material, to seize emerging opportunities.	Enhancement of flexibility (design and flexible manufacturing) Development of exporting capabilities and e-marketing Development of turn-key solutions	N/A	N/A
WCo2	Almost every year for increasing productivity, incorporate ecological aspects; achieve energy savings, and recycling while patenting innovative processes. **2006:** new production line (new product) **2007**: new ultramodern production line of laminate flooring **2008** the company buys the technology of Heat Regain System **2009** WCo2 invested further in the increase of productivity (8.000.000 €) full modernization and the addition of 4 new production lines	Total verticalization of the production with a parallel product portfolio expansion and DIY outlets.	Yes	Yes (subsidies, loans, other funding)

WCo3	Mainly improvements in production lines and automation mechanisms	Business model gradually changed from the cluster-type production to self-production of all parts.	yes	Yes (subsidies)
WCo4	**2005-2006**: biomass production **2007** increase productivity with improvements in technical parameters of existing machinery **2008** quality control equipment **2010** production line for innovative wooden bricks.	Creation of a stronger innovative and eco-image (e.g. waste elimination and exploitation, biomass production) . Customer Solutions (e.g. the wooden bricks are a combination of products and services tailored to the specific needs and requests of customer (eg architects want), in order to add value and create new markets.	yes	Yes (subsidies)
WCo5	More custom-made machinery and improvements	No changes (it will eventually turn to imported furniture to survive)	yes	no
WCo6	Investments on technology on a yearly basis: novel machinery for veneer stitching, decorative technology, handling machinery, packaging machinery, base line production line (which turned to a big success), engineering parquet investment. "Of course in any case we prepare a business plan ; the depreciation time is a criterion too besides the purpose of investmet Φυσικά πριν από κάθε επένδυση κάνουμε επιχειρηματικό σχέδιο για το χρόνο απόσβεσης της επένδυσης. Αν είναι βοηθητικό και συμπληρωματικό στο εργοστάσιο ή αν είναι απαιτούμενο για ένα νέο προϊόν.	Customer solutions as combinations of base products, specialty products, supporting equipment and services (a practice called "bundling") in order to create unique opportunities for the customers. Delineation of the business model in terms of customer loyalty through quality, complementarity and further differentiation	no	No (private capital)
WCo7	No further investment in technology	No changes	no	no
WCo8	**2001-2002:** CIM introduction **2003 – 2007**: many fixtures and installations to solve specific problems of box-concept, introduction of corian and artificial plywood in Greece, novel design **2008-2009:** new technology dyeing plant with many novelties to suit the atomization introduced by the entrepreneur. he novel dyeing installation or the corian use entailed equipment	Company's culture and strategy is based on designing methods to capture value. Building and sustaining a strong brand image empowered by innovative technology. WCo8 advances its business model to a larger range of high income groups besides home furniture such as hopsitals banks chem-labs etc) and design different architectures (according to target groups from very innovative and unique design to ergonomics and professional design).	yes	N/A
WCo9	Established in **2006** WCo9 invests on new technical solutions in **2008** and develops a new foaming technology in **2010**	WCo9 works mainly on WPC improvements (both product and process), customer training and product promotion. While mother company advances in ***product architectures*** (e.g. modular, knock down packed furniture (KDPF), total home furniture solutions, additional services etc), ***new processes on sales business models*** (franchise, in hypermarkets for the KDPF etc),	no	N/A

WCo10	Investment mainly in technology to strengthen the eco-image: technology to reduce harmful effects to the environment, to improve work conditions and reduce waste of energy and new production line for newly adapted raw materials (such as algae).	A strategy of continuous development and business model delineation[350]. Besides the growing emphasis on the protection of the environment (a commitment that is evident in the use of ecological materials and the avoidance of chemical materials, including the packaging of products, use of bicycles instead of cars), ***unconventional methods of marketing*** (e.g. the uses of the corporate shops for many diverse activities, promotion through eco-events, the hotel concept, bartering (to trade (goods, services, etc.) in exchange for other goods, services, etc). ***Mechanisms to add value*** are always added through raw material, social corporate responsibility, customer training, adaptation of new unexplored natural materials etc . Co-operation with social and corporate institutions in order to promote the message of natural living together with social responsibility. Products have won awareness and are accepted by high - income groups all over the world. Expansion through corporate multi-use shops, corporate hotels and hotel rooms. Complements regarding raw material (all over the world), semi-products, medical teams and designers. 2014: BP Target Neutral Growth Strategy of the Year Award at the European Business Awards.	yes	YES (subsidies, loans, other funding)
FCo1	New technologies were selected after problems mentioned (e.g. the packaging problem) or need for production process improvements. First years mainly modifications and combinations and several controls added New production lines and production unit followed.	Company's policy is private labeling for less marketing- design and public relation costs, plus the reason that abroad big super markets and food chains are trusted more than a Greek small company; they are more recognizable. In order to seize opportunities FCo1 reforms business model from traditional gourmet product to international gourmet products incorporating special products from other countries such as French mushrooms and African pepper etc. E's choice to build a small-scale *boutique type* modern and innovative firm in order to have flexibility and control. No verticalization but cooperation with raw material producers that can satisfy their demands and sales as private label products.	no	N/A
FCo2	The company focuses on plant improvements in order to eliminate the disease dangers, increase productivity and add	FCo2 goes on building the eco-image to take advantage of social pressure for a product that is produced without chemicals, “in-harmony”	no	N/A/

[350] A business model that reshaped an existing and framed a new market (business model at strategic level: ‘‘the totality of how a company selects its customers, defines and differentiates its offerings, defines the tasks it will perform itself and those it will outsource, configures its resources, goes to market, creates utility for customers and captures profits.’’ (Slywotzky, 1995)

	value.	with nature and economy in water and energy ('clean and green' image), use of IPM (Integrated Pest Management).		
FCo3	Mainly quality control equipment and minor additions	N/A	no	yes
FCo4	New machinery and new plant unit for product extension (from organic and sugar-free chocolate to sugar-free products)	Business plans for new products and product families besides organic, conventional and sugar-free chocolate led to the development of fresh organic juice and jam products as well as super-foods.	yes	yes
FCo5	Many modifications of new production lines A completely new production line *"We often modify the designed machinery ourselves"*	Business model turns to a more innovative and high tech image of the company which produces nutraceutical and bio-functional products besides conventional and gluten-free ones.	Yes (hired and by contract)	yes
FCo6	FCo6 invests in novel technological knowledge to intervene in innovative ways to known processes Investment in productivity increase and addition of ecological aspects, energy savings and recycling.	Continuous technology and product improvement, NPD and further development through expansions. The company focuses on a deepening on rice understanding and exploitation towards novel knowledge and science. FCo6 manages complementarities with farmers, the packaging industry, designers, researchers, labs etc.	Not mentioned	yes
FCo7	Improvements, modifications The E. had developed an innovative product but did not decide to invest in a new production line due to the fear of the risk.	A gradual shift from traditional firm to gourmet and innovative one; this was strengthened by the establishment of a purely innovative spin off in 2010 based on gourmet novelties.	yes	yes
FCo8	Although KIE in 2000 regarded significant novel technology, sensing led to more investments: 2002 - 2003 UC filters installation 2003: back to scan and microscan installation 2004: the juice production lines Around 2005: new production lines for butter Acquisition of other 2 milk companies	FCo8 maintains its image as a high-quality milk product company that targets "thinking consumers" investing further in quality and novel technology	Not mentioned	no
FCo9	Not mentioned – maybe due to newness (2008 first turnover – interview two years later)	The company maintains its initial image as a health and wellness producer with high exports and aggressive NPD. Efforts to succeed in the Greek market.	yes	Not mentioned
FCo10	The "cosmopolitan" FCo10 does not talk extensively on production technologies.	FCo10 has established itself as the absolute leader of the category of Mediterranean Greek cuisine in the international fine foods arena, synonymous with quality traditional, authentic and innovative Greek specialty food products with more than 50 awards since 2001. FCo10's policy is constant upgrade: Continuous technology, process and products improvements, NPD, new types of co-operations, new complementarities and product additions in order to fill "the nutritional basket", exploiting the new trends (Health, Well being, Mediterranean Diet, Growth of the ethnic food market, Growth of Easy –to-prepare, Search for authenticity, Environmental Protection). Revenue architectures are constantly redesigned on this basis, since the	Not mentioned	Not mentioned

		company is a "value for money" type and stretch from healthy nutrition, to environmental awareness, design, marketing ("meze" culture) and a culture of wellness through tradition (mechanisms to capture value-e,g, the promotion of Greek breakfast in hotels). A heavy investment in branding followed (per year) by novel design and marketing strategy. Its biggest asset is its International Distribution Network. New subsidiaries complement olive and olive-oil new activities (e.g. Anazoe with spa and Olive products, diffuse the relevant culture with Culinary Centers and –Enthusiast Culinary Education Facilities, co-operations on marketing and culture matters.		
TCo1	While the company presents significant innovation there are no further investments in physical technology	All new products and processes are directed towards high value products and differentiation. Mechanisms to capture value include the application of patents, the capability of treating innovative fabrics and yarns and innovative processes. Revenue architectures based on quality, differentiation, short and flexible lead times, ability to execute high tech requests but also mass production. Target customers selected among strong multinational clothing companies. Mother company is the basic customer - all plant customers chosen by the mother company by certain characteristics.	no	no
TCo2	New machinery (2005)	Continuous NPD and new revenue structures and mechanisms to capture value (e.g. individual order, co-operation with the client, B2C, branding building and development, design advantage, customer education, consulting free services in various service bodies). A constant Business model reformation in order to catch current demands, new customer targets and up-to -date technology (e.g. nanotechnology -use of social media). Flexibility is very important to add to a customer solution approach, which starts from a integrated range of safety products per category and extends to a personal needs satisfaction (individual's basis) interaction among TCo2-client (listen -consult -satisfy) and a personal care during and after sales. Outsourcing of certain activities such as dyeing and higher order quality control . The new factory in Albania to verticalize sewing and customization. Co-operation with suppliers for R&D, pilot using of innovative material. Knowledge and technology transfer in areas out of the textiles sector. Until now they had used secrecy as appropriability method. Recently they started e-commerce and tried to develop their own retail	no	no

		network in order to develop direct access to the customer. Free consulting services to customers.		
TCo3	No further investment on technology	Revenue architectures based on highly differentiated and individualized products on the one-piece order and elaboration. Yet, the main support comes from the companies of the two Es' firms (knowledge and technical support, products and clientele). TCo3 adds also value to the two "mother firms". Exploiting research programs on biodiesel production TCo3 complements specific and very specialized requests while it fulfils relevant needs of the 2 Es' fashion clothes. Works closely with the two companies' labs and colors, and there is a constant knowledge and know how transfer.	no	no
TCo4	*"Just consider the fact that even in 2008 we invested 1,5 million Euros followed by a further investment of 2 million in 2009. Such investments in our sector constitute a continuous process. Trying to become "greener", we replaced some finishing and dyeing machinery with innovative one with dicrease of the dyeing-finishing production cycle and lower energy consumption"* *(Entrepeneur of TCo4)*	The business model aspires to adapt to new rather negative market conditions widening clientele. Revenue opportunities through partner approaches and channel strategies. Sales operational model changed to catch up with new requirements (e.g. smaller order quantities of entirely new products) and increase export percentage by shorter delivery time (a strong competitive advantage against imports from China) combined to specific complementary products -on a convenient price- that cannot yet be produced by low labor cost countries. A continuous process on technology investments.	no	yes
TCo5	Yes mainly in ICT and automation systems	TCo5 changes business models in order to create competitive advantages: e.g. till 1997 changes of sales models, 1998 development of R&D Dpt and logistics, new sales models and expansion abroad till 2005, new corporate identity and a new image after 2007. The new sales model (a mixture of franchise and private shops) restructures orders taking returns into consideration. Outsourcing of costly operations	no	no
TCo6	2003: power saving investment	Development of innovative and eco-image. Revenue opportunities through NPD and high-value products (e.g. even in conventional cotton in cooperation with the Otto Group, B100, top quality Mika etc). A subsidiary in 2000 for verticalization in quality organic cotton (failed in 2007). Networking for innovation and sales abroad. Still cooperation with organic ginning mills	no	Yes (subsidy)
TCo7	Addition of protective equipment and organic cleaning installation	Focus on jeans culture creation. Value adding by several ways (revenue architectures based on: design, sales networks, company acquisitions, production costs, business model restructuring, marketing models renewal etc. A constantly developing strategy on building customer loyalty and commitment adding value also by strong advertising (Note:	no	Not mentioned

		creating a product culture equal to Levis; i.e. known even to non jean-users as I am). Company acquisition to enter the Italian market and become known in Europe due to the Italian brand that was famous all over Europe. Production moved to Bulgaria due to cheaper labor, design both in Italy (home of fashion) and Greece, sales networks for product promotion in Europe. Company established as the absolute Greek denim jeans company. A subsidiary to climb up the value chain adding important value (the dying department), co-operation in adding value activities (e.g. new dying plant, energy etc) Acquisition of a 50% of a Greek youth cloth chain company. A strong focus on specific target groups selection and a high capability on continuous product improvement and development with fast change cycles		
TCo8	Physical technology related to: 2001-2002 subsidiary in Romania (new installations) 2003 joint venture for lingerie production 2004 new joint-venture (production unit)	The new fashion-design oriented strategy changed the business model of TCo8 (complete restructure). New target groups and new revenue strictures, new sale options, different approaches (on a yearly basis) Continue NPD -network externalities. a constant upgrading of the business models at all stages (design, production, ERP, logistics, sale points marketing, new collaborations targets etc) - all in order to create aesthetically appealing new concepts of (former called) underwear. Focus on building new competencies around the design and fashion concept and achieving new combinations. Co-operation with the two subsidiaries. Co-operation with designers and a local lingerie firm for products under TCo8's brand name. Joint ventures with other "links" of the supply chain (e.g. fabric maker, fabric treatment, child/ baby clothing etc), establishment of on line shops to promote TCo8's products. Outsourcing of mostly sewing and knitting processes. Registered trademarks. Sales network extension abroad. Licensee of famous children trademarks since 2004	no	Yes (subsidies, loan)
TCo9	The company invested more that 60 million Euros in new machinery and further machinery replacements in the period 2000-2005	Mass customization : Total verticalization from fibers up to fabrics producing cotton with firm's own specifications as raw material for different yarn production (private spinning mill) to mass customized products. Company acquisitions and joint ventures to strengthen sales and enter new markets. A ginning mill acquisition even since 2000 in order to support the new business model and supply the new spinning mill (acquisition of 2001) for special yarn production.	no	Yes (subsidies, loan)

		One of the three indigo denim leaders in Eurasia (Italian and Turkish competitor). Company bases development in new technologies science and trends (joint projects). Certain appropriability measures. Strong capability on continuous product improvements and developments with a fast change cycle. Value adding by several ways (revenue architectures based on: technology, company acquisitions (see attached company reports) and further verticalization, production costs, business model restructuring (mass customization). A constantly developing strategy on building and maintaining customer loyalty and commitment adding value (mainly though variety and flexibility). Company targets the top position in Europe.		
TCo10	N/A	Target customer selection (middle and high income – *"my clients wear Choo and Manolo Blahnik"*), custom made products followed by relevant revenue architectures based on exclusive design and uniqueness in order to capture value (design, fabric and leather combinations, customization. packaging). The firms targets exports as well (Paris, London). A gradual delineation of the business model mostly based on the E's instinct: "*I started with shoes and bags using other designers; clothes. Now I am ready to "dress" my shoes"* The E walked into apparel design in 2006 - first presentation 2007. A selective co-operation with customers all over Greece. Renewal of partners in shoe manufacturing. Cospecialization mainly with the shoe makers who work on the Es exclusive designs. Cooperation with companies abroad (as customers with strict product control) were encouraged but failed due to the weakness of TCo10 to correspond to the volume of shoes' order asked.	yes	N/A

A15. Dynamic capabilities: Reconfiguration capabilities (according to the 2009-2011 interviews)

	Business model redesign	**Asset realigning** ***(besides physical technology as presented in Selection of the physical technology)***	**Routines and processes redesign**	**Knowledge management**
WCo1	No need (established in 2007)	Technological know-how, business	No need (established in 2007)	There is an embedded culture of constant learning and experimenting,

		process know-how, reputation		while know how is achieved by technology transfer and development. The team exploited their initial experience on knowledge management (Visiting and training in the manufacturing and the non competitor company, the veneer suppliers, TEI, designers. His former experience on veneer processing a good basis) and improves the relative routines. Existing resources (technology -material - methods and processes) in constant experimentation for covering emerging needs (e.g. the decoration of the hotel that required special treatment and material). Initial plans to fulfill the E.'s first concept stopped due to the economic crisis.
WCo2	No need (established in 2004)	Customer relationships, organizational culture and values, intellectual property (patent), trademarks	Not mentioned	Learning is embedded in WCo2's culture. Constant training programs at different levels for all personnel. Teams visit international trade shows and attend seminars on technology and sector innovations. Knowledge and information diffusion meetings especially on innovation and new technology issues (they want to be the first to introduce all novelty in Greece and Balkans). Both executive and employee meetings to share information and knowledge (bidirectional transfer) . Aggressive technology transfer. Processes of connecting customer feedback with the production of new ideas. Introductory training. Experimenting and learning is very important. Application of patents formally or informally acquired. Plans for an internal learning school *"to train people on wood engineering but on an empirical basis. I mean to focus on technology knowledge and operation-level knowledge" (this is usual in relevant firms in Germany)*
WCo3	WCo3 abandoned the Italian cluster in 2011; self-production of all parts.	N/A	Processes were redesigned to comply with the need of vertical production. New way to promote products to market.	No particular mechanisms on knowledge management. Knowledge comes from suppliers, personal discussions with TEI professors and students on practicum, internet and trade shows (it is still more a "hunt of knowledge" type and bricolage than embedded mechanisms).
WCo4	No need (established in 2003)	Technological know-how, business process know-how, reputation, trademark, a new building	New routines to suit the custom-made wooden bricks for specific customers. A different approach	There is an embedded culture of constant learning and experimenting, while know how is achieved by technology transfer and internal R&D in cooperation with TEI. The team exploited their initial experience on wood processing technology and expanded in new areas (composite, energy). Existing resources (technology -material - methods and processes) in constant experimentation for covering emerging needs (e.g. the areas of ecology, energy, new ecologic materials, restoration etc). Training mainly on technology and equipment and more specific

				courses for executives.
WCo5	It eventually turned to imported furniture to survive	none	N/A	Experimenting and learning due to problem solving. The firm engages in learning events mainly through TEI. It seeks knowledge transfer (e.g. from Rehau and TEI) but not in an organized way.
WCo6	No need (KIE in 2005)	Technological know-how, reputation, land	No need (KIE in 2005)	No particular mechanisms on knowledge management although there are processes to tap new knowledge on industry and market trends. Knowledge comes from suppliers, customers and trade shows. Experimenting and training is well embedded. Cooperation with technical laboratories on quality control is vital (the company has been award the ISAQ International Star Award for Quality in the Gold Category in Geneva)
WCo7	Shut down in 2012 (first sales in 2008)	none	none	No relevant processes
WCo8	No model redesign	Not evident	Not evident	No particular mechanisms on knowledge management although there are processes to tap new knowledge on industry and market trends. Knowledge comes mainly from suppliers, collaborators and trade shows. Technical knowledge is supported by machinery and manufacturers. The E claims that personnel is regularly trained.
WCo9	WCo9 does not present any changes in the business model. This is quite normal since it regards a brand new technology and the interview was only after 2 years of first revenues.	N/A	Short life	Company invests heavily on training. A special Dpt that organizes and coordinates learning and training activities. (e.g. e-learning 2009-2012) Building new knowledge on both technical and cultural issues. Direct information diffusion encouraged. Participation is rewarded. Business seminars. Regular courses and information by the technical Dpt. which is the main responsible for bringing new knowledge into the group. Training on quality through the ISO certification.
WCo10	A broadening of the social responsibility aspect next to the eco-image. (Note: What will exactly change after the 50-50% joint venture with Libra Group?)	Technological know-how, business process know-how, customer and business relationships, reputation, organizational culture and values, brand recognition, hotels, new show rooms	*Not discussed*	Employees are the biggest investment for WCo10 and receive a number of benefits such as continuous training, recognition and reward of personal achievements (in the form of salary bonuses, promotions and gifts). Moreover, employees from Holland, Cyprus, Spain, Belgium and China are visiting Greece in order to be trained and to participate in all processes and improvement actions and to attend EFQM conferences! The head of the Human Resources Office keeps a file containing personnel training charts for each department and a Personnel Training Record. She makes different educational plans for each department according to its needs. She also tries to find innovative training programs. So, in collaboration with the creative team of the company, they prepare CD-ROMs including all the appropriate information. This method has a great success and it reinforces the employees' interest. Employees consider WCo10 as a learning institution. Technology

				acquisition and diffusion by developing partnerships referring to new technologies, training in new methods of production, storage and distribution of products, production and supply of raw materials, environmental protection, research programs, training and occupation programs for people with "special skills". The company's policy is to communicate "best practices" outside the organization through its co-operation with social and educational institutions and the exchange of knowledge and experiences on a theoretical and practical basis. There is also an introductory training in order to work for the firm; Candidates must succeed in 9 courses to work for WCo10. Courses refer to sustainability, the human anatomy, the firm's culture and its products.
FCo1	No real change to business model (2003)	Technological know-how, reputation, a new building (for new production lines)	No need	Working on new ideas or solving problems is a way for learning and internalizing new skills, including tacit ones. All workers are trained since production process is very demanding in terms of hygiene, sort-out and presentation of the product within its packing. Knowledge transfer and integration takes place mainly among suppliers and company or gained after try and error processes on totally new combinations (e.g. fruits with vanilla) - a result of CEO's cumulative experience combined with a natural talent to capture strange mixture tastes
FCo2	No real change to business model (2002)	Technological know-how	No need	The Es seek knowledge "*We still have to learn a lot .This can be knowledge on climate control or crop environmental requirements and IPM programs within greenhouses. It can be the use of IT in our plant or more modern methods of energy sufficiency –photovoltaic e.g. We have to constantly search for knowledge - nothing is static. We seek best practices too.*. Still, there is no knowledge diffusion to the personnel which is trained only to new skills or practical matters (e.g. I was shown a new packaging method). Quality control systems, objective definition of quality and accurately predicted harvest times are of great importance. The knowledge basis is continuously enriched since there is a deepening in the method and updating in technology.
FCo3	No real change to business model	Technological know-how	No need	Seminars mainly on quality matters. Loose ties with customers, equipment suppliers and experts seem to play some role, since they result in constant knowledge diffusion which in turn facilitates the improvement of methods and techniques, the increase of productivity by changing main processes, control intensification, the further plant modernization, the adaptation of innovative methods through the whole

				value chain (information, promotion, knowledge exchange through internet, energy saving, disease elimination etc), emergence of new ideas (e.g. on packaging) and products (start omelet), as well as technical solutions to automation.
FCo4	New business after **2011** regards "sugar-free products". FCo4 changed sales model, exports, branding and promotion. Today the firm presents 5 categories of products; bio, gluten-free, lactose free, sugar free and super-foods.	Technological know-how, business process know-how, customer and business relationships, reputation, brand recognition, new product lines	Promotion and marketing processes became more organized when exports started –super markets were approached too	There is an embedded culture of constant learning and experimenting, while know how is achieved by studying (various knowledge sources), cooperation with Institutions and efforts to contact research projects and try and error processes. However, there is no personnel training
FCo5	No real change to business model (2004)	An R&D-based spin off, technological know-how, business process know-how, reputation	Not discussed	A constant bidirectional knowledge flow of both embodied and disembodied knowledge through skilled personnel, training, plant and equipment designs and descriptions, consulting, mutual experimenting, machinery and equipment. Cooperation with the University facilitates knowledge diffusion and technology developments/ absorptive capacity that range from a thorough knowledge on the properties and potential of semolina and wheat to the use of biotechnology and food technology through training, individual studies and efforts, co-operations with clients and suppliers and the building of a strong research team devoted to the company's vision. Clinical research is today extended to cancer patients, athletes and other special categories.
FCo6	No real change to business model (2000)	N/A	Not discussed	FCo6 follows the mother company's processes. The main strategy is to become the experts on rice and pulses by deepening knowledge and research on these products (vision: the first to introduce all novelty in Greece and Balkans). The CEO characterized it as knowledge verticalization instead of a plateau of products under the brand of the company. Training programs on a regular basis for all levels (two for the whole personnel, three more advanced for the executives), followed by personal/individual training in Greece or abroad. They cover communication, management, psychology, etc. There are also short courses on technology and knowhow subjects for department heads and the technical personnel. The firm invests in process technologies, skilled staff and know-how, in order to improve efficiency and quality, raise productivity and enhance flexibility. The company has developed absorptive capacity ranging from a thorough knowledge on the properties and potential of rice and pulses, to the use of biotechnology

				(today) and food technology. Knowledge comes from training, individual studies and efforts, co-operations with clients and suppliers and the creation of a competent research team devoted to the company's vision. Aggressive technology transfer. Processes of connecting customer feedback with the production of new ideas. Training, technical consulting and checking the farmers' productions. Training of the production groups (each group consists of 7-8 producers) is vital since they have to engage new cultivation methods avoiding certain fertilizers or other chemical treatment.
FC7	Establishment of a purely innovative spin off in 2010 based on gourmet novelties in order to distinguish traditional dairy production from innovative gourmet one.	A spin-off, technological know-how, business process know-how, reputation, new building, new plant	No need	There is a culture of constant learning and experimenting, while know how is achieved by observation, information gathering, reverse engineering and try and error processes. The interview revealed a man with an acute skill of observation and knowledge pursuit in order to answer questions that emerge by the observation. Yet there are no embedded systems of training or knowledge diffusion. Employees share only the practical knowledge needed for the experiments and to judge the results.
FCo8	In 2004 firm entered the fresh juice market as well.	New product lines, technological know-how, reputation, brand recognition	Not discussed	High importance on knowledge management. Technology transfer at all levels. Most operators of the automized production lines are higher degree diploma holders. Regular personnel training. Special knowledge transfer programs for milk providers (courses on animal health run by the Vetinary Dpt of the University of Thessaly
FCo9	The company maintains its initial image as a health and wellness producer with high exports and aggressive NPD. Efforts to succeed in the Greek market.	reputation, brand recognition, Piraeus-TANEO Capital Fund	No changes	12 out of 18 employees are higher education diploma holders (5 with a PhD, 5 with an MSc and 2 with a University degree). R&D (in house and joint projects) on a constant basis. Educational culture towards customers, join forces with nutrition specialists, gastroenterologists etc. A constant osmosis of science, technical, technological and practical knowledge.
FCo10	No business model redesign; mainly enrichments and extensions	customer and business relationships: mainly new collaborations (e.g. Trikalinos for salt, KORRES, Cretan co-operatives etc), world reputation and brand recognition,	N/A	The general policy of FCo10 is knowledge diffusion among scientific and the rest personnel through training, informative workshops, shows and videos, partnerships in research projects and interaction with the scientific world. The company builds on knowledge regarding products, traditionalist, authedicity and environmental awareness for all and more specific matters as R&D for the scientific personnel, culinary knowledge for recipes (even a book publication of 5 famous chefs based on FCo10's products), market issues for the relative Dpt. Promoting the culture of constant education on Greek traditional products, FCo10 establishes cooking schools, Omega 3 and cooperation with Chefs & nutritionists. (Note: as recognition to FCo10's overall

				work in promoting real excellence in the olive oil world, FCo10's founder & C.E.O. was proclaimed visiting Academic at "Academia dei Georgofili", the oldest Agricultural University in Europe, Florence Italy).
TCo1	No real change to business model	Technological know-how	No changes	Knowledge and information diffusion meetings among the members. Technology transfer to the executives. Experimenting (mainly try-and-error processes)
TCo2	After KIE (2004) there are enrichments (e.g. more high-tech products) and a wider range of clientele	Technological know-how, business process know-how, customer and business relationships, reputation, brand recognition	Not discussed	The company has developed specific processes to manage the required and offered knowledge by all sources. It further supports and organizes personnel training. Arising ideas not in the planned portfolio are kept on the self for future use. Experimenting and learning are very important. Organizational learning. Usually time to market is long (5-6 years) for a company of the textiles sector. There is also knowledge and experience gained by the co-operations and interactions with Research Institutes and other technology companies within research projects.
TCo3	No real change to business model	Technological know-how	No changes	Although there is too much of knowledge generated inside the firm regarding both to treatment and energy production, the main knowledge management seems to be directed by the two companies of the Es. Knowledge exchange only among executives
TCo4	Partial verticalization from yarn to final cloths (creation of own clothing company and partner of a big underwear company) The workers took full responsibility for production (sharing expenses and revenues) of the knitting plant; it was a form of collaboration between the entrepreneur and the workers.	GD Alliances, subsidiaries and affiliates. Asset specificity is important in terms of innovating. Technological know-how, business process know-how, customer and business relationships, reputation, new product lines	Some processes changed due to the new production model (with the workers)	A continuous investment on technology. After customer's requests, two patents (high value added 18 Euros/kg today 8Euros/kg). Training mainly on technical and quality subjects- as well as health and safety issues. Know how is mainly achieved by established suppliers. A more aggressive information gathering refers to fashion trends. Meetings with customers' designs, collaborations with European designers and frequent visits abroad (mainly the fashion weeks in the four fashion capitals of the world). Know how is achieved also by plant equipment. Knowledge is restricted to certain areas (especially treatment - dyeing processes) supported by the knowledge of specialist suppliers. Regarding quality assurance as a competitive advantage, an excellent quality control laboratory at European level contacts pilot tests and studies on fabric properties such as twist and oblique garments and adds to knowledge in an out-of-the door, more general sense. *"We are interested in knowledge on knowhow as well as a more spherical perception of our products and their behavior up to the final fashion product".*
TCo5	No other changes mentioned	business process know-how, customer and business relationships, reputation, brand recognition	No further changes to processes mentioned	Constant training mainly on fashion issues, sales and merchandising. Management team collects knowledge by strategic management and operations management seminars and cooperation with Universities and

				exploits knowledge and info gained this way. TCo5's policy towards constant restructuring in order to capture value creates a cycle of knowledge acquisition and diffusion. Franchisees are trained to open a shop 2 weeks before and at regular intervals. The firm has sponsored and co-organized the 6th sectoral conference inviting Dr Antonio Catalani. professor of Strategic and Business Management of SDA-Bocconi University
TCo6	no	Subsidiaries, technological know-how, business process know-how, reputation,	N/A	Know how is achieved mainly by plant equipment and supplier know-how but there is always the internal R&D. Knowledge is restricted to certain areas of ginning-spinning supported by the knowledge of specialist suppliers. Appropriability is not required. Quality assurance as a competitive advantage: an excellent quality control laboratory at European level. Training courses at all levels even when times are quite difficult.
TCo7	no	Purchase of an Italian brand in order to acquire the "made in Italy" advantage. Technological know-how, customer and business relationships, reputation, brand recognition	N/A	Technical and practical knowledge and knowhow is achieved mainly by plant equipment and supplier know-how but there are always the internal try and error processes. Fashion knowhow is gained by trade shows and the designers. Knowledge refers to the whole value chain of youth clothing with emphasis on denim. Appropriability is not required in the formal way but gained through confidence and family culture. Design, quality and denim treatment technology are the strong competitive advantages. Although training is not a policy, people are trained when new systems are adopted (e.g. in the case of RFID technology).
TCo8	2001-2002 subsidiary in Romania (new installations) 2003 joint venture for lingerie production 2004 new joint-venture (production unit)	The new acquisitions, reputation, brand recognition, new product lines	A constant reformation of processes mainly regarding production and sales to find best practice in order to satisfy the demand for a significant amount of codes and on the other side, the small Greek market. New processes and routines in the new acquisitions	A significant focus on knowledge management throughout companies functions. A constant training and knowledge collection at all levels and all Dpts; a variety of courses. Appropriability although asked for, the very first years of the big change (a certain amount was devoted for rights) was shortly abandoned since there was no practical reason for such costs. Knowledge and technology transfer through cooperation with suppliers and designers. The company invests on experimenting and diffusing new knowledge. Practical and technical knowledge comes from new technology acquired (although the group had decided not to invest heavily on new technology).
TCo9	No further changes	Technological know-how, business process know-how, customer and business relationships, reputation, brand recognition	N/A	Knowledge management is evident through knowledge seeking and diffusion at meetings, try and error processes, equipment, supplier and customer requirements and research. Emphasis is given to developing the knowledge and skills of the company's manpower. Part of the yearly budget goes towards training and education at all levels of the

				workforce, such as: Participation of executives in post-graduate programs. Foreign language learning for managers. Educational programs on technical issues, information systems, finance, accounting, management, health and safety. Continuous improvement of working conditions. Company turns to latest technology and science such as nanotechnologies.
TCo10	New efforts to enlarge business boundaries (male clothes shoes and accessories)	Mainly reputation and recognition,	N/A	Knowledge turns around design and fashion. Besides the E. - designer, there are certain skills required such as excellent sewing for the relevant Dpt and marketing / sales competencies for the show room and order undertaking. There is some weakness regarding personnel training although there is an introductory training short course for newcomers.

APPEDINX B

PERFORMANCE TABLES AND FIGURES

Diagram B1a: Sales of the 5 first years after W&F KIE (all companies)

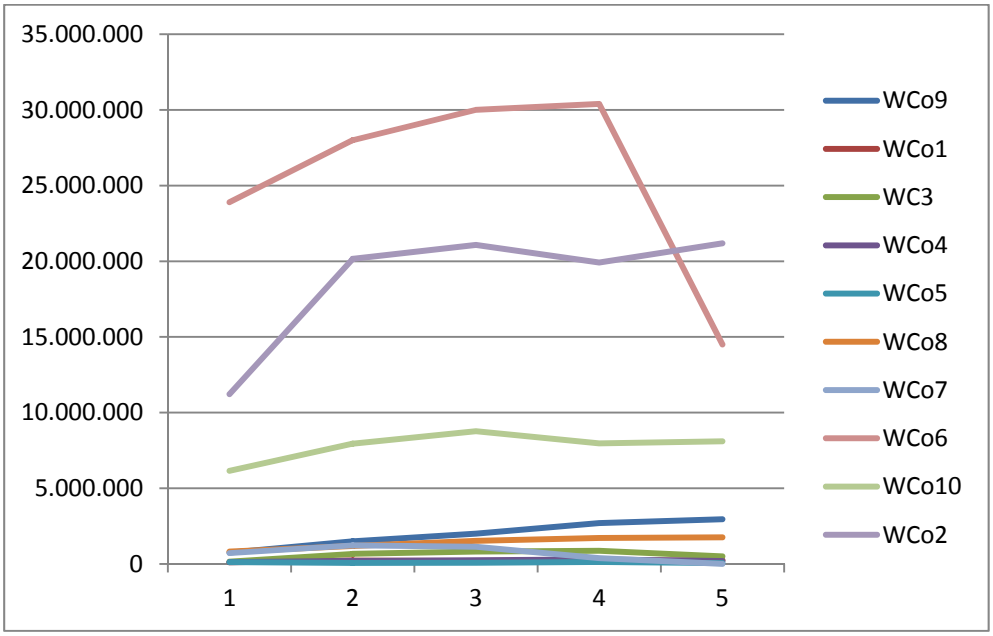


Diagram B1b: Sales of the 5 first years after W&F KIE (companies with sales up to 5.000.000)

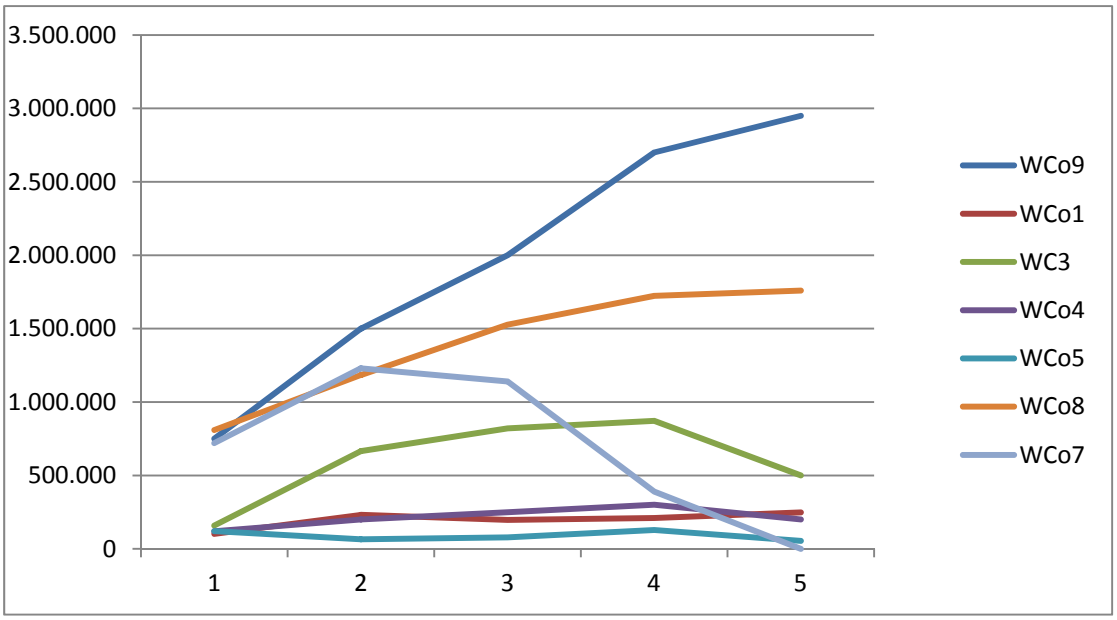


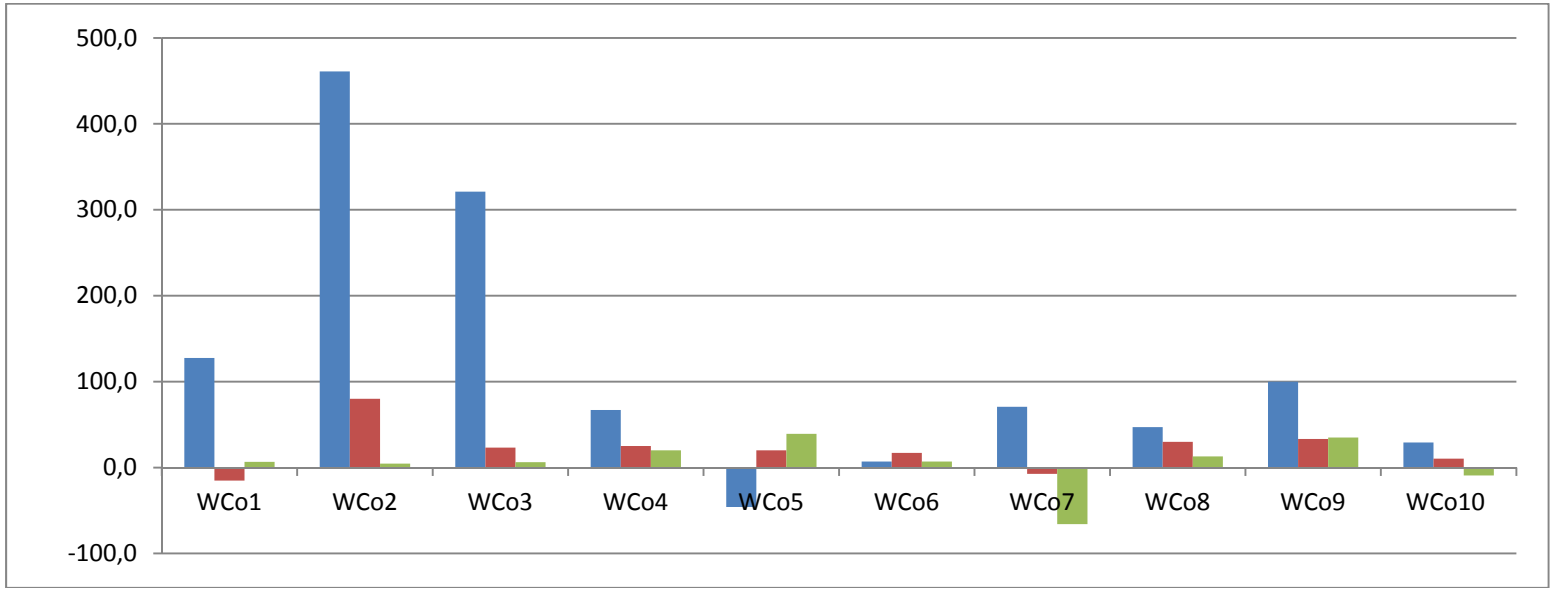
Table B2: Financial data in Euros for the W&F cases; first 4 years of KIE

	WCo1	WCo2	WCo3	WCo4	WCo5	WCo6	WCo7	WCo8	WCo9	WCo10
Investment amount	800.000	70.000.000	3.600.000	2.500.000	380.000	2.500.000	1.500.000	5.000.000	5.000.000	N/A
Sum of 4 first year sales	741.000	72.367.358	2.517.040	87-.530	391.400	112.300.000	3.480.000	5,244,200	6.950.000	30,849.537
CAGR (%)	27	21	77	36	2	8	-18	29	53	9

Table B3: Annual sales rates of the W&F cases

Year	WCo1	WCo2	WCo3	WCo4	WCo5	WCo6	WCo7	WCo8	WCo9	WCo10
1999										29,1
2000										10,33
2001										-9,17
2002								47		1,6
2003								30		3,2
2004								13		-0,09
2005					-46	7		2		-2,1
2006		461			20	17		20		33,4
2007		80		67	40	7		15		44,8
2008		4,5	321	25	-58	1		15		5,1
2009	127,5	-5,5	23	20	55,5	-24		-33,5	100	1,3
2010	-15	2	6	12	-0,5	-6	70,8	-23	33	0,05
2011	6,5	7	-20	-11	*closure*	-3	-7,3	-11	35	1,7
2012	18	-18	1	5,5		-28,5	-65,8	-40	*closure*	2,5
2013	23	-31	-21	-1		7,5				

Diagram B2: Annual sales rates of the three first KIE years; W&F cases



Blue: 1st KIE year
Red: 2nd KIE year
Green: 3rd KIE year

Diagram B3a: Mean annual sales rates of the three first KIE years; all W&F cases

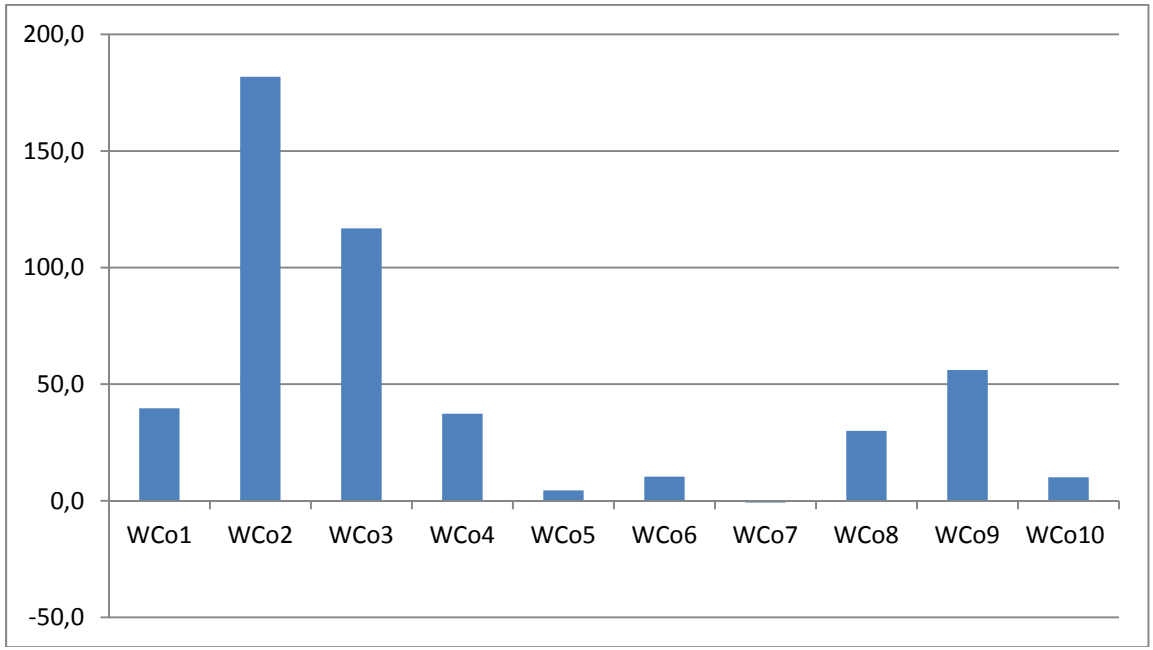


Diagram B3b: Mean annual sales rates of the three first KIE years; excluding WCo2, WCo3 and WCo9 cases

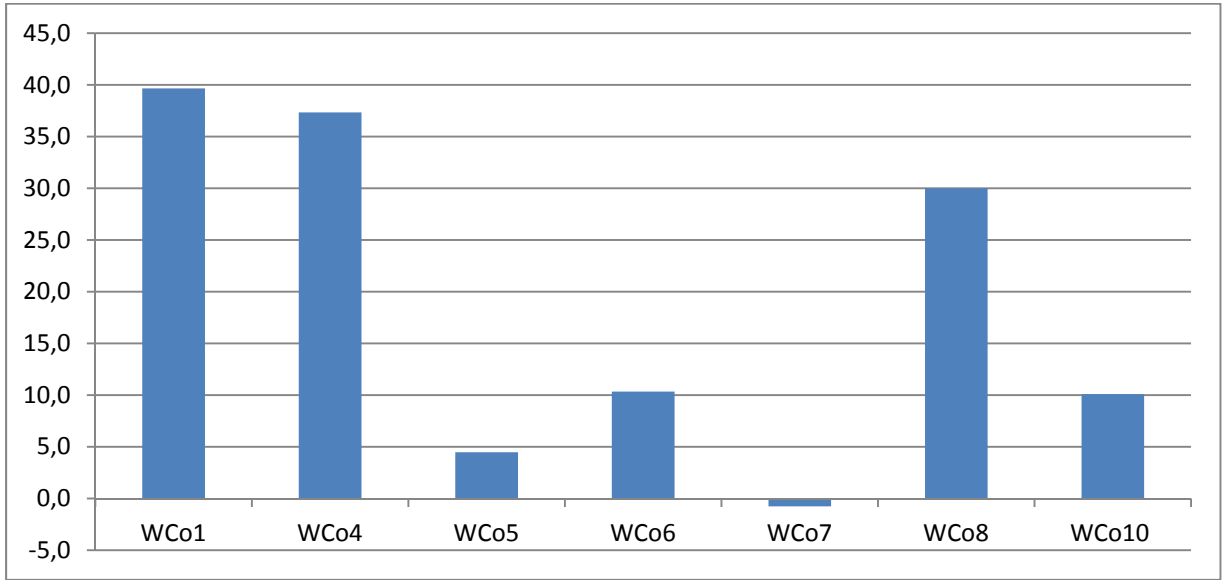


Table B4: Innovation measured in number of innovative movements; W&F cases

	WCo1	WCo2	WCo3	WCo4	WCo5	WCo6	WCo7	WCo8	WCo9	WCo10
NOVEL PRODUCT	1 main -uniform veneers later 1 as the parquet sheet	2	design novelties	3	1	3	1	design novelties	1	many
NOVEL PROCESS	3-veneer processing with paper backing and stitching , straight veneer sheet with end trim	2		2	1			1	1	yes
Novel machinery	1			1				many		
Bought new technology and further developed	1	1		1	1	1η (2005)	1	1	1	yes
novel concept				1				2		many
models			yes2 (clustering /modurarizat)							yes
Design	2		yes	1				1/year		yes
use of novel materials	2		yes					yes (2 pioneer)		yes
R&D				YES					YES	YES
Improvements of initial innovation	*yes*	*yes*	*no*	*yes*	*yes*	*yes*	*no*	*yes*	*yes*	*yes*
market innovation or pioneering	*yes*			*yes*						*many*
mean FREQUENCY	1/year	1/year	0	1/year	0	1/year	0	many/year	1/year	many/year

TYPE	Process/ material	Process/ NPD	model	Process / technology / NPD	Process / NPD	process	Process technology	Process technology / machine	Novel technology / NPD	Model, technology, products
COMPETITORS	Imports / one	imports	many	None for the innovative products	imports	One or two	4 in the next 4 years	many	imports	At global level
patents	no	yes	no	yes	no	no	no	no	no	no
Co-operations with institutes	yes	yes	yes	yes	yes	no	no	no	no	yes

Table B5a: Time to market in years for the W&F cases

	WCo1	**WCo2**	**WCo3**	**WCo4**	**WCo5**	**WCo6**	**WCo7**	**WCo8**	**WCo9**	**WCo10**
Time to market	1,5	2,5	1	3	3,5	1	2,5	2,5	1,5	1

Table B5b: Time to market in years for the F&B cases

	FCo1	**FCo2**	**FCo3**	**FCo4**	**FCo5**	**FCo6**	**FCo7**	**FCo8**	**FCo9**	**FCo10**
Time to market	2	2	1	1	3	4	3	2	2	3

Table B5c: Time to market in years for the T&C cases

	TCo1	**TCo2**	**TCo3**	**TCo4**	**TCo5**	**TCo6**	**TCo7**	**TCo8**	**TCo9**	**TCo10**
Time to market	1	5	2	5	2	3	3	3	3	N/A

Diagram B4a: Sales of the 5 first years after F&B KIE (all companies)

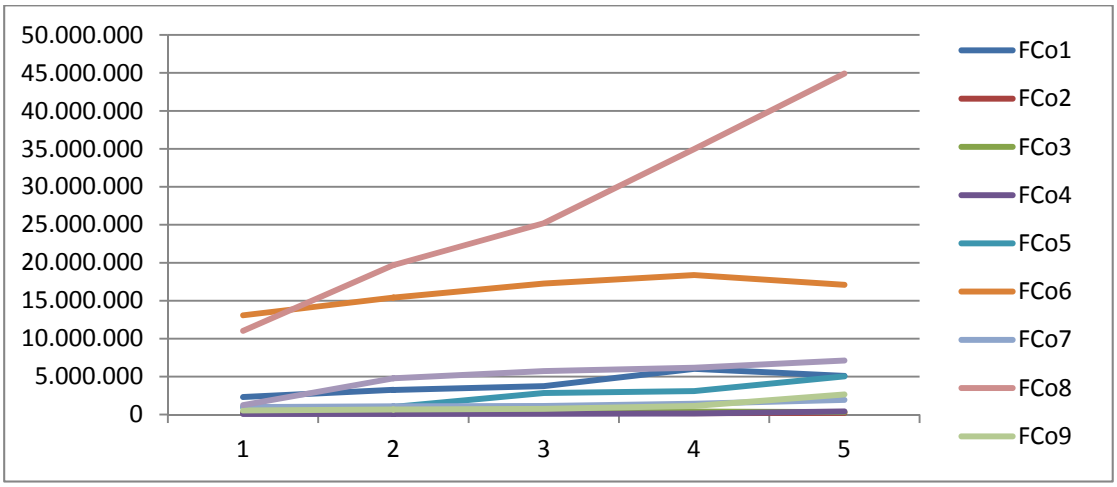


Diagram B4b: Sales of the 5 first years after F&B KIE (companies with sales up to 6.000.000)

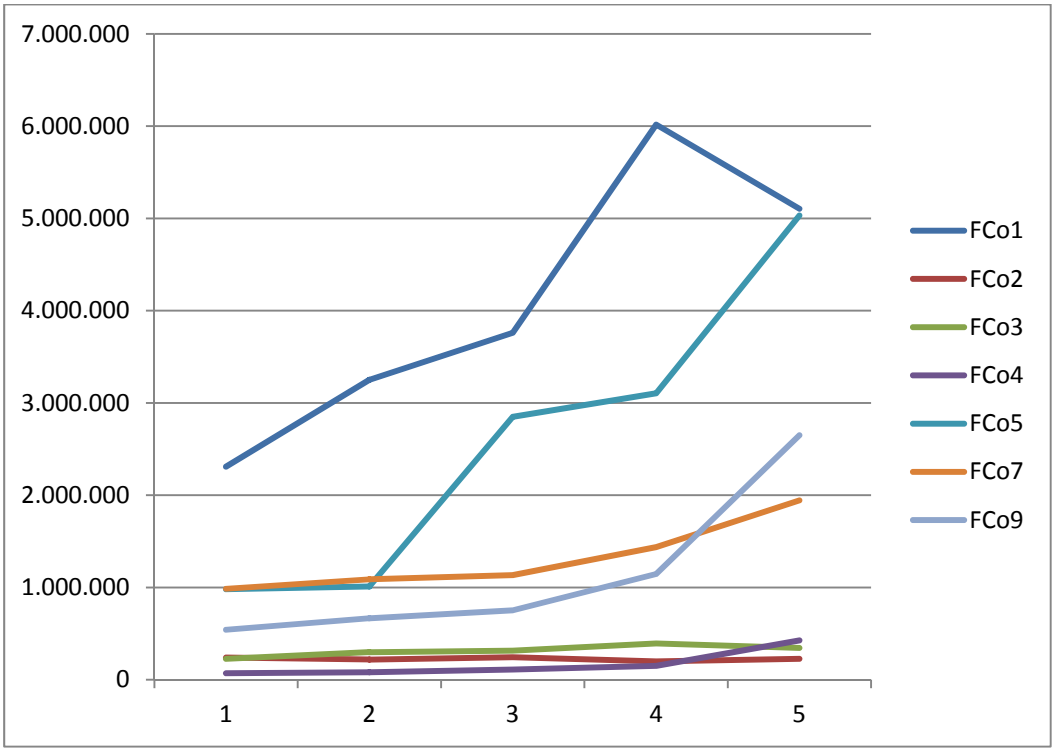


Diagram B4c: Sales of the 5 first years after F&B KIE (companies with sales up to 1.200.000)

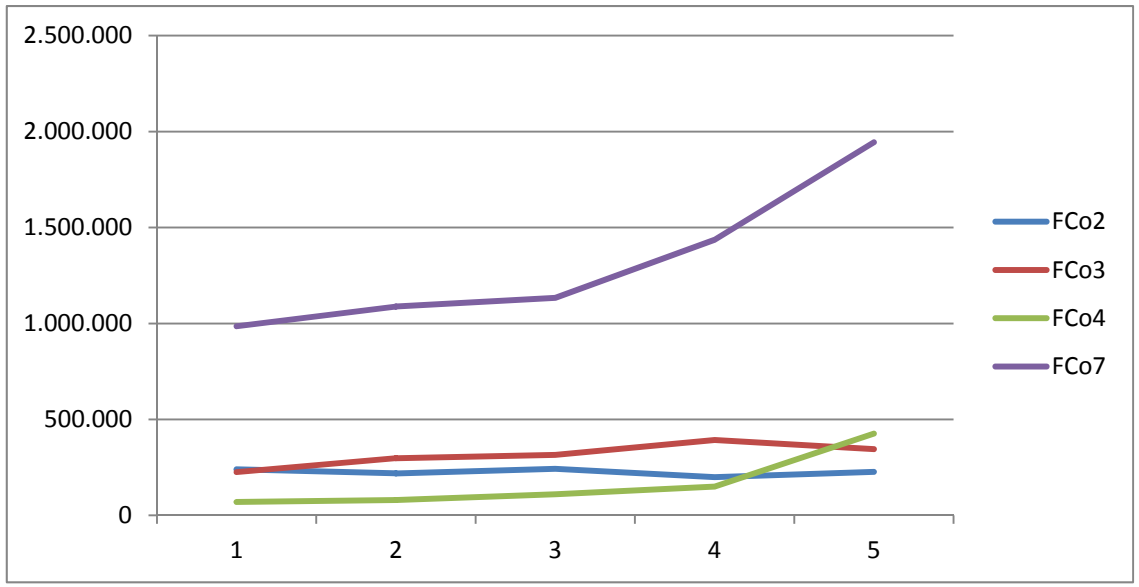


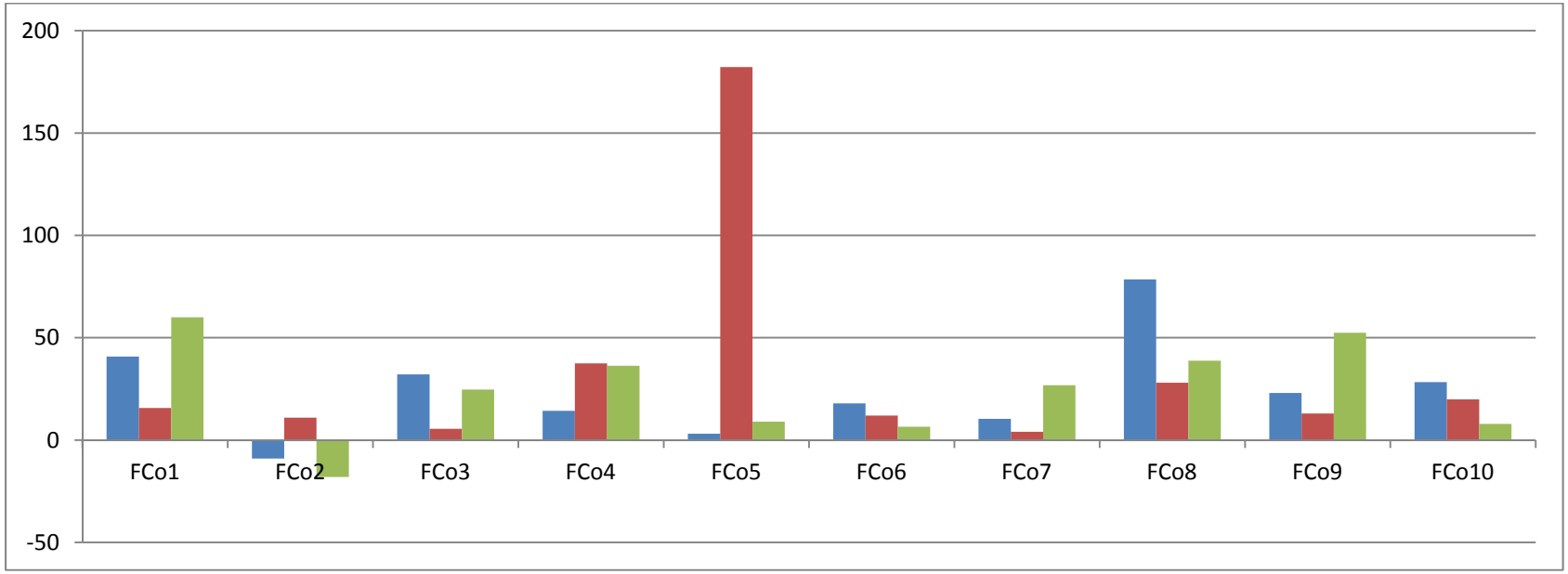
Table B6: Financial data in Euros for the F&B cases; first 5 years of KIE

	FCo1	FCo2	FCo3	FCo4	FCo5	FCo6	FCo7	FCo8	FCo9	FCo10
Investment amount	3400000	1200000		400000	5000000		500000	18000000	5000000	4000000
Sum of 4 first year sales	15.337.450	900.806	1.231.500	410000	7.945.200	64.100.240	4.643.218	90.885.732	3.105.815	17.921.558
CAGR (%)	38	9,4	20	29	47	12	13	47	28	71

Table B7: Annual sales rates of the F&B cases

Year	FCo1	FCo2	FCo3	FCo4	FCo5	FCo6	FCo7	FCo8	FCo9	FCo10
1999						6				
2000			165,5			8,5				
2001			32			18		78,5		28,5
2002			5,5			12		28		20
2003			25			6,5		38,8		8
2004			-12	14,5	3	-7	10,5	28,5		15,5
2005	41		-19,5	37,5	182	3,5	4	25,5		15
2006	16	-9	24	36,5	9	11	27	57,5		7,5
2007	60	11	6,4	184	62	22	35,5	0,5		14
2008	-15	-18	21,4	3	51	23	28,5	20,5		-1,5
2009	-1,5	13,5	16	-1,5	-9,5	6,5	10	5,5	23	1,5
2010	2	3	19,5	4	-9	-6	19	12,5	13	10,5
2011	10	-12	-43	7,5	21	31,5	11	11	52,5	3
2012	37	-25	43	16	48	-8	0	7	131	-8
2013	-22	17	-6	9,5	13	-5	12	-1,5	59	16,5

Diagram B5: Annual sales rates of the three first KIE years; F&B cases



Blue: 1st KIE year
Red: 2nd KIE year
Green: 3rd KIE year

Diagram B6: Mean annual sales rates of the three first KIE years; all W&F cases

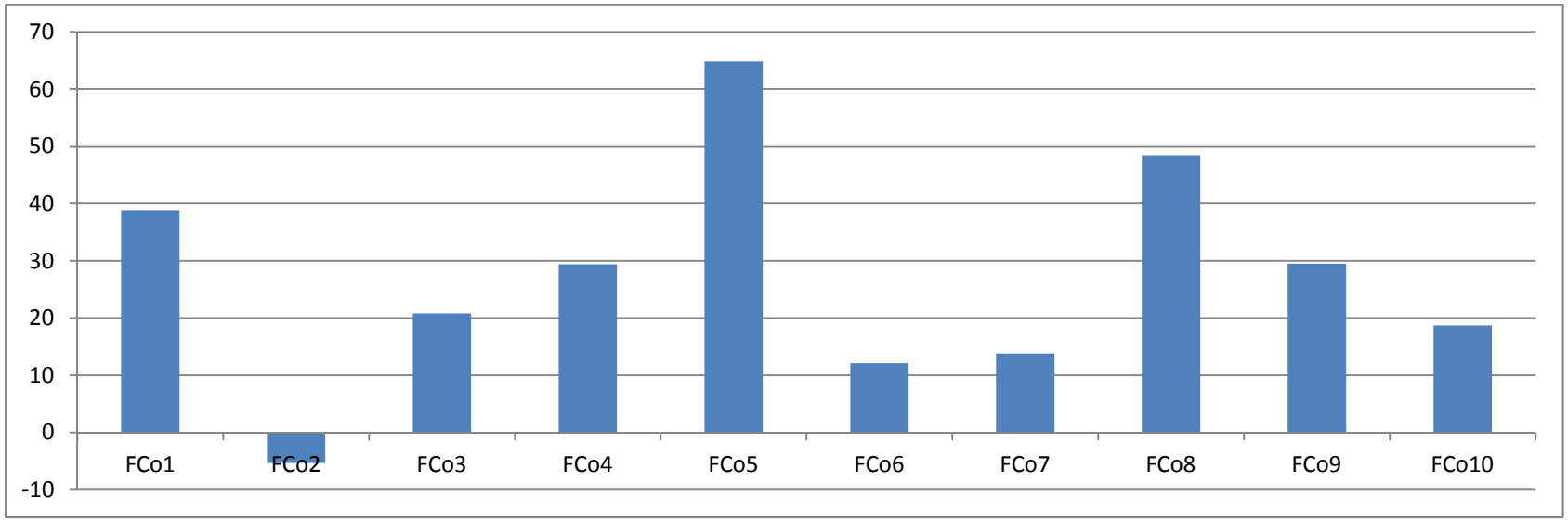


Table B8: Innovation measured in number of innovative movements; F&B cases

	FCo1	FCo2	FCo3	FCo4	FCo5	FCo6	FCo7	FCo8	FCo9	FCo10
NOVEL PRODUCT	yes		yes	yes	many	many	many	many	many	yes -NPD
NOVEL PROCESS	yes	yes (hydroponics)	yes*	yes	many*	YES	YES	YES	YES	yes mostly
Novel machinery	yes			yes	yes	YES	yes	yes (bought)	yes (codeveloped)	yes
Bought newTECHNOLOGY and further developed	yes	yes	yes		yes	YES		YES	yes (from general use to specific one)	no
novel concept	yes			yes (quasi-pharmaceutical)	yes (intro of biofunctional)			YES (*SELECTED MILK*)		yes (neutral oil/olives) meze
models								all production lines run by higher education graduates		yes (marketing,
Design	yes (package)	yes(package)		yes(package)	yes(package)	yes(package)	yes(package)	Yes (package)	yes(package)	yes(package)
use of novel materials				yes						
R&D	NPD		NPD	NPD	yes+clinical research	YES - RICH	YES / PLUS NPD	YES+NPD	YES+NPD	YES+NPD
Improvements of initial innovation	yes			yes	yes (intro of biofunctional)	yes	YES (used as a basis for NPD)	YES	YES (the first would break easily)	yes

market innovation or pioneering	pioneer globally with many followers	pioneer in Greece	pioneer in Greece	innovative in certain dimensions	world class innovation/patents	pioneer	pioneer	pioneer	αναβάθμιση της συσκευασίας και του branding.	yes (meze)
NEW spin-off (not existing in wood)					yes		yes			
Value proposition innovation	yes	yes energy saving/health		yes health	yes	yes	yes	yes	yes	yes water save carbon neutral
mean FREQUENCY										
*** in food industry novel products are tightly connected to their production processes**										
TYPE	**NPD intensive**	**process**	**NPD**	**NPD**	**R&D intensive**	**R&D - technology**	**NPD**	**technology**	**NPD**	**Model - process**
COMPETITORS	(2015) many – pioneer /opened the niche market	(2015) many – pioneer /opened the niche market	2 Greek (national level)/ pioneer in Greece	Imports and one Greek competitor	IMPORTS (similar at some products) none at patented	2-3 global companies	None	3-4 Greek companies	None yet	Now many / pioneer for the niche market
patents	no	no	no	no	yes	yes	yes	yes	yes	no
Co-operations with institutes	no	yes	yes	yes	yes	yes	no	yes	yes	yes

Diagram B7a: Sales of the 5 first years after T&C KIE (all companies except TCo10)

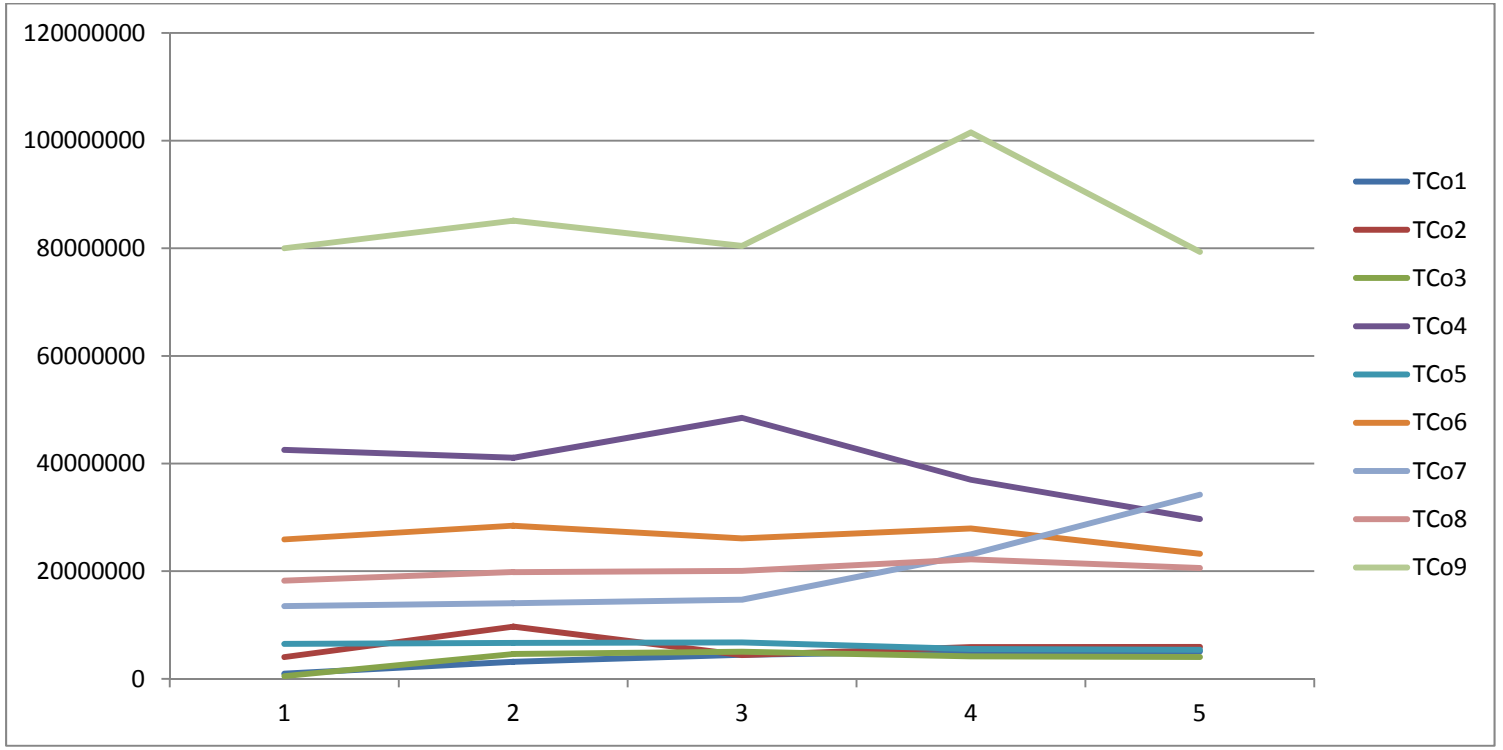


Diagram B7b: Sales of the 5 first years after T&C KIE (companies with sales up to 25000000 Euros)

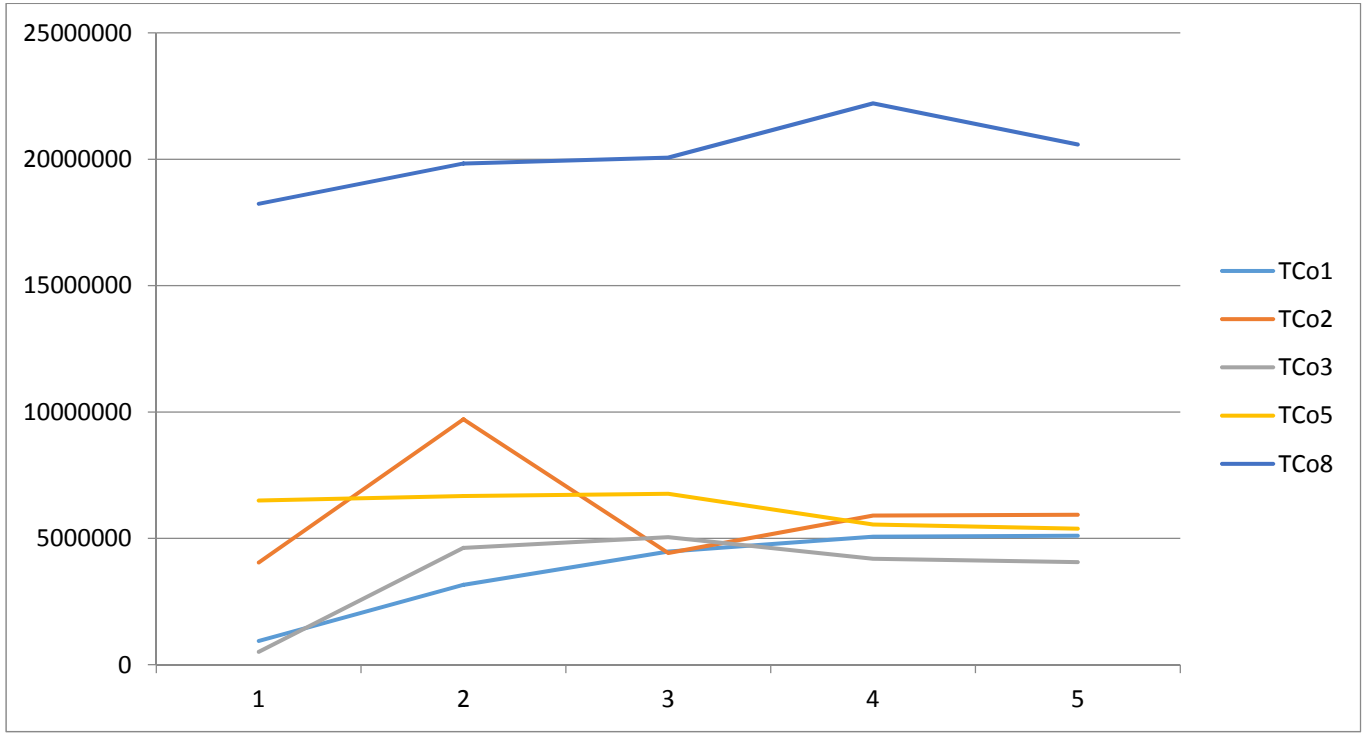


Table B9: Financial data in Euros for the T&C cases; first 4 years of KIE

	TCo1	TCo2	TCo3	TCo4	TCo5	TCo6	TCo7	TCo8	TCo9	TCo10
Investment amount	8.000.000	N/A	2.00.0.000	N/A	>600.000	30.000.000	2.200.000	N/A	600.000 (R&D) 60.000.000	300.000
Sum of 4 first year sales	3411472	6017586	3592238	42267500	6370500	27098500	16338975	20085050	86763500	N/A
CAGR (%)	75,35	13,4	102,2	-4,5	-5,10	2,6	19,7	6,8	8,3	22

Table B10: Annual sales rates of the T&C cases

Year	TCo1	TCo2	TCo3	TCo4	TCo5	TCo6	TCo7	TCo8	TCo9	TCo10
1998		*1ST KIE:* 9,7						-0,8	8,5	
1999		10,4		17,1				0,1	12,9	
2000		25,4		36				3,2	27	
2001	236,2	-20,2		3,3			23,8	8,9	21,2	
2002	136,5	-39,7		2,4		-1,5	4,1	8,7	6,4	
2003	13,2	-13,9		7,2		16,5	4,6	1,2	5,5	15
2004	1	*2nd KIE:* 140,2		11,9		-2,4	57	10,7	26,2	15
2005	0	-54,5		-3,4		8,6	48	-7,3	-21,9	15
2006	0,8	33,5		18,1		9,9	0,2	9,4	-12,1	15
2007	-13	6	8,12	-23,8	2,6	-8,2	2,2	11,1	8,3	15
2008	-11,4	62,9	9,2	-19,7	2,7	7,1	-5,8	1	-13,4	15
2009	-4,5	-29,3	-16,9	-24,7	1,4	-16,9	-8,9	-11,5	-1,6	15
2010	-2	-25,2	-3,1	6,3	-18	14,8	-6,6	-23,1	-11,2	10

2011	-17,3	-17,4	1,4	-7,6	-2,9	-19,4	-1,1	-13,4	-24,3	10
2012	-94	39,2	-26,3	-9,6	-15,4	-13,2	11,7	-23,8	-26%	N/A
2013	*Merger with mother company*	17,3	43	27,3	N/A	16,7	-9,4	-9	9,84	N/A

Diagram B8: Annual sales rates of the three first KIE years; T&C cases

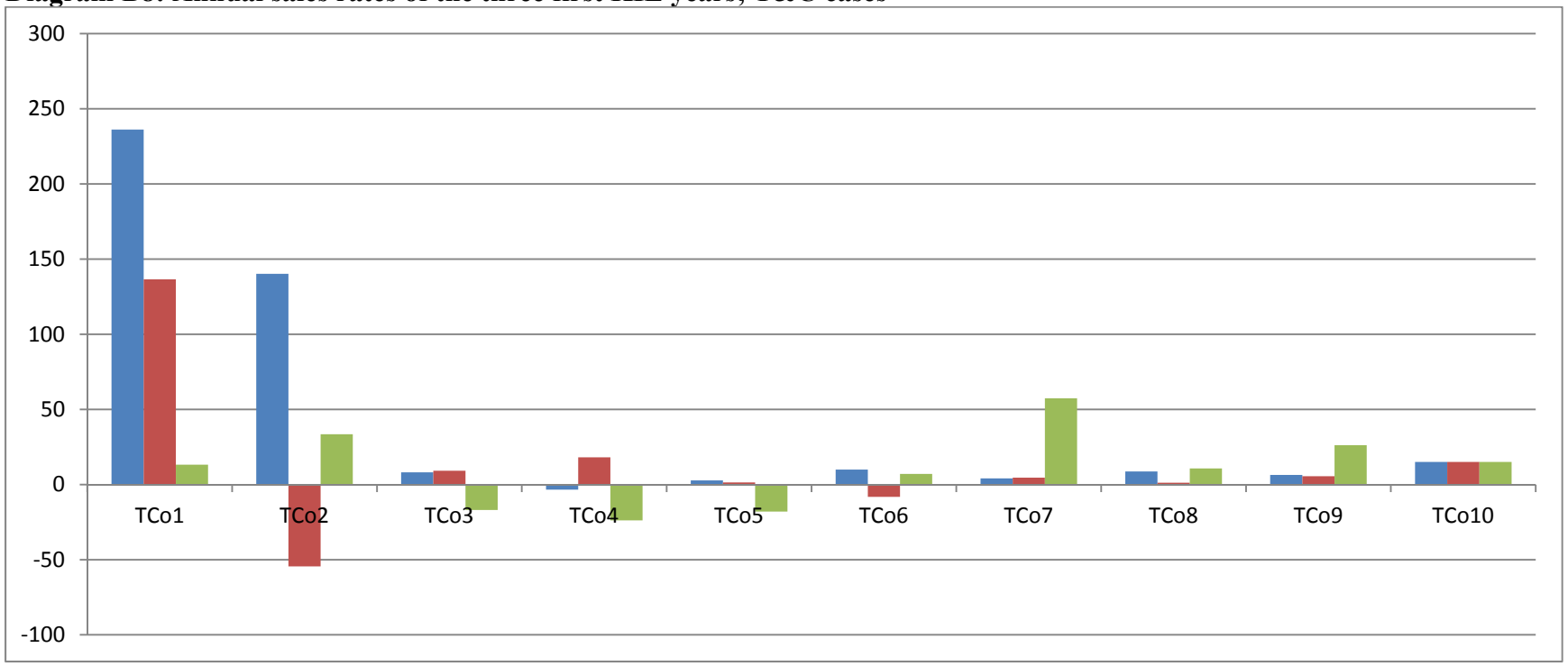
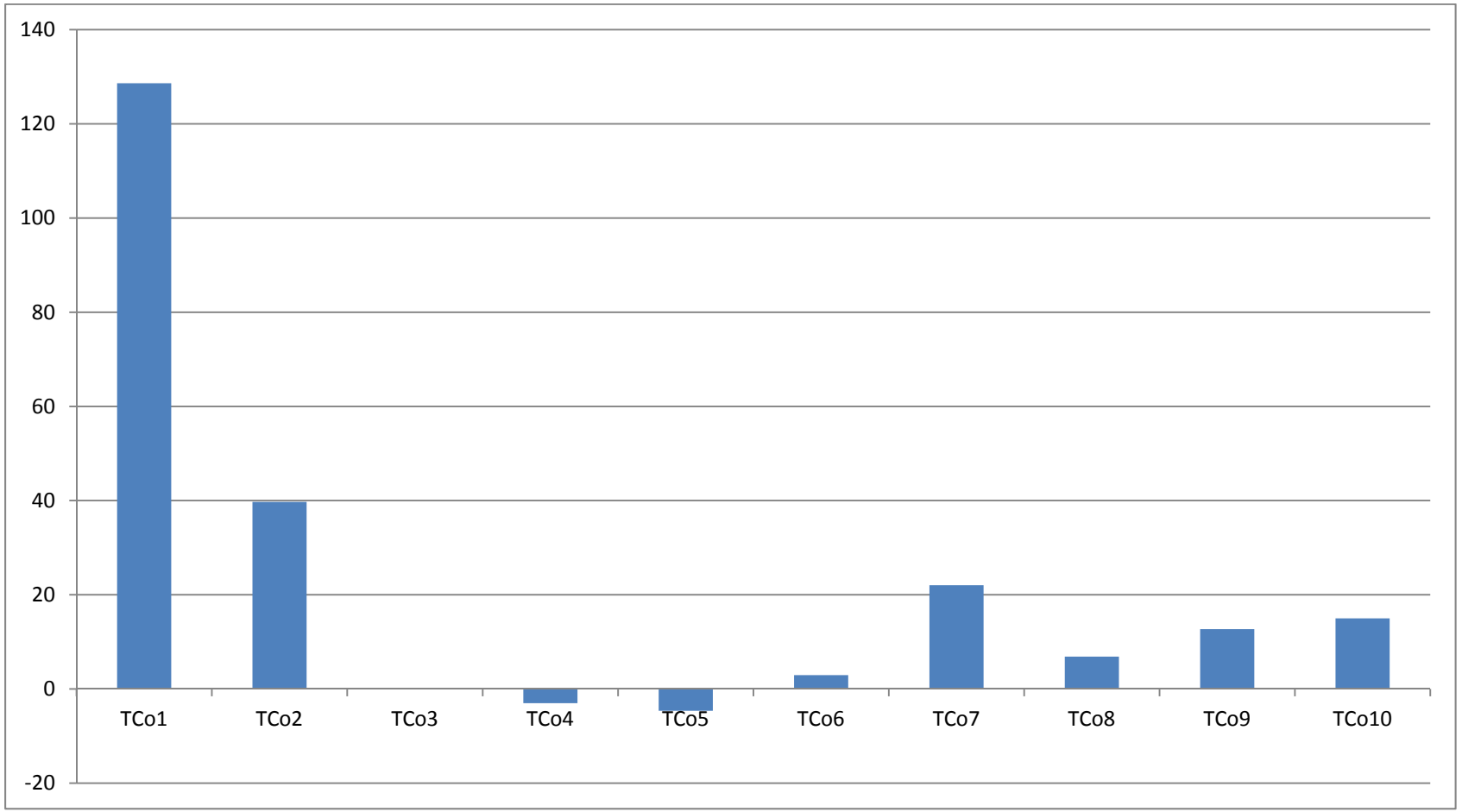


Diagram B9: Mean annual sales rates of the three first KIE years; all T&C cases



TCo3: 0,14%

Table B11: Innovation measured in number of innovative movements; T&C cases

	TCo1	TCo2	TCo3	TCo4	TCo5	TCo6	TCo7	TCo8	TCo9	TCo10
Novel product		yes	yes	yes		yes	YES (in design/ technology)		yes	
Novel process	yes		yes	yes		yes	YES (in design)		yes	
Novel machinery	yes			yes	yes	yes				
Bought new technology and further developed	yes		yes	yes		yes	yes			
novel concept			yes		yes					yes (designer/entrepreneur)
models					yes			yes	yes-mass customization	
Design (fast fashion)		partly	yes		yes		yes	yes	yes	yes
use of novel materials	yes	yes		yes		yes	yes	yes	yes	
R&D	yes	yes	yes	yes		yes		YES (2,3% 2011) corresponding to medium-low	yes	

Improvements of initial innovation	yes					yes	yes	yes		
market innovation or pioneering		yes	yes		yes	yes	yes (in Greece)			
NEW spin-off)							yes			
Value proposition innovation										
MEAN FREQUENCY	1/year	every year	occasionaly	yes	design	yes	yes	design	yes	design
TYPE	Technology (internal-external)	products	technology /fashion	technology	model	technology/ product	design	design/new model	model - technology	fashion design
COMPETITORS	NO DIRECT	not in Greece	no direct in Greece, very few in Europe	yes globally	yes many (various models)	some in Europe	yes (global)	YES	Italy, Turkey	yes
patents		yes		yes / 2					yes / 2	
cooperations with institutes	NO	PARTIAL	PARTIAL (ENERGY)	NO	YES	no	yes (Italy, project)	NO		NO
									yes /Gandi other research projects	

Table B12 (a,b,c): Rating of cases regarding competitive advantage and innovativeness according to the author's opinion

Table B12a: W&F cases rating regarding competitive advantage and innovativeness

Rate	strong initial competitive advantage	all existing life	Reputational enhancement	
	Change ecosystem	Innovativeness	Keep sustainability	
			fame (brand name)	trend (increasing /decreasing)
1	WC10	WC10	WC10	WC10
2	WCo2	WCo2	WCo2	WCo2
3	WCo9	WCo8	WCo9	WCo9
4	WCo8	WCo4	WC6	WCo6
5	WCo6	WCo1	WCo8	WCo8
6	WCo1	WCo6	WCo1	WCo1
7	WCo7	WCo9	WCo4	WCo4
8	WCo4	WCo3	WCo3	WCo7
9	WCo5	WCo5	WCo5	WCo5
10	WCo3	WCo7	WCo7	WCo3

Scale 1-10: 1: the strongest, 10: the weakest (1 to 10 applies for all three sectors)

Table B12b: F&B cases rating regarding competitive advantage and innovativeness

Rate	strong initial advantage	all existing life	Reputational enhancement	
	Change ecosystem	Innovativeness	Keep sustainability	
			fame (brand name)	trend (increasing/decreasing)
1	FCo5	FCo5	FCo5	FCo5
1			FCo9	FCo9
1			FCo10	FCo10
1		FCo6	FCo6	FCo6
1			FCo8	FCo8
1	FCo9		FCo1	FCo1
2	FCo1			FCo7
2				FCo4
3	FCo10	FCo9		
3		FCo1		
3		FCo7	FCo7	
3		FCo10	FCo4	
4	FCo4	FCo4		
4	FCo6			
4	FCo8	FCo8		FCo2
4	FCo7			
4	FCo2	FCo2	FCo2	
5	FCo3	FCo3	FCo3	FCo3

Scale 1-10: 1: the strongest, 10: the weakest (1 to 10 applies for all three sectors)

Table B12c: T&C cases rating regarding competitive advantage and innovativeness

RATE	strong initial advantage	all existing life	Reputational enhancement	
	Change ecosystem	innovativeness	**Keep sustainability**	
			fame (brand name)	**trend (increasing/decreasing)**
1	TCo2	TCo2	TCo2	TCo2
1	TCo7		TCo7	TCo7
1		TCo6	TCo6	TCo6
1		TCo9	TCo9	TCo9
2		TCo4		
2		TCo7		
3	TCo6			
3	TCo3 *mainly at national level*			
4	TCo10	TCo10	TCo10	TCo10
4	TCo1	TCo1	TCo1	TCo1
5		TCo3	TCo3	TCo3
5		TCo5	TCo4	TCo4
6	TCo9	TCo8		
7			TCo5	TCo5
8			TCo8	TCo8
9	TCo4			
9	TCo8			
10	TCo5			

Scale 1-10: 1: the strongest, 10: the weakest (1 to 10 applies for all three sectors)

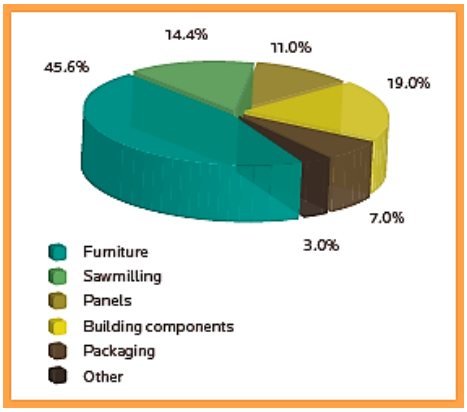
APPENDIX C

C1. WOOD AND FURNITURE SECTOR

Industry structure and markets in Europe

The woodworking and furniture industries constitute two vital, sustainable, innovative and eco-compatible sectors with a turnover in 2008 of around EUR 221 billion and an employment rate of 2.4 million people in more than 365 000 companies, the vast majority of which are SMEs. The *furniture industry* accounts for nearly half of this turnover, followed by the production of construction elements (19.3%), sawmilling (13.9%) and panel production (9.2%). The general financial and economic crisis has had a major impact on the entire industry; turnover decreased by more than 20% between 2008 and 2009.

Figure C1: Share of most important wood-bases production in 2010



The ***European woodworking sector*** comprises of 184000 companies which are in their majority SMEs with the exception of the wood-based panel sub-sector and a handful of sawmills that are large enterprises. In 2010-11, the woodworking industries employed 1.093 million people and had a turnover of EUR 122 billion and an added value of EUR 31.2 billion. The crisis of 2008 had caused some damage to the industry as evident if we compare this date with the relevant ones of 2006; In 2006 the woodworking industries had a turnover of €134 billion and an added value of €37.2 billion, employing 1.27 million people in 197,000 firms. The woodworking sector features among the three top industries in Austria, Finland, Portugal and Sweden. It should be mentioned that there are also many more full-time and part-time jobs in micro-enterprises, which are not counted in the official statistics.

Sustainability, product development, resource availability, multiple forest use, biodiversity, the production of bio-energy and energy efficiency are key issues in the sector. Increased investments in research and technology development (RTD) and innovative use of technical

and commercial know-how are necessary elements for enhancing the competitiveness of the forest-based industries.

Besides sawmills and furniture, ***wood-based panels*** constitute the third major product category in Europe, with an overall production of 51.1 million m³ (2011): particleboards cover the 60% of production followed by MDF (23%). OSB, plywood and hard/soft board count for a percentage around 5%

Furniture manufacturing is described as a dynamic industry, with its success factors lying in the "creative capacity of combining raw materials and technology in order to meet the demand emerging from the markets and to satisfy consumers' needs" (Renta et al., 2014). European manufacturers contest at the global level, mainly with design and innovation as competitive advantages. Since 2004 the sector faces growing competition from low-cost, emerging economies and a growing number of technical trade barriers. Furthermore, the furniture sector is not only facing difficulties in accessing wood as a raw material, but also a dramatic rise in the price of materials such as leather, plastics natural fibers and petroleum derivatives.

The furniture industry is essentially an assembling industry, which employs various raw materials to manufacture its products. They range from wood and wood based panels to metals, plastics, textile, leather and glass. There are many different types of furniture (e.g. chairs, sofas, tables, wardrobes, kitchens, mattresses) with very different uses (e.g. households, schools, offices).

The sector is dominated by **micro enterprises** (86% of EU furniture enterprises have less than 10 workers). 12% of companies are small (10 to 49) and 2% are medium-sized companies. There are also some large manufacturers although they count for less than 1%, which generate more than one fourth of the total value of EU-produced furniture. Figures vary substantially across countries with the highest share of micro enterprises found in France and Poland and the highest share of large companies in Germany.

According to CSIL in EU15 together with Norway and Switzerland, the top 20 kitchen companies provide 60% and the top 20 office furniture companies the 53% of the total supply. Small companies often act as subcontractors for larger firms producing, for instance, components and semi-finished products for the finishing and assembling of furniture. Wooden furniture used in bedrooms, dining rooms, living rooms and other spaces together with plastic and metal furniture are the dominant manufactured products in the EU (38% of total furniture production value). Other important production subsectors are seats and office furniture (29% and 17% respectively) as well as kitchen furniture (12%).

Over the years and as a response to competitive pressure, in particular international competition, furniture companies have undertaken a lengthy **process of restructuring and modernization and production volumes went down**. From 2005 production volumes

increased slightly but in 2008 this positive trend was reversed and production dropped again. Major factors of competitiveness for the sector consist of research and innovation, skills and quality, design and added value, knowledge and know-how, together with better access to third country markets. Regarding **voluntary approaches**, a growing number of furniture manufactures are implementing environmental management schemes (e.g. EMAS) in order to monitor and continuously improve their environmental performance. In addition, an EU Ecolabel for wooden furniture is under discussion.

In 2012 the global production of furniture was worth €361 billion (CSIL, 2013), i.e. 60% higher than 10 years ago. However, 80% of world production is concentrated in ten countries; China accounts for 40% of global production, The United States rank second, and Germany and Italy[351] follow at some distance. In the last decade and more precisely after 2004, the growth of the Chinese furniture market has been impressive; China became the world leader in furniture production while India and Brazil more than doubled their production values over the last decade (Renta et al., 2014).

According to the Final Report on the EU Furniture market (2014) the EU's share of world furniture production has constantly contracted over the last decade and the value of furniture production in 2012 was almost at the same level as ten years before (Table 5.5). A quarter of the world's furniture is produced in the EU.20 with Germany, Italy, Poland and France to rank among the Top 10 furniture manufacturers worldwide and have a combined share of 13% of world production and almost 60% of total EU production. Production on European ground seems also to increase in the last decade. Nowadays, the EU furniture industry has a high level of production quality in technical, aesthetic, design and fashion related terms and has a strong image worldwide.

Table C1: EU28 furniture production and share of world furniture production (€million and percentage share)

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
EU28	84,911	88,136	89,985	95,232	99,828	97,594	82,478	83,470	85,419	84,147
World	223,014	229,598	248,386	268,020	278,709	278,495	263,596	299,342	321,026	360,862
EU28 share	38%	38%	36%	36%	36%	35%	31%	28%	27%	23%

In 2004, in the EU-25 the total number of firms in the furniture industry amounted to 143,840, with most firms in "other furniture" sector, which according to IFM, can be described as home and garden furniture. In 2006, the European furniture sector comprises around 150,000

[351] Italy is the world's second largest exporter of furniture. Until 2004, it had been the leader in furniture exports, but since then China has been the leader. China is also the world's largest producer, and Italy is the third largest after China and the US (CSIL, 2011). In 2011, the Italian furniture industry suffered from a shrinking domestic market, and the slight recovery in export markets failed to offset the fall in domestic sales

companies, generates a turnover of almost €126 billion and an added value of €38 billion and employs around 1.4 million people (EU27, 2006). Main producers (in terms of the value of production) are Italy and Germany followed by UK, France and Spain and, to a lesser extent, Poland. Consumption in the EU28 in 2012 was still below the pre-crisis level since all the national markets in the EU witnessed contractions in consumption in 2009 as a result of the global crisis). In 2012, there are 126000 registered enterprises occupying around 920.000 people (EU28).

More specifically, the EU lost 2% of the furniture market (in value) in 2008 and 15% in 2009; some positive signals emerged in 2010 counterbalanced by new falls in the subsequent years. Of the largest EU furniture markets, only Germany, Sweden, France and Austria returned to pre-crisis consumption levels in 2012, whereas contractions were strong in Italy, Spain, Portugal, Greece, Ireland, Romania and some of the other Central Eastern European countries with some of them at a level that is at times 30%-40% below the historical value. The great majority of demand in the EU is currently satisfied by EU production, which accounts for 85% of total EU consumption; the remainder is imported from other countries

It should be mentioned that some furniture sub-segments are less sensitive to international competition than others for several reasons such as product and purchasing process peculiarities, design and innovation, price strategies and other factors related to the production process. For example, kitchen furniture is highly dependent on the installation work complementary to the kitchen purchase, as well as to different standards in size and other technical issues that can vary from one country to another. Besides the maintenance of competitive advantages in the kitchen and office furniture subsectors, imports are growing in the upholstery and the "other furniture" segments. This is assigned mainly to the delocalization and re-importation activities of many European companies.

A furniture segment that seems to outperform the furniture sector average in terms of both consumption and production is the so-called **RTA furniture** (Ready to Assemble) also known as flat-pack, knock-down (KD), DIY (do it yourself), self-assembly or kit furniture. Furniture is sold in flat-packs that include all the hardware and instructions necessary for assembly, with flat-packing reducing not only volume and cost, but also the risk of damage in storage and transport[352].

Breakdown of products by main material used highlights the significance of the wooden furniture including both solid wood furniture and wood-based panel furniture (57% in 2010). Soft furniture production, with a share of 20%, follows including textiles, rubber, leather etc, as well as some wood in the production of upholstered frames. Metal furniture claims a share of 12%. Furniture made from other materials (such as natural fibres, plastic or glass)

[352] For more details please refer to Renta et al., 2014

represents around 10% of total production and comprises an extremely varied mix of products. However, a significant volume of products are made of a combination of materials with, for example, items classified as metal furniture to use also wood or wood components.

EXPERT TEAM:

Dr G. Ntalos, Dr I. Papadopoulos, G. Karagouni MSc of the Department of Wood & Furniture Technology and Design and Dr M. Trigkas of the Department of Forestry & Natural Environment

Department of Wood & Furniture Technology and Design

The *Department of Wood & Furniture Technology and Design*, which is part of the Technological & Educational Institute (TEI) of Thessaly is based in Karditsa, Greece. The scientific fields which are covered through the studies in the Department of Wood & Furniture Technology and Design include *wood science and technology*, *furniture production technology* and *furniture design*, all done in compliance with the social rules and with respect to the environment.

The mission of the Department of Wood & Furniture Technology and Design is *'to promote the spread and growth of knowledge in the areas of wood science and technology, furniture production technology and furniture design through teaching and applied research, as well as to provide students with a high level of technological training and knowledge for their own benefit and potential future employment'*.

Institute of Technology and Management of Agricultural Ecosystems (ITEMA) is responsible for the promotion of research and services in the areas of sustainable agricultural production, rural environment management and timber technology. The main purposes are innovative technologies, innovation promotion and industry support for the sectors of agriculture, food, pharmaceuticals and wood and furniture. Main activities are research, quality control, cooperation on industry problems and aspects and incorporation of research in production by training and problem solution. The administration unit is located in the city of Karditsa, and its two departments are located in the cities of Karditsa and Volos.

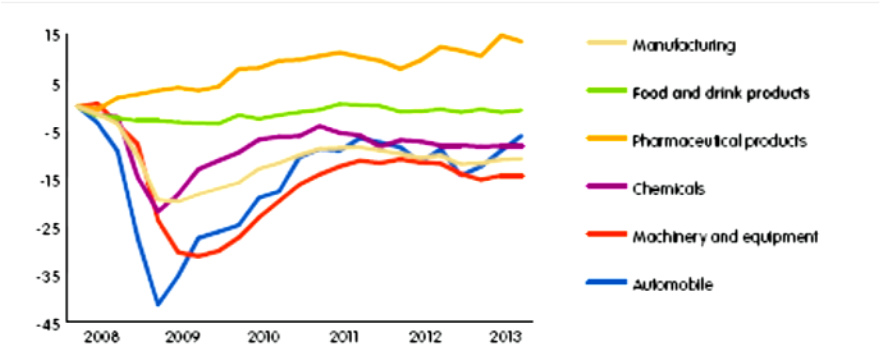
C2. THE FOOD AND BEVERAGE SECTOR

Industry structure

The food products and beverages (F&B) industry known also as food and drinks industry (F&D) includes processing of the products of agriculture, forestry and fishing into food and drinks for humans and individuals. The F&B industry constitutes one of the largest and most

important manufacturing sectors in Europe. In 2008 it was the second largest (after metal) in the manufacturing industry, with 310.000 companies, 14.5% of total manufacturing turnover i.e. €917bn for the EU-27. Today (end 2014) it is the largest manufacturing sector in the EU economy in terms of turnover, value added and employment. It generates an annual turnover of over EUR 1 trillion with a share of 14.6% in manufacturing, and a value added of 206 billion Euros. The sector employs directly 4.25 million workers in the EU representing the 14% of the employment in the total manufacturing sector. It is also part of a value chain which employs altogether 32 million people and generates 7% of EU GDP. Europe's food market is made up of about 286.000 companies; SMEs account for 99.1% of companies in the food and drink industry[353]. It processes 70% of EU agricultural produce and provides safe, quality and nutritious food to European consumers. Medium-sized companies count for only 4% of EU F&B industry; they contribute 29% to EU food and drink turnover and employ 26% of EU F&B workforce. ON the other hand, although very few, large companies account for 48.4% of EU food and drink turnover, 51.2% of value added and 35.7% of employment in the sector (Food-drink Europe, 2014).

Figure C2: Production in the EU manufacturing industry, 2008-2013 (% change since 2008)



Source: Eurostat (STS)

The share of private R&D investment is 0.27% of the industry's turnover. The 2012 Joint Research Centre (JRC) Scoreboard confirmed that the EU has sustained levels of private R&D but is still lagging behind its international peers[354].

In 2012 worldwide exports from Europe of food and drink products were worth EUR 86.2 billion[355] making it the largest global exporter in the sector. Over the past 20 years trade in

353 Source: Data and Trends of the European Food and Drink Industry 2013-2014 http://www.fooddrinkeurope.eu/uploads/publications_documents/Data__Trends_of_the_European_Food_and_Drink_Industry_2013-20141.pdf.

354 Source: 2012 EU Industrial R&D Investment Scoreboard, JRC and DG RTD.

355 http://www.fooddrinkeurope.eu/uploads/publications_documents/Data__Trends_of_the_European_Food_and_Drink_Industry_2013-20141.pdf.

food and drink products between Member States has increased threefold to approximately EUR 450 billion[356] (Food-drink Europe, 2014).

The industry remains stable, resilient and robust, even in times of economic downturn. It is actually one of the very few manufacturing sectors to produce above its 2008 output level constituting a pillar of most EU national economies. Germany, France, Italy, the UK and Spain are the largest EU food and drink producers (Food-drink Europe, 2014).

The food industry is characterized by fragmentation. There are few European multinational companies competing worldwide with a wide variety of products but 99.1% of all enterprises in the sector are small and medium sized enterprises (SMEs with less than 250 employees) and few are able to compete on the global market. The employment in the F&B industry represents about 14% of the total manufacturing sector. Germany, France and the UK represent the three largest European producers. The large multinationals (like Danone, Diageo, Nestle, Unilever and Heineken) are registered in the UK, Denmark and the Netherlands, and the sector profile is very different from that found in Italy and Greece where SMEs dominate.

Figure C3: SMEs in the EU food and drink industry (% in total)

	Micro-companies	small companies (10-19)	small companies (20-49)	Medium-ized Companies	total SMes
Turnover	8,2	5,2	9,7	28,5	51,6
Value added[1]	8,9	6,1	9,2	24,6	48,8
Number of employees	16,9	9,6	11,7	26	64,3
Number of companies	78,8	10,8	5,8	3,8	99,1

The sector is classified as a scale intensive sector according to Pavit's innovation' taxonomy; it is characterized by large firms, process innovation, tacit knowledge and entry barriers to appropriate innovations. It is supplier-dominated, focusing on process technology and related equipment, turning to suppliers of equipment for imitation and technology transfer.

The EU remains the leading exporter of F&B products worldwide, despite its shrinking market share in global F&B trade. EU exports reached 86.2 billion Euros with NAFTA to be the EU's largest trading partner by region, followed by EFTA and Mercosur. Major export destinations are China, Australia, Saudi Arabia and Japan. Yet, the strongest growth rates for food and drink imports were observed in Russia, Ukraine and Malaysia (EU-report, 2014).

356 http://ec.europa.eu/internal_market/publications/docs/20years/achievements-web_en.pdf.

Innovation trends

The F&B sector has been producing innovation for more than the past two centuries by increasing goods at falling prices and managing to feed a population six times greater than in 1800. However, innovation in its contemporary form emanates during the 1950s and 1960s with "TV-dinners" and ready meals introduced in 1953 and the discovery of the artificial sweetener aspartame in 1965 and the birth of the soft-drink industry in the 1960. The sector presented a significant number even in the number of patents; indicatively the total number of patents in the period 1990-1996 was 88% while for the average industry it was 81% (Mendoca, 2009).

Customers' preferences are crucial sources of innovation and a number of factors could play a role in shaping future demand. These include changes in the demography and the socio-economic environment, busier lifestyles of many customers, increased awareness about the relation between health and nutrition, environmental and safety concerns, as well as changing demand patterns due to migration, culture and the emergence of ethnic food. According to Food-drink Europe (2014), pleasure is the leading driver of innovation with a share of 57% in 2013. The five axes of general consumer expectation are presented in Figure 5.10:

Figure C4: Trends of food innovation in Europe

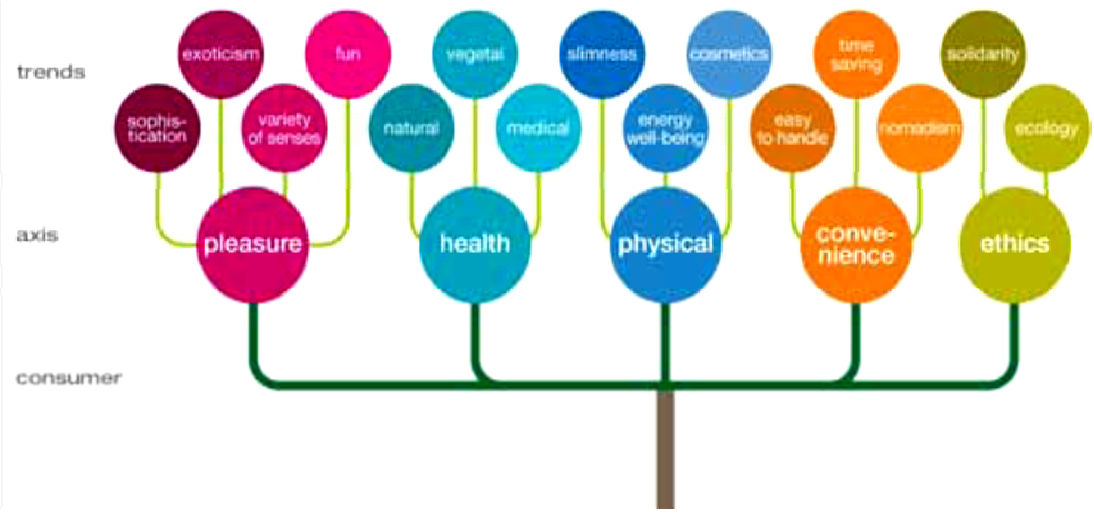


Figure C4 denotes quite clear that the core treads are:

- **Health** (health and physical in the figure): including mainly wellness and wellbeing, weight management, energy and vitality, targeted nutrition, nutraceutical foods and drinks
- **Pleasure** with premium/gourmet products including guiltless gourmet (i.e. low cal/low fat gourmet), super-premium products, authenticity, variety and sophistication, as well as novel flavor combinations, ethnic food repositioned and turned to exotic food
- **Convenience** regarding mainly the on-the-go food, the "freshly prepared" concepts and the innovative packaging for flavor/nutrition preservation, and

- **Ethics** related to ecological and solidarity issues

The F&B industry profits a lot from R&D conducted in fields like chemistry and physics, molecular bio(techno)logy, medicine, material sciences, nanotechnology, and even neurosciences (Innova, 2011). In this vein,

- *nutrigenomic, epigenetic and neurological research* may lead to new forms of production and products such as personalized nutrition[357], functional foods[358], medicinal food, nutraceuticals, genetically modified organisms (GMOs) for pharmaceutical purposes and even food replacement products such as cultured meat.
- *material sciences and nanotechnology* enable innovations such as the creation of anti-biotic materials, heat/cold resistant materials, smart, eco-friendly and even edible packaging
- *natural ingredients* innovating in terms of food preservation (e.g. membrane filtering, enzymes etc) and novel anti-microbial properties , ingredients without compromises in taste, processes that reduce fat, salt, sugar etc

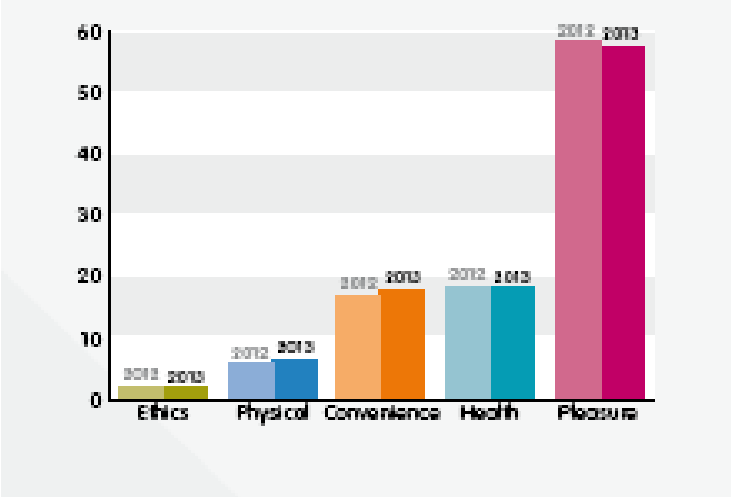
Innovations from other sectors such as automation, robotics and ICT are very important too. RFID-technology allows for consistent traceability, innovative technology enables faster and better food testing methods and innovations in logistics and transport.

Eco-friendly production with the reduction of food waste and wasted food, energy efficiency in manufacturing and especially improved water usage are further major challenges for F&B industry innovation. However, many activities that relate to eco-innovation are actually to be found in other sectors such as agriculture or transport. On the other hand, food and drink products are made available through a wide range of processes, e.g. frozen, chilled or at ambient temperature, packaged in glass jars and bottles, cans, plastic containers and packaging papers and board. Most of the physical operations are quite common such as separation, cleaning, cutting, crushing, blending, grounding, and packaging methods. Chemical and biological operations such as fermentation, homogenisation, hydrogenation, curing, drying, pigmentation, and conservation are rather different (Innova Watch, 2011). Thus, eco-innovation regards:

- Sustainable food processes and relevant management (e.g. zero emission systems, process automation, etc.)
- Eco-sensible packaging, eco-labelling and waste recycling (e.g., smart/eco packaging)
- Effective monitoring of the food (e.g. intelligent labels)

[357] The basis of a new firm founded by professor Kouretas in Greece
[358] Functional foods for kids have long be launched and positively accepted by the market

Figure C5 : Drivers of innovation in Europe, 2012-2013 (%)



Source: Food-Drink, 2014-2015

Putting together suggestions[359] for innovation in the F&B industry, a summary of the most often mentioned ones includes the following:

- New lifestyle products (e.g. inspired by the LOHAS-movement, i.e. Lifestyle of Health and Sustainability)
- Science-based functional food (e.g. on basis of nutrigenomics) in various categories such as mood, cosmetic, anti-aging, digestive health
- Non-prescription nutraceuticals and medicinal food
- Weight management-related food; growing share of "light" and calorie-conscious products
- Indulgence: specialty gourmet foods; New international and exotic products or "domesticated" foreign products and "ethnic" food
- Growing share of organic foods
- Food for specific target groups; i.e. for the elderly, food for allergic consumers
- Healthier fast and "junk food"
- Advances in food processing automation, logistics and warehousing
- Variety of new fast and convenience food (including healthier and less healthier varieties); microwaveable packaging, portion control, on-the-go food
- "Fashionable" foods and drinks – goods, often associated with "youth culture" and franchise

[359] Suggestions in: "Sectoral Innovation Watch," (2011), "The future of the food and drink sector (2004), Future Innovations in Food and Drinks to 2012 (2007), Hardy, "Future Innovations in Food and Drinks to 2015" (2009)

- Alcoholic drinks, energy drinks at reduced prices
- Value chain integration
- Selected applications of GMO for innovative products like allergen-free nuts ("knock-out nuts")
- Cultured animal protein
- Improved traditional foods, retro-innovation (the paradox to innovate using tradition)
- Service innovations like science-based recommendations for optimal food combinations
- Combinations of traditional knowledge (e.g. Ayurveda) and high-tech (e.g. nano encapsulation of nutrients to improve bio-availability)
- Adjustable food, e.g. the possibility to regulate spiciness or other taste characteristics

Figure C6: Food innovation trends in Europe, 2013 (%)

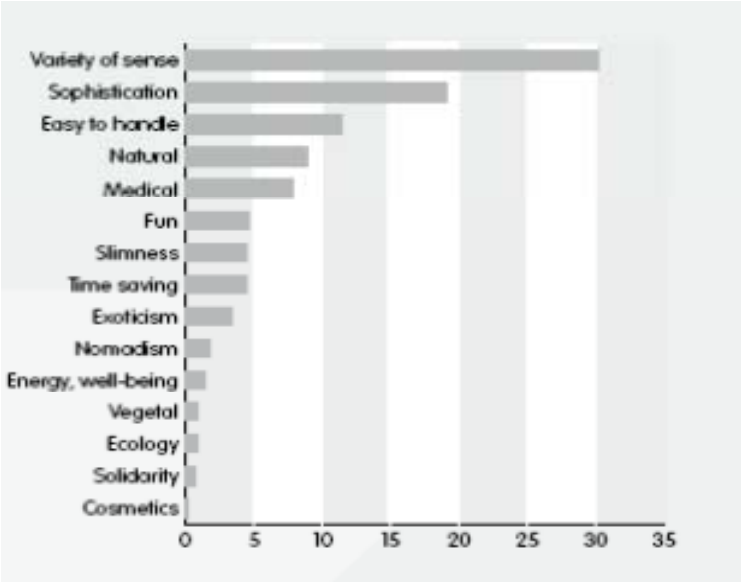
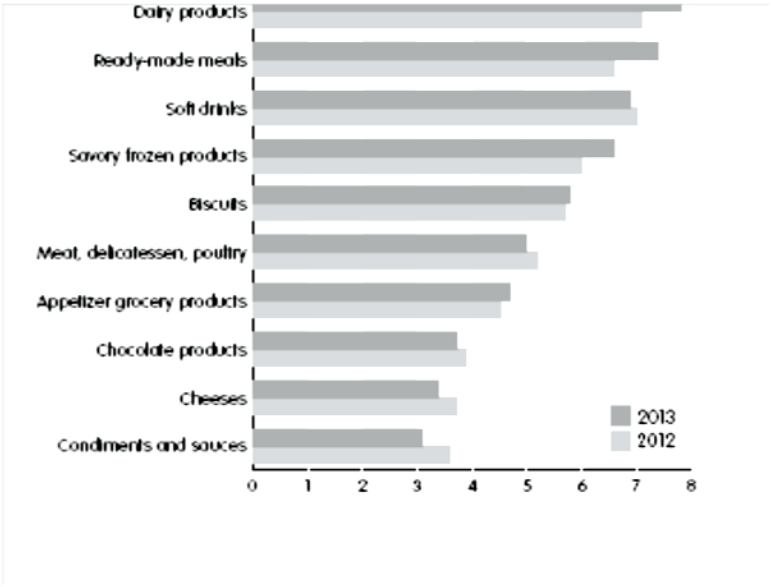


Figure C6: The ten most innovative food sectors in Europe, 2012-2013

(% of total European food innovation)



Source of the four figures above XTC World Innovation Panorama 2013
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Some of these cross-cutting innovation areas may be:

- Assessment of functional (natural) ingredients as replacements for less healthier ones
- Personalised diets
- Evidence-based functional food
- Reduction in fat, salt, sugar and other problematic ingredients
- Alternative proteins
- Improved preservation methods
- Advanced and continuous food testing
- Sustainable production (energy efficiency, waste and water reduction)
- Automation in processing (could improve hygiene)

F&B firms turn to open innovation surpassing sectoral borders and engaging even consumers on a broad range of strategic procedures. The majority of new or modified products are usually combined with process innovations. The product lifecycle model is changing dramatically with new products to being brought to the market much faster than ever (Hardy, 2009). Besides the science and industry fields mentioned above, F&B firms engage in technological co-operation with foreign suppliers of machinery and equipment and co-operate with research institutes. Large firms develop stronger capabilities for cooperating with research institutions and universities, especially at international level. Furthermore, large companies and, in particular, multinationals are the main producers of R&D-based innovation; yet, CIS data indicates that small firms invest more in R&D than large firms relative to their total turnover. In 2012, the world's top 61 leading food and drink companies

collectively invested €8.7 billion in R&D in 2012 with 17 of them to be based in the EU[360] and to have invested around €2.3 billion.

At the sub-sector level dairy products are considered as the leaders in innovation followed by ready-made meals (Food-drink Europe, 2014). Also the drinks sector appears to be quite innovative given the presence of sports and functional drinks.

Safety and quality are the focus of innovation regarding the production capabilities of the industry. Novel production processes move away from the traditional emphasis on efficiency and economies of scale, to more flexible processes for higher output in real time, fast safety controls[361] and the fastest production and introduction of product varieties (Mendoca, 2009; Innova Watch, 2011).

Firms obtain innovation ideas in trade fairs and conferences and by reading scientific or business journals. Although innovation reports, such as Innova Watch, stress the fact that process innovation is most common in the industry, innovation related to communication, logistics and distribution is similarly important for the sector. For example, the use of ICT and e-business supports marketing and distribution of niche products.

Some **main barriers** to innovation that have been identified are scientific and technological challenges, uncertainty about consumer interests, conservatism of food consumers, laws, and health claims as well as financial constraints and lack of qualified human resources. Europe Innova Panel experts view political and regulatory framework conditions in the EU as hampering factors considering the scientific and technical discoveries or developments on the demand side. Legal uncertainty and non-harmonized regulatory conditions impede innovation activity and result in a loss of market opportunities.

According to Sectoral Innovation Watch (2011) the sector is experiencing a shortage in high-skilled workers, especially food scientists, food technologists and food engineers, which is considered a significant hampering factor for innovation. The industry has fewer workers with higher education are employed in food and drink industries in comparison to other industries, although the share of F&B firms that implement staff training is higher. SMEs and small companies show a lack in ICT skills.

The lack of financing is another hampering factor for innovation in the F&B industry too (Sectoral Innovation Watch, 2011). Firms with better access to public or private funding develop higher innovative activities. Across countries the sector presents a rather unfavorable internal financing situation.

Sources

[360] NL 5; The UK 4; DE 3; FR, DK, FI, BE, IE 1 (Food-drink Europe, 2014).

[361] Contamination and perishability are critical in F&B industry.

Information on the food and beverage industry in Greece has been mainly based on experts and sources mainly from the following Greek national centres (which are further involved with research and technological development activities dedicated to the agro industrial sector):

Ministry of Rural Development and Food (http://www.minagric.gr)

ETAT – Food Industrial Research and Technological Development Company (www.etat.gr/?&lang_change=en)

The Pan-Hellenic Confederation of Unions of Agricultural Co-operatives (PASEGES) (www.paseges.gr)

SEVT (Federation of Hellenic Food Industries) (www.sevt.gr)

Foundation for Economic and Industrial Research (IOBE)

National Statistical Service of Greece,

Institutes and Departments in Universities

NAGREF – National Agricultural Research Foundation

MAICh – Mediterranean Agronomic Institute of Chania

University of Thessaly (http://www.uth.gr)

NAGREF – National Agricultural Research Foundation

Institute of Molecular Biology and Biotechnology – ITE

Institute of Biological research and Biotechnology – National Hellenic Research Foundation, (http://www.certh.gr/ina.en.aspx)

Institute of Biology – EKEFE DEMOKRITOS

Institute of Agrobiotechnology - EKETA

Hellenic Centre for Marine Research (www.hcmr.gr/listview2.php?id=99)

http://www.xrimatistirio.gr/index_afieromata.asp?TitleAfieroma=trofima

C3 THE TEXTILES AND CLOTHING (T&C) SECTOR

Industry structure

The T&C industry is a very diverse and heterogeneous industry whose products are part of the daily life of private as well as commercial users. The variety in products corresponds to a multitude of industrial processes, enterprises and market structures. Its activities range from the production of raw materials (i.e. natural as well as man-made fibres) to the manufacture of a wide variety of semi-finished and finished products.

The T&C industry plays a crucial role in the economy and social well-being in many regions of Europe. According to data from 2013, there were 185 000 companies in the industry

employing 1.7 million people and generating a turnover of EUR 166 billion[362]. The sector accounts for a 3% share of value added and a 6% share of employment in total manufacturing in Europe. With regards to external trade performance, about 20% of EU production is sold outside the EU despite limited access to many non-EU markets.

Today, the T&C industry is a really globalized industry with constantly increasing trade flows all over the world. Italy is the most important contributor to the EU-textiles industry with 31.97% of the total EU-25 value added, followed by a group of 4 countries with about 10 percent in EU-value added in textiles. These countries are Germany (13.22%), France (12.34%), the United Kingdom (10.47%) and Spain (9.45%). Italy, Greece, Portugal Romania, Bulgaria, and Poland; and, to a lesser extent, Spain and France contribute more to total clothing production. On the other hand, northern countries such as the United Kingdom, Germany, Belgium, the Netherlands, Austria, and Sweden contribute more to textile production, notably technical textiles.

The sector in the EU is based around small businesses. Companies with less than 50 employees account for more than 90% of the workforce and produce almost 60% of the value added.

Traditionally, the T&C industry was among the economically strongest industries worldwide. In the 80s and 90s, several products were among the 20 most trade-dynamic products (UNCTAD, 2002). In 2002, world T&C trade reached US$ 152 billion and US$ 200 billion, respectively, or 2.4 % and 3.2 %, respectively, of world merchandise exports (OECD, 2004; WTO, 2003). The industry has undergone significant restructuring and modernisation during the last two decades of the former millennium. This resulted in increased productivity throughout the production chain while innovative, high quality products became the focus of production efforts. These structural changes, however, has left significant traces in the textiles industry. In the time period of 1996 to 2004, 7% of the textiles enterprises closed down leaving around 205.000 companies in business in the EU-25. While employment in manufacturing even increased slightly, the work-force of the EU textiles and clothing industry was reduced by almost a quarter 25 % since the mid 1990s leading to substantial increases in labour productivity. The relevant numbers in Greece are really dramatic (102.000 employees to 43.800, -58%).

The sector has undergone radical change recently to maintain its competitiveness by moving towards high value-added products. This was due to a combination of three major milestones:

- The introduction of China in the World Trade Organization in 2001
- The abolition of quotas for textiles and clothing in 2005

[362] In 2008 (before crisis) there were 140.000 companies with a turnover of 202 billion Euros

- Technological developments

The textiles industry has been one of the most highly protected sectors in the global economy. While tariff protection applied to textile and clothing imports still remains high compared to average tariffs imposed on manufactured products, foreign trade experienced a substantial 'liberalisation boost'. This process was mainly driven by the abolition of the quota system in the course of the phase-out of the Multi-Fibre- Agreement (MFA) between 1995 and 2004. The phasing out of the Agreement on Textiles and Clothing in 2005 gave these trends a further push. Mass production largely disappeared from high-wage areas in the EU. The first reaction was the transfer of production to low-cost areas i.e. the New Member States while Portugal and Greece were able to keep at least parts of the production for some more years. Meanwhile northern countries start investing in innovation regarding mainly textile products. Southern countries invested heavily in automation and IT-based supply chain management in order to increase flexibility and serve better their large global customers. In 2006 the T&C industry in Europe would still occupy 3 million workers.

USA and Japan followed Europe with production and employment reductions (in Japan it was the 15th year of decline) and import increase, mainly from China whose share reached 81%. Therefore, due to globalization, "European T&C industries have passed through stormy weather over the past decades" (TexMedin, 2010).

The world economic crisis and the euro – dollar parity completed the already bad landscape of the T&C sector. All the above evolutions turned to: A) fierce competition especially in price, b) the transfer of production to developing countries, c) an enormous number of enterprises that closed down in developed countries d) the increasing imports from Asia and especially China e) changes in consumers' behaviour and f) the excessive product supply in all markets.

T&C changes appear a two-gear development pace regarding the cost-level of the European countries; high cost countries invested in fashion, design, innovation and branding. They have developed efficient value chain networks and their high-level management; however they lag behind in mass markets, while their current strengths seem to be challenges by the Asian competitors. Low-cost European countries confront a real crisis; they cannot compete with the Asian competitors in terms of costs and prices. They survive with demanding orders of high-value European producers which may regard difficult designs to be transferred to cloths, fragile fabrics, extreme flexibility or very short lead times. However, money offers for such specificities do not correspond to the high-value work done.

Table 5.11 -Strengths and weaknesses – opportunities and threats

SWOT ANALYSIS		
	Strengths	**Weaknesses**
High-cost areas (1)	Leading in fashion design and branding Strong position in top market segments Good position in specialty textiles Value chain management Efficient production networks Innovative machinery industries Experienced labour force Functioning training institutions	Weak cost position Weak position in mass markets Weak attractiveness for young people Declining training participation Experience in manufacturing processes is weakening
Low-cost areas (2)	Competitive wages Experienced labour force a Proximity to large consumer markets (partly) new capital stock	Large-scale production Weak market position Weak innovative culture and few brands Lack of highly skilled professionals (designers, engineers) Few training institutions High transport cost
	Opportunities	**Threats**
High-cost areas (1)	Increasing demand for specialty textiles products and specialty textiles Rising worldwide demand for high-level products Preferences for European fashion style Strong attendance to environmental issues	Closing-up of emerging countries in high value Rising productivity in emerging countries High price sensitivity of consumers Disappearance of textiles and clothing machinery producers a Closure of training institutions
Low-cost areas (2)	Europeanisation of demand Short-distance transportation Cost advantages compared to high-cost areas	Rising cost advantages of emerging countries Skills shortages due to low attractiveness of the sector Relocation of production
(1) AT, BE, DK, ES, FI, FR, GE, IE, IT, LU, NL, SE, UK **(2) BG, CZ, CY, EE, GR, LT, HU, MT, PO, PT, RO, SL, SV**		

Source: Economix, 2009

Market structure in Europe

The most important factors that affect the demand are the population size and structure, the income and mostly the fashion. Clothing appears to be related to cultural attitudes such as social status and business conventions. While consumers may differ among Member States regarding their fashion orientation, quality preferences or price sensitivity, a certain level of homogeneity due to fashion trends supported by press media and the internet as well as clothing multinationals. According to Perotti-Reille (2008) consumers are "individualizing", "professionalizing" due to easier information about products and markets through internet and wish to be participatory ie interact with the industry stakeholders and be co-inventors. Furthermore, contemporary consumers of all ages care about social and ecological issues; for example, they are sensitive in child-labor and energy or water consumption.

Table 5.13 -Product Spectrum of TCL Industry –EU 27

Product area	% share of TCL value added
Textiles	47,5
Other textiles	11,9
Weaving	9,2
Made-up textile articles except apparel	7,5
Finishing	6
Preparation and spinning of textile fibres	5,4
Knitted and crocheted articles	5,3
Knitted and crocheted fabrics	2,2
Wearing apparel	34,9
Outerwear	21,6
Other wearing apparel, accessories	5,9
Underwear	4,9
Workwear	1,6
Dressing and dyeing of fur	0,4
Leather clothes	0,4
Leather and footwear	17,5
Footwear	10.,7
Luggage, handbags, saddlery etc.	3,8
Tanning and dressing of leather	3,9
TOTAL	100

Source: Eurostat (2007)

Such consumer behavior in combination with the imports of mass-products from low-cost countries and the low-price products of the big retail chains has led to an increasing fragmentation of markets which caused certain changes in production regimes overcoming mass production principles and differentiated distribution channels. However, these strategies seemed to be effective in certain high-price niches, since crisis has led European consumers towards “a culture of cheap, disposable fashion” (Allwood, 2006). Thus, while domestic output prices of manufacturing products increased by 25% between 1996 and 2006 in Europe, textiles, clothes and leather products saw an increase of only 8%. Furthermore, the share of clothes in total EU consumption decreased from 5.2% in 2000 to 4.7% in 2006. On the other hand, China, earned a share of 33% of EU27 textiles and clothing imports, while its share in footwear rose to 40% in 2006.

With thousands of firms, millions of employees and labor costs less than one third of the European and US competitors, China seems to be the winner of T&C restructuring; it is today the number one producer of wearing apparel with a share of one quarter of world exports (Perotti-Reille, 2008). After the first failures in quality and production, today most Chinese firms are strongly export oriented with optimized production chains to provide all functions from fibers to garments, confection, and finishing. The European answer so far was:

- *vertical product differentiation* (including fashion and branding) which however has some impact on high-value T&C products and none on mass production
- *production relocation* to Asian countries while the control over the value chain remained with the global retailers, as did the design, quality control, and marketing. "Trend scouts" to detect the most recent preferences of consumers, the shortening of the "time to market" with frequent changes of fashion patterns, and the establishment of real-time IT networks to observe both sales and production are highly developed[363]
- *innovation:* around 35%-50% of T&C enterprises are engaged in product and process innovation (TexMedin, 2010).

However arising trends can create new markets; for example increasing health awareness among European consumers and the aging society support the production of functional clothing. Furthermore, changing life styles and attitudes such as ecology and solidarity can create new niche market opportunities.

Innovation trends

The T&C industry is often referred to as a 'traditional industry', as a sector belonging to the so-called 'old economy', a mature industry or as "low-tech industry" implying that there are little R&D and innovation efforts within the sector. Its companies on average spend a relatively small percentage of their turnover on R&D as compared to other industries. These notions divert attention from the fact that the textile and clothing industry has undergone significant restructuring and modernisation efforts during the past two decades increasing productivity throughout the production chain, and reorienting production towards innovative, high-quality products.

Innovation activity relies on the acquisition of external technologies than on in-house R&D. Innovation co-operation is less frequent while means of intellectual property protection such as patents are rarely used. Main reasons for the low innovativeness have been recorded to be the low average firm size, a lack of qualified personnel, and poor access to financial resources, besides the very nature of the industry.

In general and according to literature, industries that are called "low or medium-technology industries" such as Textiles are characterised by incremental innovation and adaptation. Technical change comes mainly from suppliers of machinery and other production inputs. Companies are focused on improvements and modifications in production methods and making production more responsive to customer demands.

Actually innovation is achieved by continuous improvements in production technology and innovation in symbiosis with machine developers and the most innovative user companies.

[363] Even companies of high-value brands relocated production in low wage countries. However, they maintain strict control to guarantee high quality.

However, empirical research analysis, such as the PILOT project and the Sectoral Innovation Watch, reveals that most textile producers are big and well established **knowledge-intensive** organizations[364], with a significant number of them to be R&D-oriented, linked to external sources of knowledge and to invest a considerable share of their turnover in innovation.

Since the industry is of high intensity of work, some countries, especially in South-East Asia, have become very competitive in textiles and clothing manufacturing, as they combine low wage costs with high-quality textile equipment and know-how imported from industrialised countries. However, competition is one of the strongest market factors that drive innovation. The EU textiles industry strives to remain competitive by means of higher productivity and through competitive strengths such as innovation, quality, creativity, design and fashion. These competitive advantages are the result of a permanent process of restructuring and modernisation. The sector has been adopting new technologies at a fast pace, both with regard to information and communication technologies and new production techniques. Innovation has taken place in all parts of the value chain of the T/C sector (Aslesen, 2008).
Equally, the EU industry has a leading role in the development of new products.
Since price competition is definitely no longer a viable positioning quality, creativity or service competition, which imply creating additional value for customers in order to be able to charge premium prices, is the only strategic option left. Especially after 2000, textile firms that survived and prospered relied mainly on cutting edge technology, intramural R&D and knowledge transfer combining it at times with in-house research to differentiate and create competitive advantages. More precisely, analysts recommend five fields of action:

1. New materials and products (multi-functional textiles and garments)
2. Production technologies (process technologies, automation)
3. Information and communication technologies (ICT)
4. Innovation and research and development (R&D).
5. Fashion and creativity

Prospective innovation challenges with regard to **new materials and products** will be related to how this industry will keep the lead with regards to high value-added products such as technical (or intelligent) textiles and non-woven materials (industrial filters, geotextiles, hygiene products and products for the automotive industry and the medical sector). In this respect, important technology areas to which the industry has tried to relate in this respect are engineering and design.

[364] While the rest sub-sectors are composed of micro and small companies with a few exceptions

Actually, challenges are related to new textiles and composite materials and their need for process and production innovation both with regard to new machinery, processing methods and activities, challenges will lie in the breakthroughs in technology areas such as:

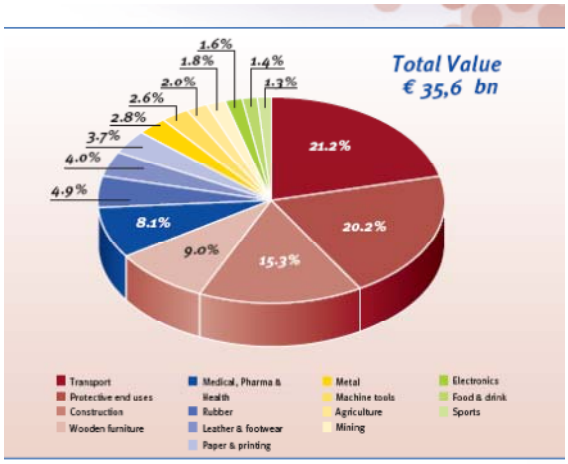
Biochemistry, • Biotechnology, Plasma, Laser, Nanotechnology

One of the major growth areas is *textiles for industrial and technical uses,* where novel applications in the car industry, house construction, environmental technologies and sports are generating new, sophisticated and specialised markets. While technical textiles represent less than 25% of textile output in the EU-25, some countries previously more active in traditional textiles have turned to these new products which now represent up to 80% of textile production in the Nordic countries and 50% in Germany (Euratex, 2004). Still, Greece has shown no interest in technical textiles.

Technical textiles are today used in construction, medicine, or engineering leading to an improvement of T&C industry quality position on world markets. Specialty textiles are equipped with electronic components, or embedded communication and information technologies, coated with new materials, and used for packaging, filtration, or for construction and mechanical engineering purposes.

In a broader sense, 'Intelligent textiles/clothing' or 'smart materials' refers to materials that use findings in high-tech sciences such as nanotechnology or biotechnology and integrate non-textiles technologies into textiles and clothing to add additional features. Examples of new functions produced are antimicrobial functionality and the possibility of embedding sensors for monitoring health issues into clothing. Usual application areas are military and medical ones, followed by leisure and sports clothing.

Figure 5.15: Western Europe's consumption of technical textiles by application



Source: Euratex estimate for 2004 based on Eurostat, 2004 and OETH, 2000)

New production technologies can enable EU industry to offer products tailored to the individual needs and wishes of customers. In general, innovation challenges with regard to process innovation lie mainly in new process (production) technologies, automation and flexible high-tech processes which offered for example the potential of tailor-made clothing in a mass production system. A major process innovation of the last decade is mass customization; i.e. the production of tailor-made clothing at ready-to-wear prices which is being further excelled. Furthermore, new textiles and composite materials have required certain adaptations or even entirely new machinery and processing methods which are usually developed in co-operation with other industries such as machinery and chemical, biochemistry and biotechnology industry.

At the same time there is increasing attention for *ecological and environmental* aspects (e.g. hazardous material, energy consumption, chemical safety, water consumption), both at the consumer level as on the regulatory level. Innovative production technologies support such issues and more precisely (Diaz Lopez et al. 2010; Zahradnik and Dachs 2010):

- Water and land consumption (we remind that cotton mills are established in places with abundant water sources)
- the use of pesticides in the production of fibers
- energy use mainly in cases of cotton products laundry and the relevant production equipment
- release of toxic chemicals in waste water (dyeing, bleaching, finishing and laundry)
- Solid waste in textiles production;

Based on the above issues, Montalvo et al (2011) stated a number of eco-innovation opportunities:

- Enzymes for textiles manufacturing
- Improved textile methods for dyes and auxiliary chemicals
- Eco-fibers and eco-finishing of clothes
- Automated systems for monitoring and control
- Plasma technology for eco-wet processing
- Reused and recycled textiles

It should be mentioned that a series of regulation measures foster T&C eco-innovation such as the Integrated Pollution Prevention and Control (IPPC) directive (2008/1/EC) for organizational and technological change in the T&C sector, especially for water and energy consumption of textile processing. In addition to the IPPC, REACH regulation (EC

1907/2006), the European Emission Trading System (Directive 2009/29), the Biocides Directive (98/8) and the European Eco-label scheme are important drivers for this sector.

Information and communication technologies (ICT) play a major role in production processes, the supply chain management, customization, and reducing lead times. Some companies have already developed a variety of business strategies for producing and marketing customized clothing using Computer-generated body measurements.

ICT is a significant supporter of n**on technological innovation** in the industry which rests mainly on new types of supply chains that offer fast small size batches of high value products ("fast fashion"), lean retailing, virtual enterprises etc. *E-commerce* and the increasing use of online shopping enables producers to introduce new business models and fosters information flows between consumers and producers. However, even today, a challenge for manufacturers in the textile and clothing industry is how to get hold of the kind of market information that lies in the retail groups in order to make quick adjustments and make marketable products derived from creative passion, know how and fashion. According to experts, the potential lies in the possibility of having the 'creativity lead' and to take up mass customised goods and business to consumer (B2C) trade on the Internet. In order to reach this goal market research and competitive watch should be promoted.

In Europe, trademarks, secrecy and lead-time advantage on competitors are most used by Textiles innovators to protect their innovations, but a large share of innovators also uses complexity of design and registration of designs patterns. Of the various methods of non technological change, introducing significant changes in the aesthetic appearance or design in at least one product and implementing new organisational structures are used most often by Textiles innovators. The use of IP in the Textiles industry is below average, in particular for patents (22% vs. 38%), copyright (1% vs. 11%) and secrecy (44% vs. 54%). Greece has never surpassed the 1% use of patents.

Table 5.15: Typical T/C Industry Business Models with principal IPR strategies

	Brands & trademarks	Registered & unregistered designs	Technological IPR	IPR exploitation
Textile supplier (Yarn producer)	X		X	
Non-woven supplier (Technical Textiles)	X		X	X
Finishing Company (Functional Textiles)			X	
Integrated company (Interior Textiles)	X	X	X	X

Branded Clothing company	X	X	X	X

Source: NetFinTex, 2006

Technological developments have had a different influence on the textile industry than on the clothing sector. Whereas huge productivity gains were achieved through innovations in the textile industry, the clothing industry can only point to various improvements in fragmented clothing processes. In fact, today's sewing techniques do not differ much from those of a century ago. And although the textile and clothing industries can be considered to be mature, they both use technological innovations that are largely generated in other industries, above all in chemicals (complex manmade fibres) and machinery (computer-aided design systems). Actually almost all clothing companies use some CAD programme while most of them have or show a great interest in CAM, MRP and ERP.

Different factors have driven innovation and development in the three main textile sectors – clothing, home textiles and technical textiles. In the largest, clothing, European manufacturers have traditionally dominated in fashion and creativity, but the sector is now in decline because of high labour costs. Production of home textiles is highly automated and capital-intensive, with labour costs playing a much smaller part, so this sector of production is more stable.

As emphasised by the experts, the technical textile sector and the clothing industry sector are driven by different factors: the former is characterised by technology-driven innovation, whereas innovation in the clothing sector is more market-driven. Especially for **the clothing industry**, the fashion sensitivity of the market is an important determinant. Regarding their income, consumers are willing to pay extra for fashionable brand-names. As emphasised by the experts, consumers often buy clothing products not for them but for the image they give to the external world ("*There is no common logic in Fashion*"). Prestige and image are very important in this sector.

The life cycles of textiles and clothing are becoming shorter, with the emphasis on price and fashion rather than on technological innovation. This requires short time-to-market and short product life cycles. For example, Rapid Manufacturing (RM) was adopted by the industry to reduce the time between design and production, allowing complex designs and leading further to the innovative concept of *mass customization* increasing flexibility and the ability to react to market changes. Furthermore, quick reaction market trends in the fashion industry and customized clothing is supported by intelligent technologies such as virtual prototyping. It should be mentioned that the market for customized products can be subdivided into customization in design and customization in fit (made-to-measure clothing). Fairly simple design customization is today quite common; a variety of mostly internet-based firms offer customized products such as shirts.

Fashion remains the main innovation –in terms of creativity – for EU T&C manufacturers. According to experts, Europe can and must continue to enjoy a lead in terms of flair and creativity along the apparel pipeline (design, innovation, creativity apply to the production of yarns, fabrics, both woven and knitted, just as much as they do to the final consumer article) by renewing collections. Over the last decade and in favor of a continuous renewal, there was an addition of 3 to 4 mini-collections within the same season.

Meanwhile, the fast fashion trend known already from the '90s is continuing to grow at high rates. "Fast fashion" objectives are characterized by rapid response to market stimuli through short product life cycles and continuous renewal of stocks at affordable prices and with an attractive design. Indicatively, in the period 2008 – 2012, the income of the fast fashion players has grown with an average of 15-20% while the luxury segment records a growth of 0.8% (Bain & Co., 2013). The Inditex group (Zahra, Bershka, Massimo Dutti etc) registered a growth of 52% in these years in an industry strongly influenced by the crisis, in Europe and not only (Tartaglione and Antonucci, 2013).

Information sources

EUROSTAT

Innova - European Commission DG Enterprise and Industry

http://www.europe-innova.org

European Central Bank, Statistic Pocket Book December 2006, Frankfurt 2006

Strategic Research Agenda of the European Technology Platform for the Future of Textile and Clothing Industry – EURATEX, Brussels, June 2006

http://www.textile-platform.org

http://blackmoney2011.blogspot.com/2011/05/7000.html

Athens Chamber of SMEs

The **Hellenic Fashion Industry Association (SEPEE)** is the main representative of the apparel and textile industry in Greece, founded in 1973 as a non - profit organization with headquarters in Thessaloniki, and with a branch office in Athens. Today its active members are approximately 300 Greek clothing and textile companies, including all major companies of the sector. It is a member of Euratex (European Apparel & Textile Association) and provides a number of services to its member companies, from trade support such as organization of trade fairs and trade missions in Greece and abroad, development of integrated marketing plans, establishment of technical and training centres such as:

Endysi is a training centre for the apparel and textiles companies (www.endysi.gr) offering customized training, and surveys of local labour force market in the sector.

The Greek Somatometric Institute (www.bodymetrics.gr).

The Technology & Design Centre S.A. ELKEDE (www.elkede.gr).

The Greek textile association called SEVK

Clotefi (Clothing textile and fibre technological development s.a.) http://www.etakei.gr/ was established in 1986 and falls under the supervision of the Ministry of Development. It provides a range of services such as:

- product quality control testing,
- trouble-shooting and solving special technical problems,
- applied research,
- designing and implementing research projects,
- the application of resource management and administration systems,
- human resource training.

SHORT DESCRITION OF THE THIRTY CASE STUDIES

a) Wood and Furniture Sector

WCo1 case study (second pilot case study)

Summary
- Legal form: Ltd
- Year of foundation: 2007
- Starting year of producing the new product: 2007
- Number of employees: 10 full-time; up to 15 part time in high season / started with 4
- Located in: Larissa
- Product families: veneers, marquetry inlays, wooden accessories, decoration parts, veneer stitching
- Manufacturing: batch production
- Major customers: furniture manufacturers
- Major suppliers: wood processing companies (Greece) fleece (Germany), veneer providers (Europe)
- Sales' structure: national 90% - international -10%
- Founders: the entrepreneur (TEI) and his wife (TEI –mechanical engineer)
- Patents: no
-Trademarks: yes
- Awards: no

This is the second pilot interview but the first to open the W&F case study research. It lasted 3.5 hours and actually tested the general outlines of the research questions. It was suggested by the Department of Wood and Furniture Design and Technology (WFDT), TEI of Thessaly, Greece. The author belongs to the Academic Staff of this Department. Its Academic Staff can be considered experts in the Industry and participate in almost all innovative and knowledge-

based activities of relevant firms in Greece and Cyprus while they are acquaintant with the most known research institutes and Wood and Furniture Technology Universities in Europe.
Interview with the entrepreneur lasted about 3.5 hours with a visit to the plant to follow. Additional information has been conducted by phone-calls and regular visits as well as by the company's internet website and customers. The researcher keeps contact with the entrepreneur, while students of the department became customers. The entrepreneur's son studies in a relevant Department in Germany (Rosenheim University after WFDT professors' consultation) and his daughter in the WFDT.

Company Profile

WCo1 sets a model among manufacturing companies by exclusively undertaking the stabling and commerce of veneers and roots (burls). The modern equipment in combination with the exquisite quality of materials is the base of high quality services which is the characteristic of the firm.

WCo1 was founded in 2007 in Larissa, Greece. Equipped with state-of-the art machinery in a 3,000 m2 plant, sets an example in the Greek carpentry industry and carries out exclusively the veneer and root stitching and trading. Veneer is a thin sheet of wood, used to cover the surface of furniture and architectural woodwork. The high quality materials combined with cutting edge equipment have ensured the position of the front runner in the field. The company enriched its range of wooden parts, inlays and marquetry, in order to establish its presence in the industry. It is operating in all Greece, Cyprus and the Balkans

Basic Products: Pioneers in veneer stitching with the use of state-of-the art equipment. Innovative veneer processing with paper backing and stitching in a wide choice of designs. The innovative solution succeeds in achieving high stability and flexible veneer. Wide variety of wooden parts, inlays and marquetry. High quality veneer, wooden parts, inlays and marquetry

Techniques used: Stabling veneers, Spliced veneers with fleece backing.

The entrepreneur: a young dynamic man about 45 years old is the founder of the company. He was working next to his father in their family company, a conventional veneer stitching since his childhood. He studied at the Department of Plant Production of the Technological and Educational Institute (TEI) of Thessaly but he never worked on it. On the contrary, he went on with the family business, a job he really loved and which was prospering in the 90s.

Still it was a very small company with already two partners (father and first son). After making his own family with a mechanical engineer (TEI), the entrepreneur felt that there was no room for his own vision. So he started searching for the opportunity to run his own business.

Innovation / entrepreneurial process: Knowing the regional market of Thessaly, the entrepreneur wanted to do something differentiated and innovative which would help him exploit his long experience and knowledge on veneers but would also lead to the creation of a niche market.

The family company used conventional machinery, facing problems such as overlapping or the existence of considerable gaps among the pieces, which led to more waste for its customers (mainly furniture makers). Furthermore, pieces could never be arranged in exactly the same way *("it's a natural product, so it cannot be exactly repeated*" is the usual answer we get as final customers when buying veneered furniture.)

The entrepreneur searched the regional market and found that the only competitor was A.W. a big wood processing company in Greece with a great range of similar products at standard dimensions, and imported products. They all used the same conventional technology; although in different productivity and mass ranges. Yet, that was not enough. He didn't want to do something that would make him a direct competitor of the family business.

His initial ideas laid on more ecological products and different kind of cuts, which would eliminate waste and improve quality, but he could actually find no solution. On the other hand he believed in the motto "stick to your knitting", A prime strategy advocated by Tom Peters in his business book In Search of Excellence, written in the early 80s which had impressed him. The writer reported that excellent companies were careful to avoid trendy distractions and were very good at focus. They knew what they did best, and they concentrated their efforts on improving performance.

The innovation: The innovative idea came at the Cologne wood and wooden products fair, Interzum in 2007, May 9-12. He came across an innovative product of Danzer Group which creates fine wooden surfaces with an entirely new look that has not been available until now. This new product line has numerous advantages over conventional wooden surfaces and delivers many benefits to customers. There are an unlimited number of individual and exclusive surface designs that can be created with it. Surface patterns can always be repeated in exact detail and with the highest quality although it is made completely from authentic wood species. The new wooden surface brings out the beauty of natural wood in a brand-new way and with a truly unique look. Its new design and innovative manufacturing process, it allows for accurate cost calculation and cost-efficient processing.

The product is God's answer to the Entrepreneur's prays and he immediately contacts the company's people at the fair for more details. Danzer Group is one of the world's leading manufacturers of hardwood veneers and lumber. The new product resulted from years of development within a global team beginning in 2003. The project involved global efforts and ideas from Danzer Group's engineering, production and sales divisions. In 2005, the first machines and a test line were built. The new division decided to apply for worldwide patents

in the same year and invested in machinery and equipment. The market introduction took place at the Interzum trade fair at Cologne, Germany, in May 2007 after very positive market tests and amazed the entrepreneur. He wants to see the stitching technology but he is not allowed to visit the manufacturing unit.

The idea stands in front of him. Veneering is a rather old technique but Danzer's R&D proved that properties can be improved and the results are amazing. He is in front of a puzzle and breaks it into three parts: technology, processing method and know how. The last one lays on his own ability to study the new product and try. He meets the company that sells the necessary fleece to Danzer and discusses as a prospective customer about the necessary temperatures. He also meets Mrs Kiefer the owner of Furnier + Design GmbH in her stand in Interzum. She owns a similar company and uses some of the techniques of the new product (the pressing process). They are not direct competitors and she agrees that he could visit her manufacturing unit and see the process. The entrepreneur speaks no foreign language and has to pay a translator for all his connections. Trouble appears with his family ("*spending their money for my own benefit*").

Two days later and with many ideas on his mind for a total production of this exiting innovative product and him becoming a pioneer in Greece, Cyprus and Balkans, he flies for Hannover where there is the Ligna happening (May 14-18), the largest wood machinery trade fair worldwide. He wants to find the company that cooperated with Danzer in the machinery sector. Resting at a bar for a coffee he accidentally meets Dr Ntalos, an Associate Professor (At that time) of the Department of Wood and Furniture Sector in Greece who is a specialist on wood product innovation and one of the few specialists in the wood and furniture industry. They know each other since a seminar of the TEI Dept. on colored MDF. They have a long discussion on his ideas and visit together many machinery companies, among which Fischer+Róckle AG. The company develops and markets solutions in the line of veneer preparation, veneer conveying and veneer glue splicing. They arrange an urgent visit at the company's headquarters. Three nights in Hannover the entrepreneur and Dr Ntalos refine the emerging business idea. The new company will finally deal only with veneer stitching, at least for the first five years. The new stitching technology requires fine veneer pieces referring to quality and dimension tolerances and a very accurate know how which would be both very expensive (financial resources were limited) and difficult to be acquired together with the innovative technology. The entrepreneur should concentrate on the entirely new technology of stitching which would give his products added value, but he could also make a better invest of his money on more specialized and tailor made machinery. So the raw material (the ready veneers) would be bought and the search of them would be the next step of this adventure.

He returns in Greece and starts the founding procedures for the company establishment and the business plan in order to submit for the incentives investment law 3299/2004 with the help of an economist and the TEI Dept.

With his wife they visit Furnier + Design GmbH for two days and are shown the factory and the stitching techniques. They then fly to Fischer+Róckle AG for cooperating with the engineers in the machinery's specific changes that would further ensure differentiation. He ensures Cutting to the length ordered by the customer followed by cutting to width or cutting the edges for joining. The double knife veneer guillotine makes the longitudinal cuts on both sides in one operation, guaranteeing an absolutely parallel cut. Knowing the Greek market where standard products do not flourish, insists on flexibility in all three dimensions. The machinery should be also able to produce conventional products. The design process takes about three months and the entrepreneur has to go to the company many times, while he is consulting Dr Ntalos on unexpected problems.

The entrepreneur has seen the final product and learnt the main concept by Danzer and the fleece supplier, had his machinery made by the company that developed Danzer's machinery and watched the stitching and pressing process in Kiefer's factory, but the design and the exact process of the new products were his own area of discovery.

He combines the above knowledge (product field specific and machine -technology) with his long experience on the conventional veneer covering (firm specific) to reach the desired result: unique and exclusive designs from both single or various species, combining extra narrow components. He learns more about veneer behaviour and processing searching with Dr Ntalos (scientific knowledge base).

In Kiefer's factory he was also introduced in new design techniques and in the culture of eco-friendliness and waste elimination. He learns to enter all parts of veneers in exclusive designs. Ecology turns him to further specialization and differentiation.

Waiting for the machinery he follows Dr Ntalos's advice and searches in Internet to find best quality veneers which must further be pure natural and not treated chemically. He visits many suppliers in Spain and Italy and learn far more about innovative products which decides to introduce in the Greek market. An entirely new capital on innovative materials opens for him.

The machinery is installed by the end of November 2008. The entrepreneur starts producing conventional veneer sheets for neighbor companies in small batches, while stresses the production of the innovative product. He has to go on many try and failure routines to succeed in offering a qualitative product. He has to find out alone the right environment and operating conditions in order to manufacture the innovative products he saw in Interzum. He finally produces similar products, quite different in a micro-level referring to specific properties (e.g. sleekness). He goes further and he is the first to introduce the joint of straight veneer sheet with edge trims and the parquet sheet. He manages to offer veneers by using the fleece

(paper) at the back side of the veneer and to achieve flexibility and stability in a better prize and flexible dimensions. Furthermore, he can satisfy any order, while the German company sets a minimum order quantity that is rather prohibitive for the Greek Furniture Industry.

The product was a complete innovation in Greece and innovative in Europe, while the start up would offer differentiation, value added, and new perspectives for its customers while it would not be a direct competitor against the family company.

The founding procedures for the company establishment are time consuming and frustrating. The entrepreneur decides to establish a limited liability company with a sole quota-holder. It is quite fast, it does not require a big initial capital and the partner is responsible till the money he contributes. Assisted by a lawyer and an economist he starts the process through the Chamber, the local Bar Association, a notary, Tax Office, other two law Societies and court of first instance. *"It's a long run and you have to do it by yourself…*" commented the entrepreneur. In order to submit for the incentives investment law 3299/2004 he prepared the business plan with the help of an economist and the TEI Department. Yet, although he cooperated with the National Bank of Greece with almost no problems, the subsidy money have not been given to him yet (2009, maybe due to the political concurrence he notes and continues that in Greece you can never be sure and always expect any kind of concurrences, underlying the extremely turbulent entrepreneurial environment).

Processes / innovativeness: Since then the entrepreneur develops a culture based on development. He counts on the veneers bought by the Italian and Spanish companies. Without them he cannot succeed in applying his innovative stitching. *"Although my initial plans were to produce the veneers – as we did in my father's plant- after realizing the know-how these fine surfaces demand and the R&D needed to innovate, I found it better to see them as an input*" he mentions.

The entrepreneur counts on the cooperation with both the Department of Wood and Furniture and a number of designers (some in Larissa and two of Thessaloniki). Twice a year meetings are held on matters of technology, production, design and marketing. Several new products mainly of design and eco-friendliness have been prepared after try and error processes during 2009 and 2010. Regarding new products there is a large number on wood veneers and marquetry inlays produced. He visits the two biggest trade shows on material and machinery attends all supplier seminars on new material and has accepted to be a pilot plant for innovative material processing. He meets consumers demand for the beauty and quality of genuine, high-value wood procured according to the highest environmental standards: natural surfaces offering uniform high product quality and consistent availability. He offers every year new designs and a wide variety of applications, opening up new decorative applications that never before seemed possible.

Trying to make a list **of knowledge bases** one can note wood processing technology, wood behavior science, chemistry, mechanical engineering (cutting, pressing and processing), chemistry (glues), material engineering and design. He establishes an open dialogue with architects and designers all over Greece which brings both ideas and customers (hotels, banks etc).

Market Catalysts:

- A saturated and mature wood and furniture market where the already small market share is becoming even smaller due to the increase of imports (both of cheap and value – added products)
- The very own size of the Greek market
- The lack of relevant products in the region of Thessaly (before the innovative idea)
- The problematic use of the convenient products.

Determining factors

"There is no help by the state, although we hear too much about helping innovators… Both the subsidy delay and the economic crisis in Greece bring trouble to the newly established company which tries to stand on its legs with no mother help." The entrepreneur seems a little disappointed. *"I have brought something completely new and customers hesitate to use it considering it expensive. On the other hand we heard too much about state support to innovators……".*

The coincidence of the economic crisis and the first steps of the enterprise hindered a dynamic entrance of the innovative products. The market he enters is mature and intense, with fierce competition on price, but he succeeds in finding a promising niche. Yet, the sector culture (mainly furniture makers) is a strong barrier to differentiated products.

The small market of Thessaly Region is also negatively affecting sales and has lead the entrepreneur to start e-business and marketing all over Greece and abroad, although his first estimations were that his production would cover the local market, since Thessaly is third in furniture manufacturing in Greece (after Attica and Thessalonica) and close to Thessalonica.

Increase of imports (both of expensive and cheap furniture) affects his production due to the decrease of furniture manufacturing.

The stagnancy of the building sector has the same negative impact as mentioned above (architects, decorators, building companies and the relevant jobs (i.e. doors, floors, cupboards, kitchen etc. they offer). On the other hand: The general trend towards environmentally friendly products and innovative materials is a good opportunity. Big companies in Athens and Thessalonica start working with WCo1. The company's site is improved, while he is waiting for a pin number to start e-business.

Corporate strategy: The entrepreneur mentions **that his competitive advantage** is

innovation, eco-friendliness and flexibility in design and batch size. But he goes further stressing the need of efficient marketing in order to make his products known and show their real uniqueness. Till now, besides the site, he is advertised in the sectoral magazine *Epipleon* and has visited a big number of furniture companies (mainly around Larissa) to promote his innovation. He has asked the help of the Laboratory of Marketing, Management and Economics of the Wood and Furniture Department to consult and assist him in the company's promotion in Greece, Cyprus and globally.

The entrepreneur is using internet in order to capture global trends and innovative technology. Still, he mentions that time is not good to invest in further verticalization.

Implementation

"Solving technical problems posed to us by architects mainly from Thessalonica and selling the products in better prices than imported products opened the market to our innovative veneers. In parallel, market and economic constraints led to conventional production for furniture companies". In August 2009 the company realizes its first important order for a company that produces MDF and novopan in Thessalonica. Since then the customers become more and come all over Greece (mainly Athens and Thessalonica), Cyprus, Balkans and there is some interest by Indian companies. He also offers turn-key solutions engaging in architectonic projects (e.g. a hotel on some island and the bank). The entrepreneur tries to capture customers from furniture makers to project developers stretching either design or production flexibility and eco friendliness next to the benefits of his innovations.

Besides the short production period, the company has got a real dynamic. The Marketing Lab of TEI considers is a matter of time and promotion quality in order to make the new product desirable. The entrepreneur uses TEI reports on market research and is also consulting TEI on many subjects. He is also among the first of the industry to enter the cluster established by the Department of Wood and Furniture of TEI Larissa.

The entrepreneur is the main actor of the play. He uses his knowledge and deep experience in order to find, collect and mix the relevant knowledge bases (know –how, materials, markets). His main sources are trade fairs, company co operations (material and equipment suppliers and future co-operations in importing similar products), the Department of Wood and Furniture, sectoral magazines, seminars and internet searching. He has not established any kind of mechanisms. He is not afraid to run his own experiments assisted by specialists and cooperates with architects to find better designs and combinations. He has set his vision and priorities and this are: constant differentiation and innovation, quality, flexibility and aggressive marketing.

One can detect a strong need for achievement and reputation improvement since he has to prove that not only can stand alone away of the family company but can also do it better.

Additional Notes

The entrepreneur thinks that a main problem that hinders innovators - entrepreneurs is the uncertainty of finding a promising market. *"If an already established company hesitates to enter a new product into the market due to consumers' hesitation, think about the entrepreneur who invests his money and hangs up his own life on something new to the market! You can never be sure that it will sell. Of course you have done the market research. When investigating everybody seems happy with your idea, but things change when they have to pay the value added due to innovativeness".*

The costs of innovation are also higher if one tries to establish a company, since it go together with the foundation ones. "Business plan changes all the time. You start with some idea and then you find something better or a barrier that is too difficult to overcome. Everything is liquid…"

The entrepreneur pointed out decidedly negative political factors such as: high costs, particularly labor costs and taxes and an inflexible and restrictive state bureaucracy

The main barrier that the entrepreneur had to confront was the cheap conventional products sold by well-established big companies. *"Nobody in the area of the furniture sector (which I considered my main customer) seemed willing to pay the extra money. There were many excuses: the crisis, the final consumer could not tell the difference, the price of the conventional products was too low etc."*

At any case the entrepreneur was sure that it was a temporary reaction, since nobody questioned the innovativeness, the quality and the surplus value of his products. Furthermore it is quite clear that customers' wish shapes the market but sometimes innovation is too far away from them. *"There was no hesitation about my veneers. They were all excited and I needed no words to understand it. I could see it. It was just a matter of money and I would say of culture, You know, in our staff (the Greek Furniture sector) people think foxy – why give the customer something he/she does not ask for… That made me think that I should "educate" Greek ladies (the most important final target group)…"*

Discussing with the entrepreneur reveals a dynamic man, with creative thinking and a tendency to learn and exploit knowledge, innovativeness, locus of control and a tendency to high risk.

WCo2 case study

Summary
- Legal form: SA
- Year of foundation: 1981 / 2004
- Number of employees: 126 full-time (2008)
Educated staff: 13
- Located in: Grevena
- Product families: 5- MDF raw, MDF coated (veneered) – continuous process production, laminate flooring, MDF lacquered, melamine (chipboard and MDF) – medium volume production
- Major customers: furniture makers in Greece and abroad (Albania, Cyprus, Fyrom, Jordan, Saudi Arabia, Egypt, Malta, Romania, Iran and Turkey)
- Major suppliers: wood processing and impregnation suppliers, hi-tech machinery (constant investments), glues, colors
- Sales' structure: local 2%, national 73%, Europe 25%
- Founders: two with the one to be the champion
-Patents: yes
-Trademarks: yes
-Awards: yes

Object of investigation

The case was suggested by the Department of Wood and Furniture Design and Technology (WFDT), TEI of Thessaly, Greece. The author belongs to the Academic Staff of this Department. Its Academic Staff can be considered experts in the Industry and participate in almost all innovative and knowledge-based activities of relevant firms in Greece and Cyprus while they are acquaintant with the most known research institutes and Wood and Furniture Technology Universities in Europe.

There were three interviews contacted: one with the entrepreneur which lasted about 4 hours; a second one with the Group CEO four days later which lasted around 3.5 hours and the third with the CEO of WCo2 in Grevena which lasted around 4 hours with a visit to the plant to follow. It should be mentioned that WCo2's facilities as well as the other plants of the Group are places of visits of the WFTD Department's students. Additional information has been conducted by phone-calls and regular visits as well as by the company's internet website and customers.

WCo2 is located in the Community of Mavranei, 7 km away from the city of Grevena, in a privately owned site covering 107.000 m2. On these grounds, there is a 26.054.89 m2 building which houses the administration offices and the company's production facilities. After having invested in the increase of productivity, an investment that was completed by the beginning of 2009, the unit is able to produce 120.000 m3 of raw MDF per year. With full modernization and the addition of 4 new production lines, the quantity of raw MDF produced, can be used to the production of Veneered, Sanded, Lacquered and Clicked Laminate Floor.

Basic Products: WCo2 officially started the production of MDF and veneered MDF in April 2006. Today, it produces 6 groups of products:

MDF (raw), Veneered MDF, Sanded MDF, Laminate flooring (clipped), Lacquered MDF, Melamine

Competition: at the time of the interview (2010), there was another Greek company that produced MDF. However, today (2015), WCo2 is the sole national MDF producer. Imported MDF products constitute the competition.

The entrepreneurs and the parent company

1981: Two friends (and relatives by marriage) found a small furniture company in Larissa to serve the local market. Mr A (the champion) had finished carpentry at a technical school in Australia (similar to the Greek OAED). When he finished school, he worked as a carpenter in a relevant factory for three years and then he opened his own business in Melbourne. After six years he returned in Greece and opened the furniture micro-company at their neighborhood. The second entrepreneur had nothing to do with the job (he was a builder).

1984: In the following three years, the small firms will present a remarkable progress of the company which had now 3 more employees. Meanwhile, Mr A noticed that MDF while one of the most consumable raw materials in Australia was unknown in Greece. This observation and the prosperity of the micro-carpentry leads to the expansion of the production to veneer coated MDF and chipboard. The facilities are located in the 10th km of Larisa-Kozani and cover an area of 14.874m2. By then, the two big wood processing companies (which do not exist anymore today) worked with novopan and did not believe in the potential of MDF. Word-of- mouth and the very good relations of the two entrepreneurs supported the spread of the MDF products in Thessaly

1991: The firm changed from a partnership to an incorporate company by the name "Thessalia Woodtechnics SA" since the initial target was the Thessaly region. At the same time, the company is divided in two functional departments: the industrial wood processing and the furniture one (today this second department runs as a furniture showroom, situated in Tirnavos and covering an area of 10.000m2. Its main aim is the selling and distribution of Greek and imported furniture not only to the local market but all over Greece).

1997: The constantly growing demand for the new products resulted to the relocation of the production force to ultramodern facilities of 26.600m2 in an area of 42.500m2 at the industrial area of Larisa. The firm occupied then around 35 employees and in October of 1999, the company acquires its current name

2000: Since August of 2000, the firm takes action in the industry of chipboard and veneer production, purchasing a relevant firm (listed on the Bulgarian Stock Exchange) located in Varna, Bulgaria while it invests $7.5million to the renovation of the facilities, automating the

production lines with cutting-edge technology.. The industrial buildings cover 46.600m2 in an overall surface of 265.000m2.

2001: On February 27th, the firm is certified with ISO 9002. In May, during the program "Thessaly Innovation Week RIS + 2001", it receives the award "Innovation in the Production Process" of the Ministry of Development.

2002: In the beginning of 2002, the new melamine production and natural wood streaming & drying lines are being initiated at the plant of Larisa Industrial Area. At the same year, the company founds a corporation for treating wood in Ioannina,. Aim of the new company is the increase of the market share in Epirus.

2004: In February, the small firm from Larissa with the exciting growth takes over the company a bankrupted wood processing company in Grevena. Mr A, was the best customer (according to his sayings) as long as the company had been working. This is the case WCo2 which will become the sole MDF manufacturer in Greece, contributing to the growth of both local and national economies.

As a client, Mr A visited many panel suppliers in Greece and abroad. He would always as for plant visits. He narrates: "*As a client I tried to visit all relevant plants of the planet! I needed to know everything. It took me* ***about a decade*** *to create and realize my vision…At the end of the visit I would devote time to write down what had impressed me during the tour"*. He would also visit most of the relevant trade shows in Europe. He confesses that it was his dream even since he established his micro-carpentry to found such a panel business:

> *"It became the most modern plant in the world. Actually this was a bet, my bet. You know, when I visited Interzum in Koln in 1983, as a very small company I was disdained by some German…"*

The entrepreneur went on trying to broaden his knowledge on wood and its products and keep in pace with the developed technology all these years. He established a good relationship with some professors of the WFDT department.

His executives talk about his deep knowledge for the whole value chain. *"He started as a furniture maker; so he knows the needs of WCo2's customers. He knows panel production extremely well; he started the business back in the 90s and since then he has search the issue very well… If Mr A. sees a panel, he knows immediately where it can be used and how it will look as a finished product!"*

They talk about a man with "the gift": "*He has his own rules - that is just a more complicated way of thinking or I don't know. If I knew I could be an entrepreneur myself ... maybe….*" *(General Director of WCo2)*

The innovation: The initial target was the creation of the most modern MDF plan on earth. The process innovation that made WCo2 famous around the globe was an accidental observation of Mr A during installation regarding the gluing process of the MDF pieces. This

lead to a series of technological and process innovations, sealed with a patent and global recognition.

Innovation/Entrepreneurial process: The entrepreneur of WCo2 grasped the opportunity to buy the bankrupted plant in 2004. It was a time of buoyant economic activity and intense construction activity. MDF was only imported, while government would support the entrepreneur's developmental plans. Against the business plan as prepared by the financial department which suggested to follow the practices of the established plants in Europe, Mr A makes his own plans to enhance flexibility which was translated in the development of new machinery. *"If he had accepted the suggestion of the executives, we might have failed*" says the Group CEO and continues *"Well, after the positive outcome of the techo-economic study, Mr A's business acumen come; innovation of the new product of WCo2 was necessary and would serve mainly as a market "crier"*.

The entrepreneur cannot find "that innovation" from the very beginning. Thus, he bets on the cutting edge technology. In order to realize his dream for the most modern MDF production unit globally, the entrepreneur engaged 20 machine manufacturers of various fields, which were ranged as global leaders in specific technologies to co-operate under the guidance of a leading consultant international company (Swendish METSO) to produce "*his technological miracle"*.

All major technologies are developed mainly by **twenty** machine manufacturers and technology providers from seven European countries and USA; Greek companies are used for supportive constructions and ICT solutions. The entrepreneur strategically chose to work with a very limited number of former employees of the bankrupt plant and none by mother-company, while the two entrepreneurs were the only links among the mother and the new company. They engage engineers from Grevena preferring the ones with at least a Master. The entrepreneur states it quite clear:

> *"I believe in constant development. Every new piece (explanatory note: new venture or SBU) is unique for me. It is quite wrong to mix the habits of your mother company with the new one. This is why I choose new, "fresh" members for the new companies. These people have a different attitude; they are not boxed in the everyday routine of the mother company"*

All machine and technology providers are obliged by contract to oversee installation and train the local engineers. Some of the trainers (mainly from Germany, Italy and Sweden had to stay about two years).

Innovation comes up incidentally; trying to solve some trouble on a production stage, the entrepreneur had an idea that created the patented innovative process in MDF production. Major benefit is the decrease in the Consumption of Glue and Wood (glue blender), saving 1.600 tons of glue and 4.000 tons of wood per year for the company and making the whole

process friendlier to environment (less formaldehyde in the E1-type panel and lesser quantity of wood per MDF cubic meter). Furthermore, melamine produced by WCo2 brings up the challenge of modularity and variety entering ecological aspects in an artificial product.

"That innovative technology came out after our disagreement with the German manufacturing company. We insisted on what we wanted but tried to find alternative ways; we turned to a Greek manufacturer. It was actually a bet. Later the German company asked to use our technology. We had no problem to reveal our secrets, since we are no machine makers!"

This impressive operation ended with a patented MDF production technology which had cost more that 70 million Euros. Melamine produced by WCo2 brings up the challenge of modularity and variety entering ecological sides in an artificial product.

"We have changed the Greek market! We invested in flexibility and try to discover needs of the Greek market."

Market entrance: Against conventional thinking, the entrepreneur of WCo2 took advantage of its innovative process to become worldwide famous by ***revealing his secrets*** to global competitors; a rather unorthodox idea! He organized a campaign around it, inviting all interested in the specific innovation. He himself explained his novelties to the most important multinational melamine producers of the world. CEOs of American, European and Japanese companies visited Grevena to see the novel technology (see Archive in the end). That was the entrepreneur's way to enter the world of global leaders and to "*become one of those, who make the rules of the game... The plant is open to everybody. It is a way to build new contacts and relations, to exchange knowledge… This networking is driving me today in USA's market"*.

Appropriability Strategies: A patent, and **r**egistered trademarks. There are also appropriability contacts with some of the employees but they have been never activated. However, the entrepreneur is revealing its secrets to everyone who asks about it.

"I gave the technology to them. I will have more novel ideas. This is a way that we became famous. This is how they all visited our plant!"

Knowledge bases: wood processing technology, wood behavior science, chemistry, mechanical engineering, chemistry (glues), material engineering, market analysis, business management, environmental engineering, constructions

Financial resources: Investment Incentives *Law 3299/2004 (45%). The investment started from 30 million Euros to reach 70 million Euros. Private capital and loan*

Suppliers, University and Research Institutes: besides the raw material suppliers mentioned in the Summary, collaboration with the WFDT Department and Chemical Industry

(new technology produced by Chimar[365] resins. However, much knowledge and know-how comes from the various companies which develop specific technologies as e.g. for energy saving. WCo2 invests mainly in technological knowledge to intervene in innovative ways to known processes increasing productivity, incorporate ecological aspects, achieve energy savings, and recycling. In all cases learning comes besides conscious knowledge generation, through trial and error and experimentation. There are well established and long-term relationships with suppliers and a constant knowledge exchange ; WCo2 is further a pilot user of many of the suppliers' innovations.

WCo2 caused significant changes mainly at national level. It became the first Greek company to produce MDF in Greece (all imported by then) by additionally introducing novel production technology (patented innovative process) and flexibility in final products (pioneer at least in Europe).It also created new business (e.g. laminate flooring), new (local/national) suppliers of raw material, and changed the home produced/imported MDF balance since till its establishment, national furniture and other woodworking producers could buy only imported relevant raw material. The company achieved a share of more than 20% in the second year of sales, while the bigger competitor, a Swiss-Greek company, had achieved a share of 11% (ICAP, 2008).

Institutional: Besides its own aspiration the entrepreneur and his team considered the positive environment for the investment; the vigorous signs of growth of the building sector, due to a general climate of prosperity in Greece of 2000, a positive political and economic environment for investments, the Olympics 2004 and the flourishing of the construction field together with the fact that there was no direct competitor (besides imports). However, bureaucracy is considered a significant problem (mentioned by the entrepreneur and the Group CEO). They both highlight the importance of personal relationships with members of Ministries and other public services.

Corporate strategy: One of the main strategic aims of WCo2 involves the updating and making the most of the new technologies, as well as using more effectively the resources and staff. The ultimate goal of this strategy is the advancement and, consequently, competitiveness. WCo2 aims at providing products that are:

• consistently high qualitative

• competitive

• covering a broad range to meet complex and special requirements

[365] Chimar Hellas SA is globally active in the field of chemical products dedicated for the production of wood-based panels (particleboards, fibreboards, plywood, OSB etc)
http://www.exportleaders.gr/en/index.php?about=3&id=10

Processes/ innovativeness: WCo2 turned mainly to technical innovation and excellence but this was followed up by parallel novel strategies such as a vertically integrated business model in cooperation with the rest SBUs of the sector and flexible just-in-time production which is very unusual for the specific subsector. The entrepreneur states that "*Development is supported by good relationships"* and has established a plan of meetings with all value chain partners at different levels. This strategy led to multilevel construction team approaches focused on specific interests. The team uses the "*open books*" method (term provided by the entrepreneur) meaning meetings on various subjects such as problem-solving, knowledge diffusion and information sharing. Company's motto is "high-level extroversion"**.** This is done per company sector for shop floor employees and at executive level.

WCo2 invests on **aggressive technology and NPD almost every year** by parallel investment in innovative technology; the company produces new products and improves the existing ones in regard of quality, appearance, new characteristics and properties as well as novelties in production engaging green technologies for saving energy and protecting the environment. More specifically**:**

By the end of 2006 a *new product*, lacquered MDF enriched product portfolio advancing quality of innovative products. It is *further improved with printed designs.*

In 2006-2007 the company invested on a *new ultramodern production line* of laminate flooring which, until that moment, was an exclusively imported product. At the same time, a new unit for veneer jointing is taking effect while the logistics system is enlarging to cover 4.000m2. Additionally, new spacious offices of 300m2 are inaugurated.

By the end of **2008** the company *buys the technology of Heat Regain System* with Direct Use of Exhaust Fumes in the Fiber Dryer, becoming **a pioneer in Greece and Balkans.** Additional innovative solutions have been applied during erection. E.g., within the context of the specific systems, the company stores in silos the wood sub-products that are discarded during the *production process by the use of an integrated suctions system*. Thus pollutants such as micro-particles are nullified and their highest possible quantity is used as fuel. This investment saves energy and money and protects the environment. The company also introduces *a new R&D product the fire-resistant MDF* (90 minute resistance which is under certification by a relevant European Organization – the new properties can save lives in case of fire)

In **2009** WCo2 invested further in the *increase of productivity* (8.000.000 €), with full modernization and the addition of 4 new production lines (unique in Greece and Balkans), in order to produce 120.000 m3 of raw MDF per year.

In parallel it develops innovation in logistics and ICT and invests further in increasing productivity and entering markets abroad.

Processes regard also **market and technology research**: regular meetings follow international trade shows (mainly Italy and Germany) to discuss market shifts, technology advances or the adaptation of best practices. WCo2's departments follow the rule of gathering both bottom-up and up-down information which is diffused in regular meetings. The marketing department performs organized market research at European level. (However, the two executives mention the tendency of the entrepreneur to stick to his own ideas no matter the market analysis and according to their sayings he succeeds in whatever he suggests even if it is against the analysis' results).

Although there is a written process regarding customer feedback, it is not followed since, according to the interviewees, the responsible people for this process never manage to follow the exact process.

WCo2 invests **on training**; there are several in-house courses on wood technology, energy saving logistics etc. The entrepreneur dreams of a sort of internal learning school "to train people on wood engineering but on an empirical basis. I mean to focus on technology knowledge and operation-level knowledge."[366]

The company adapts the policy of buying novel technology; this means training by the manufacturer. However, since they are pilot users they encounter problems which cannot be directly solved be the manufacturer; the two parts co-operate and use try-and-error to solve problems. The company has also co-operated with competitors in Europe to solve problems on novel technology.

From the archives:

ΞΕΝΑΓΗΣΗ ΔΙΕΘΝΩΝ ΚΟΛΟΣΣΩΝ ΣΤΗΝ [redacted]
3/6/2009

Το ενδιαφέρον Διεθνών Κολοσσών προσελκύουν τα επιτεύγματα της [redacted] ακόμη και μετά από δύο χρόνια λειτουργίας. Πρόσφατα, στελέχη της εταιρίας FINSA από Ισπανία (ένας από τους μεγαλύτερους Ομίλους της Δυτικής Ερώπης) επισκέφθηκε τις εγκαταστάσεις τις [redacted] στα Γρεβενά. Λίγο, αργότερα τον Όμιλο επισκεφτήκαν οι εταιρίες SCHNEIDER και DIEFFENBACHER . Κύριος, σκοπός και των τριών εταιριών ήταν η ενημέρωση τους για τις νέες τεχνολογίες που εφαρμόζει η [redacted] στα Γρεβενά, δείχνοντας ιδιαίτερο ενδιαφέρον στο καινοτόμο σύστημα της χρήσης του μηχανικού αναμικτήρα της κόλλας (mechanical blender) με το οποίο εξοικονομείται ενέργεια καθώς και συγκολλητική ουσία.
Στη συνέχεια ακολούθησε ξενάγηση στις καινούριες γραμμές παραγωγής του εργοστασίου , όπως γραμμή μελαμίνης , στη γραμμή printing line , που παράγει το MDF Λακαριστό, και τέλος στη γραμμή δαπέδων laminate μοναδικής στην Ελλάδα. Οι επισκέπτες είχαν την ευκαιρία να εμπλουτίσουν τις γνώσεις τους με την επίδειξη των νέων εφαρμογών και μοναδικών γραμμών παραγωγής που έως τώρα εισαγόταν τόσο στην Ελλάδα όσο και στα Βαλκάνια.

[366] This is something very usual in large manufacturing organizations at least in Germany according to the author's knowledge. People trained to be employed are called "Lehrlingen" (industrial trainees)

WCo3 case study

Summary
- Legal form: Industrial and Commercial SA
- Year of foundation: 2007
- Number of employees: 10 / now 14 full-time
Educated staff: 3
- Located in: Karditsa
- Product families (I) kitchen furniture (II) wardrobe furniture
- Major customers: retail furniture shops
- Major supplier: wood processing companies (Akritas – Greece, Engels – Austria), manufacturers of kitchen components (Italy)
- Sales' structure: local 10%, national 90% (mostly north Greece)
- Founders: 5 friends
-Patents: no
-Trademarks: yes
-Awards: no

Object of investigation

The case was suggested by the Department of Wood and Furniture Design and Technology (WFDT), TEI of Thessaly, Greece. The author belongs to the Academic Staff of this Department. Its Academic Staff can be considered experts in the Industry and participate in almost all innovative and knowledge-based activities of relevant firms in Greece and Cyprus while they are acquaintant with the most known research institutes and Wood and Furniture Technology Universities in Europe.

Interview with the entrepreneur lasted about 2.5 hours with a visit to the plant to follow. Additional information has been conducted through articles and papers and further information on the firm's events mainly by internet sites. The researcher keeps contact with the entrepreneur and has co-operated with the entrepreneurs during the foundation stage, preparing the newly established firm for the ISO 9001:2008 certification.

WCo3 was created in 2007 having lots of expectations and a great vision for the future. The new firm has managed, within a small amount of time and in the beginning of hard times for Greece to grow in the field of furniture manufacture, and especially in the fields of manufactured kitchen and cabinets. It owns modern buildings of 4000 sq. meters, located at the Industrial Area of Corgovites, Karditsa, within a 10 acres plot.

Aiming at high quality, full service and at strictly following deadlines (as a core competitive advantage based on modular design), the entrepreneurs have invested in latest technology equipment of great potential and productive ability as well as fully experienced and trained personnel. In order to offer products of high aesthetic, modern design, constant quality and high ergonomics, the founders tried to follow *"the Italian way"*. The firm is certificated with ISO 9001:2008.

Basic products: Kitchen and Cabinet furniture. Since May 2013 our company has been offering complete proposals for hotel room furniture

Competition is severe with many local, national and imported products to compete WCo3's products and quality. A point of differentiation is the fact that WCo3 does not address the final customer but sells to retail furniture shops (and lately to hotel constructors). The company did very well in the crisis years 2011 -2012 and keeps working quite satisfactorily despite the crisis.

The entrepreneurs: The initial founding team consisted of five people. However, two of them were only investors. During the foundation stage the two abandoned the effort. The **t**hree remaining entrepreneurs of the same city with a ten year experience in the kitchen sector. More precisely, two of them had finished the Department of Forestry (TEI of Lamias) and they were selling mainly Italian (imported) Kitchen and cabinet furniture for more than ten years. The third partner was a carpenter.

The Innovation: Innovative production model and actually a combination of Italian *distretti industriali* (cluster) and modular design, a new process based on Swatch's modular design model, customized solutions in production and organization, flexible automatization and IT solutions for the modular design and production, acquisition of innovative equipment (first to install M80[367] machine).

Innovation/Entrepreneurial process: Working with Italian for more than ten years, the entrepreneurs located the strengths and weaknesses of both the Italian and the Greek sector; the high quality of solid cabinet doors (top quality according to the interviewee and to our own opinion), as well as the finishing and stain processes and the use of cheap material in the interior pieces of the cabinets an drawers for the Italians. On the other hand, Greeks would use expensive material according to specific orders (from the customers) inside, but they could not manage to produce uniform pieces, could not reach top quality in finishing and were almost never able to follow deadlines. Furthermore, the entrepreneurs estimated that imported Italian kitchen was of high cost for customers due to the transportation costs since the transport companies charge on volume and not on "quality".

The ***strategic decision*** was based on the motto "Throw the Italian middle class kitchen in the sea!" (Note of the author: this reminded me of the "Maru C" motto of the Komatsu company when they decided to become global and take a major share of Caterpillar's market). The entrepreneurs listed the most important problems for this move and made the strategic decision of total verticalization of the production line: but for a one-digit number of middle

[367] A novel type of machinery

and large wood product producers, there are no small kitchen and cabinet firms in Greece that are totally verticalized:

"We wanted to verticalize but our budget did not allow for it. We turned to other companies for cooperation. But that is rather impossible in our sector. There are many companies that work as subcontractors but they do not guarantee either uniformity or consistency in deliveries... Doors seemed closed for our initial concept. Still, we did not want to become "a conventional company". Being former representatives of Italian kitchen furniture, we knew their way. I mean distretti industriali".

In order to find the best model to satisfy the pre-conditions mentioned the three entrepreneurs visited many plants in Italy since they were their customers and were many times invited. They were surprised to find a complete different way of producing *"Their firms were completely different! Each plant is like a small storeroom… The state's support was also evident! We went to Milan, the cluster area and then to the Pesaro industrial district. Most of our Italian suppliers' suppliers were there. We came in contact and we asked to become customers of their products in order to produce the kitchen and cabinet furniture ourselves in Greece instead of buying them from their Italian customers. This would be outrageous for Greeks, but the Italian culture fits this policy; however they are quite hesitant with distance. Ok! Pesaro is very close to Ancona but we are not close, are we?"*

Knowing almost nothing about clustering, the entrepreneurs approach the WFDT Department educational staff who since 2006 made significant efforts to create furniture clusters in Greece and Cyprus[368] . There were certain question on the distance problem. We decided to participate in the cluster but we had to solve the distance problem which was actually significant for our delivery times. This problem was solved by developing modular design in our sub-sector supported by the academic staff of WFDT Department. We (the TEI team) used the SWATCH example in order to develop the method but we had to further be creative in order to apply it in the kitchen production case. "*Modular design solved it (i.e. the distance problem), creating the problem of the production line. All of these problems while we were accepting orders and working in unconventional ways!*"

The entrepreneurs invested in innovative technology to suit the specific purposes**; production technologies** had to incorporate flexible automatization and IT solutions for the modular design and production in combination with the cluster mode were not usual and had to be developed. This was achieved in co-operation with cluster members exploiting knowledge

[368] indicatively,
http://www.wfdt.teilar.gr/papers/epipleon/82_Karagkouni_kai_Papadopoulos_Cluster_EPIPLEON.pdf

and experience. This was a further reason that WCo3's entrepreneurs entered the Italian cluster; the matter of distance to machine manufacturers:

> *"In Pesaro all stakeholders are close to each other. They share knowledge and experience and can experiment. We have no manufacturers here. As members of the cluster we managed to have their assistance and expertise. We were members of the family. Otherwise this would be very difficult. We are not [WCo2] or [WCo9]; for these companies, manufacturers would rush to find technical solutions to their inquires"*

Discussions on the new model went on for three months. Then it took five months (working 24 hours a day, according to the interviewee) to install the production line. Several parts of the production line were custom-made while they were the first to install M80 (edge bander*). "However, we had to change the technical designs a lot! There were many unknown novelties for the manufacturers. And then it was N. (WFDT Professor). He supported all these novelties, he taught us, he consulted us where to place each machine."* WCo3 in co-operation with *WFDT* crated a new program for the cutting machinery since its own program did not suit the new purposes. The interviewee remembers that the machine manufacturers were impressed to hear that their production technology concept was based on SWATCH concepts.

Market entrance: In 2008 WCo3 was famous as the Italian firm in Greece; they conquered the Thessalian market and stretched to the rest of Greece too. *"We sell to retail shops. The fact that we were active members of an Italian cluster enhanced our status within the market. They also used it when selling to their customers because we – the Greek – believe in the power of the Italian brand, whether it is furniture or cloths. We think it of high quality. Actually, we had not thought of it! It just emerged as the best of publicity for us!"*

Appropriability Strategies: Registered trademarks

Knowledge bases: Knowledge came mainly from the cluster members and consultants and the TEI academic staff. *"The co-operation years in the cluster was an excellent school for us! Thin about us! We were nothing but carpenters and kitchen sellers from Karditsa who aspired to reach Italians!"* ***Sources:*** Wood processing technology, industrial engineering, logistics, cluster management, mechanical engineering, automatization.

Financial resources: own resources, loan and a subsidy (investment law, 40%). The investment was about 3.600.000 Euros.

Suppliers: as mentioned in summary

University and Research Institutes: So far WCo3has mainly collaborated with the WFDT Department

Institutional: The entrepreneurs complained about the dysfunctional state mechanisms and public services which sometimes cause vital delays for the new firm's development. By the time of the interview (2010), they had not taken the subsidy money (application in the first months of 2007). They also complain about the behavior of the public servants when applying for the subsidy *"Who are you that you dare say that you will throw away the Italian kitchen?"* remembers the entrepreneur. (Note; a similar trouble in the case of FCo2) and goes on *"If I had made this investment in Bulgaria or Skopia, the state would be next to me all the time! Then they wander why companies seek other countries for their plants!"* They also focus on the importance of personal relations to people working in such positions. They refer to the assistance on several issues by a member of the Association of Thessalian Enterprises and Industries. An additional problem was the fact that they were the very first plant at the Industrial area of Karditsa and encounter problems with accessibility and the electrical power (in combination with the irresponsibility of all those involved).

Corporate strategy: Value for money and quality. Target group: middle class kitchen and cabinet furniture. Accuracy in delivery

Processes/ innovativeness: The novel business model, was initially properly exploited with significant profits but it was later (end 2011) abandoned. After the initial innovations, the company presented nothing new and today it is a conventional kitchen cabinet producer with modern technology still exploiting modularization to achieve flexible production. WCo3's model was to be further studied but the entrepreneurs soon found that difficulties and obligations were too many to go on.

After the return to the conventional business type (one and a half year after the interview), the entrepreneurs sought other markets as well. Regarding processes, one partner is responsible for marketing and sales and the other for the production and technologies. Twice a year they collect their issues, selected information and individual contacts or visits to international trade shows and discuss with the design and shop floor executives in order to make decisions on new products and designs, new materials and new directions (for example the development of the door production line after their involvement in the hotel sector in 2013). Non-scheduled meetings take place in cases of problems.

They do not perform training courses. They keep personal relations with the academic staff of WFDT Department. Two of its students work in the plant (one in CNC programming and one in plant management and quality control)

WCo4 case study

Summary
- Legal form: Ltd
- Year of foundation: 2003 – START 2006
- Number of employees: 11 full-time / start with 8
Educated staff: 4
- Located in : Grevena
- Product familes (5) panels, flooring, sawn timber, glue – laminated products (mostly 3-part), decorative parts
- Major customers: furniture/stairs / frames and flooring makers (Interscala, Labrakis)
- Major supplier: Timber co-operatives (local), glues (Europe), timber (USA – Canada).
- Sales' structure: 100% national
- Founders: two brothers following the family business
-Patents: yes
-Trademarks: yes
-Awards: no

Object of investigation

The case was suggested by the Department of Wood and Furniture Design and Technology (WFDT), TEI of Thessaly, Greece. The author belongs to the Academic Staff of this Department. Its Academic Staff can be considered experts in the Industry and participate in almost all innovative and knowledge-based activities of relevant firms in Greece and Cyprus while they are acquaintant with the most known research institutes and Wood and Furniture Technology Universities in Europe. Interview with the two entrepreneurs lasted about 3.5 hours with a visit to the plant to follow. Additional information has been selected mainly by two colleagues of the Department and internet sites.

WCo4 is a Wood processing industry sawmill, with Drying and Steaming rooms of a 5.000m3 capacity. The firm is located in Grevena, at a 22 acres plot. The production covers 3000 square meters with additional storerooms. The facilities are of cutting edge technology controlled by SCADA and using MIS (Management Information Systems). Wood comes strictly from areas of sustainable forestry management. The firm has developed a constant collaboration with the certified and accredited quality control laboratory of the WFDT Department. It has further participated in research projects of the Department.

Basic products: Beech wood, Pine, Spruce and Oak, drying lumber and special dimensions planning or not.

Solid panels and FJ panels of Beech and Oak (innovative processes).

Solid flooring Oak.

Glued items for parts of windows (innovative products).

Competition is severe with many local, national and imported products to compete WCo4's products and quality and in combination to the Greek crisis. It is worth-mentioning that 80% of the sawn wood is imported! However, the company is a micro-one working mainly at the regional market. The entrepreneurs seem to be satisfied with their performance.

The entrepreneurs: The two brothers have been raised in a wood and furniture business environment. Their father had established a furniture business in 1960 but he abandoned it in 1980 and opened a saw mill. The older brother studied economics and business management and the second Information technology in private colleges in Greece. However, they grew up in the saw mill helping their father; the first one had taken over the general distribution in 1994 and his brother the production.

The Innovation: Biomass from wood and agricultural residues

• Utilization of wood residues for solid fuel production

• Utilization of wood industry waste for innovative glue-lam production

Innovation/Entrepreneurial process: In 2002 (at the ages of 34 and 32) the two brothers wanted to establish their own business in the same sector and contacted Dr Nt. Of the WFDT Department. At that time the professor was preparing a research project which was of interest for the two brothers. However, in 2003, the plant was totally burnt down to ashes. The two brothers abandon their business ideas for an innovative start-up and concentrate on the re-built of the saw mill. This time it would be a modern saw mill which a) could produce products of high value and b) would have the potential for innovation. Father was not involved in the new business effort. The two brothers commented: *"We wanted to change the established traditional was of the old saw mill. We wanted to invest in science and knowledge. We contacted Dr Nt. and we approached the other professors as well for specialized knowledge. We also contacted machine manufacturers who were suppliers of our old company and we knew them. What we had in mind was neither easy nor cheap."*

The two brothers prepared a business plan and applied for the subsidy of the Ministry of Agricultural Development provided by the *European regional development fund, Act 2.2 for* the European Agricultural ... forestry, processing and marketing of *agricultural products*. Machinery was mainly from Italy and Greece. However, the two brothers worked together with the manufacturers to excel the saws as well as to achieve smaller trunk diameters. The plant started pilot production in 2004 with many try-and-error processes. It included a fully automated production line equipped with SCADA systems.

The following year they entered the K-cluster (project of the WFDT Department) in order to start exploring the potential of one of their innovative ideas. This research project lasted two years (2005-2006) and regarded the use of biomass from wood and agricultural residues for solid fuel production (a just emerging trend in Greece by then) and for innovative glue-lam production (3-part glue-laminated wood products with trapezoidal particles, innovation at

least at European level, patented by WCo4*). "We had this idea before the fire. All residues was literally offered to other big panel companies as cheap raw material. Experiments were run by Dr Nt."* Experimentation and control tests are run at the Department's laboratories. However, the entrepreneurs admit that the innovative products did not return the earnings they expected; they blame themselves for inadequate marketing and a bad timing for the Greek market. *"However, we expect that the trends towards eco-based products and recycling will support the promotion of our novelty; it is actually an innovation at least at European level!"*

Market entrance: The firm sold to the same market as before. Regarding the innovative product, there was some effort to approach mainly decorators and architects but it was not well-organized. The chance to use the innovative material in a well-known mansion in Thessaloniki supported their efforts to become known for their innovation in Northern Greece.

Appropriability Strategies: patented innovative product and its technology, registered trademarks

Knowledge bases: wood processing technology, wood behavior science, chemistry, mechanical engineering (cutting, pressing and processing), chemistry (glues), material engineering, design, marketing, business management

Financial resources: *European regional development fund, Act 2.2, K-cluster, bank loan, private capital. The investment was about 2.500.000 Euros.*

Suppliers: as mentioned in summary

University and Research Institutes: So far, WCo4 has mainly collaborated with the WFDT Department for both technology and marketing issues. The company participates in many associations such as the Chamber, the Association of Industries in Western Macedonia, the Balkan Business Center in Kozani, the Panhellenic Association of Wooden Frame Constructors etc.

Institutional: The entrepreneurs complained about the dysfunctional state mechanisms and public services and bureaucracy. *"Too time-consuming! We started in 2003 and the first part was approved at the end of 2005! They all delay while we have paid in advance! That means money!"* They refer to the importance of personal relationships with people in public services. They also discuss the problem of political instability and the fact that there are no public institutes to inform firms on needs, exports and relevant knowledge in Europe.

Corporate strategy: Exploiting the power of wood in regard of processing technologies and in terms of quality. We want to create an eco-innovative image. We target flexibility, differentiation, quality and fast delivery. Costs are always of great importance

Processes/ innovativeness: the firm's policy is to present something new every year. It follows routines on information collection such as attendance of novel techniques seminars, visits to international material and machinery shows and internet. They have developed informal processes of customer feedback selection and elaboration in order to plan new movements. They also get regular information by WFDT Department, sectoral journals and Internet.

WCo4 has further developed processes for regular meetings with designers, suppliers, architects, and association representatives.

There is regular training mainly regarding wood processing technology.

Innovativeness: WCo4 invests in combinations of innovative products and technologies. In parallel with the innovation regarding the use of biomass, they develop a novel idea on limited production of special decorative parts, which is however not totally developed at this stage. This idea combines a novel service with a novel product: wooden "bricks" specially designed in cooperation with decorators on specific projects; i.e. a combination of technology innovation, product innovation, and design and service novelty.

2007 was devoted to productivity increase with in-house innovation on technical parameters and specifically saw geometrical characteristics and ability to produce smaller diameters. The research was once again supported by the relevant TEI Dpt.

2008 was devoted to quality

In **2009** research starts again. Participating in a new research project of TEI, the firm works to build a process of receiving and working out information to group Greek timber according to European norms. The research went on till 2011 and now the company is at the stage of applying for the relevant certificates. The same year an R&D project results on wooden bricks development. They were presented at the most important relevant trade show in Greece in 2010. According to the entrepreneurs, this innovation was possible due to their ability to combine creatively design, cutting-edge technology and the know-how of producing a large variety of glue-laminated products.

In **2010** they enter the BIOCLUS research project in order to further exploit the particle possibility to produce "green" energy. The BIOCLUS project was focused on the sustainable use of biomass resources and aimed at boosting the regional competitiveness and growth in five European cluster regions: Central Finland, Navarre (Spain), Western Macedonia (Greece), Slovakia and Wielkopolska (Poland). The project was funded by the EU seventh framework program for research and technological development. The project was coordinated by JAMK University of Applied Sciences, Jyväskylä, Finland.

But for knowledge and innovation, the plant would be "a conventional sawn-mill condemned to death" (according to experts' opinions as heard in "Building with wood" seminar, 2010, Thessaloniki). The initial innovation effort was multifaceted and spread in many areas such as

quality, production processes, NPD, design, energy and ecology. Thus, the initial competitive advantage was the introduction of innovative sawing technology that enabled more flexibility and quality. The entrepreneurs added novelties in some parts of the equipment.
In 2009-2010 their innovative glue-laminated products encountered for 8% of total production while the novel decorative parts reached a 2%. There **are no competitors** regarding these products at least in Greece.

WCo5 case study

Summary
- Legal form: Ltd
- Year of foundation: 2001
- Number of employees: 8 at the beginning / 16 full-time - 3 part time at peak times / 6 today
Educated staff: 2
- Located in: Kozani
- Product families Light-weight honeycomb for (I) panels for furniture, (II) wall panels
- Major customers: Akritas, furniture makers
- Major suppliers: Gogoulis, Akritas, Alfawood
- Sales' structure: local 2%, national 98%
- Founders: a former furniture maker and a friend of his
-Patents: yes
Trademarks: yes
Awards: no

Object of investigation

The case was suggested by the Department of Wood and Furniture Design and Technology (WFDT), TEI of Thessaly, Greece. The author belongs to the Academic Staff of this Department. Its Academic Staff can be considered experts in the Industry and participate in almost all innovative and knowledge-based activities of relevant firms in Greece and Cyprus while they are acquaintant with the most known research institutes and Wood and Furniture Technology Universities in Europe.
Interview with the entrepreneur lasted about 2.5 hours with a visit to the plant to follow. Additional information has been selected mainly by colleagues of the Department and internet sites.
WCo5 is located in the 1st km of Servia Kranidi (Kozani). Its main product is the honeycomb panel production with a capacity of 50.000 m^3 per month. The company has also a separate trade department where they sell mainly imported furniture. The firm has developed a constant collaboration with the certified and accredited quality control laboratory of the WFDT Department, not only for typical quality controls but for the improvement of production technologies and the development of novel products and processes.

Basic products: Light-weight honeycomb for (I) panels for furniture, (II) wall panels

Competition: None direct competitor at the time of WCo5 establishment. Other types of materials used for furniture manufacturing can be considered as the real competitors in the market where the novel panel tried to enter. Today, imported panels in Greece but with no big success either. There is a significant increase of use in the European and US market.

The patented technology is protected until 2027 in Greece. No similar products have been developed in Greece.

The entrepreneurs: the firm's owner (and his brother) had not studied but they grew up in his father's carpentry which shut down in the middle nineties. By that time, a business investor put money in a new similar business entering as a partner (50%). The business however was not doing well and the owners called the interviewer to manage it. The interviewer had studied business administration and had a long experience in micro and SMEs.

The innovation: creation of panels of lightweight paper honeycomb for furniture pieces and wall construction. First productions for table tops (note: the flat surface of a table). It is about a modern wood board material low in weight and with great stability, which allows creative freedom in design.

It is manufactured by a main core made from honeycomb paper and it has chipboard surfaces in its both sides, which are faced with melamine or veneers. The use of honeycomb paper in the middle layer of the board for the innovative panel manufacturing, results in presenting the product a better relation between mechanical properties and weight. (Suppose you were given the task of designing a new furniture-grade panel, one that was 50% or lighter than those currently available and yet with the favourable characteristics of particleboard or MDF, including appearance, tight tolerances and strength – this product would be the ideal choice). A further advantage is that as the final construct is composed of approximately 95% of air, giving excellent thermal and sound insulating properties, but also absorption capacity of any form of energy

The idea was patented but had no success in Greece. The same idea was much later developed by German companies and honeycomb tables were presented in the most significant international show in 2012 as innovative products (while WCo5 tried to launch them in Greece in 2001)

Innovation/Entrepreneurial process: The main product of the owner's company (before shut down) was table tops with a quite satisfactory clientele. The new company started with the same basic product while the interviewee entered initially as a friend willing to help. *"As soon as I entered the firm I saw the problem; the top tables they made could not offer and type of competitive advantage…. They should either change the production line verticalizing production which meant significant capital and it was out of the question, or try to do*

something innovative which would create a niche market and add value to the business." The interviewee searched in the internet and in sectoral (mainly European) journals for types of innovation. He saw honeycomb which by that time was mainly used in walls and similar constructions in Europe*: "We loved the material and we considered that it will have a future. This was rather intuitional you know, an analysis of our own poor data – what we have seen in the internet and some journals"*

The interviewee found the only honeycomb panel producer in Greece, a fanatic supporter of the product and shared with him the idea of producing honeycomb panels for furniture making. He liked the idea; they worked together on developing the **production technology** and applying for the patent. They had good chemistry; he taught them all he knew about honeycomb. *"He was an engineer (note: in 2010 he was dead) but he stuck with the product. He had discovered it around '88 and spent his whole fortune in trying to persuade Greek carpenters to use it in constructions. He had no luck with it! Greeks do not change materials easily. The 90s and 00s were very good times for construction and wood panel users. Besides most in the sector had no idea on costing. There were still significant problems with technology…"*

The team went on in developing a novel cutting press for the production line (included in the patent). Yet, there were many technical problems which resulted in problematic final products. They contacted the WFDT Department and started a long-lasting collaboration. They had to change even raw materials (e.g. edges and covers). The interviewee claims that they had no money to invest on R's assistance in their R&D (note: R is the producer of honeycomb as a raw material. By then it was the only company to produce it. The TEI professor and the honeycomb panel provider did not ask for money.

Two friends who were cabinet makers offered to try the product during the try-and-error-efforts and provide information on material behavior during the production of the final products and afterwards as a finished installed product. The final product with limited (but still existing) faults was presented at a national trade show in 2005. At this event they also meet the editor of the most important sectoral journal in Greece and stalk about promotion though the journal and other events (note: the journal editors had established then one of the most important sectoral events in Greece on wood and its products). They further met their main supplier and make discussions around their product which lead to an exclusive agreement: *"He would buy the 90% of our product at least for the following five years!"* However, the registered trademark had to go to the customer as well who would sell the product through its own channels. The rest was sold in carpenter that provided wood constructions for shops and other business (hospitals, hotels etc)

The interviewee enterer (officially) the company in the early 2002 as the general director and R&D responsible. In summer 2002 the owner's brother abandoned the company and went on

with a shop of imported furniture in Kozani. In 2007, the interviewee became a 25% partner of the business.

Market entrance: the friends that assisted with product testing were the first customers as well, at the end of 2003. The first use was in cabinet drawers and then in tables and chairs. One of them had established his furniture company in 2000. In 2004 the entrepreneurs tried to sell door-to-door to local and regional furniture makers. The clientele of table makers was the first to use to cover the Greek market. Then, according to the interviewee's sayings, they would choose clients mainly from manufacturing catalogs and with their products as the only criterion: *"We did not check their financial credibility or their potential. I was responsible for this job and I thought I had better visit only those with products that our novel material could cover as raw material! A (the owner) was in the production."* At the end of 2004 the co-operation with one of the two friends stopped. There were many returns up to the end of 2004 due to the technical problems. The interviewee claims further that the fact that the business was in Kozani was a further obstacle for the innovative business: *"We could directly approach 10-15 furniture makers. We had to go to Larissa or Thessaloniki. If we were located in Attica, there would be more potential users in the trial phase and of course more customers."* Then, in 2005 the company found the big customer. However, this company was producing and trading a number of really profitable products. The executives did not pay the due attention the product deserved. *"We hoped that they would experiment with it for kitchen cabinets where we had the most failures due to the humidity existing in the kitchen area. They did not want to invest on know-how development. They further were directed in markets that did not serve our product. Their sellers could not support the product. They were never educated to learn about its competitive advantages and its unique uses. They present it as an alternative material..."*

Market strategy: WCo5 had around a clientele of around 80 customers before the agreement with the big company in 2005. In order to satisfy the new customer, the company kept only 8 customers. After 2006, the firms tried to make new collaborations but with no success.

Appropriability Strategies: patented innovative product and its technology. Registered trademark

Knowledge bases: natural and artificial wood processing technology, polyurethane reactive (PUR) hot-melt adhesives technology, furniture manufacturing, composite materials processing, honeycomb technology. Mechanical engineering, marketing

Financial resources: investment for new machinery around 380.000 Euros. The company entered the EU-GR co-funded program of Woman entrepreneurship using the owner's wife as applicant.

Suppliers: as mentioned in summary

University and Research Institutes: only with the WFDT department. They contacted the research department of the R-company. No agreement due to the high costs.

Institutional: The conditions for success were perfect in the early 2000s: chipboard had made its cycle in 90s and by then there was no direct competitor since R-Company that produces honeycomb as raw material got interested in the Greek market only in 2008. The interviewee blames the Greek state for not supporting innovative business activities at their birth and considers that places in Norther Greece are rather isolated.

Corporate strategy: To enter the novel panel in the furniture manufacturing sector in Greece either as raw material or ready-to-use product.

Processes: there are no processes to identify target market segments, changing customer needs, or customer innovation. The company seems to rest on internet, sectoral journals, WFDT (occasionally) and personal contacts. It appears rather unable to establish long-lasting relations with customers, suppliers or NPD partnerships. According to the narrations of WCo5's entrepreneur all efforts to form any type of collaboration have ended to failure.

Innovativeness: Efforts on eliminating technical problems and improving the production process went on until 2007. In 2008, WCo5 created a ready-to-use product starting with pieces of tables and cabinets. The new products were created to enhance value added and for more differentiation.

Crisis had a negative impact on WCo5 even since its very beginning. In 2008 the entrepreneurs open a new show-room to sell mainly imported furniture in 2008. In 2010 they stop mass production of the novel products and work only specific production orders.

WCo6 case study

Summary
- Legal form: SA
- Year of foundation: 1924 / corporate venturing 2005
- Number of employees: 185
- Educated staff: 13
- Located in: Kalamaki Korinthias
- Product families: Plywood wooden flooring decorative panels
- Major customers: shipyards in Greece an abroad, constructors, traders
- Major suppliers: certified wood and panel suppliers,
- Sales' structure: 50% national – 50% exports (up to 70%) main countries: Holland, Italy, Germany, Switzerland and USA
- Founders: two cousins following the family business, Okoume logs from West Africa, glues from BSF (eco-glues free of formaldehyde included)
-Patents: no
-Trademarks: yes
-Awards: yes

Object of investigation

The case was suggested by the Department of Wood and Furniture Design and Technology (WFDT), TEI of Thessaly, Greece. The author belongs to the Academic Staff of this Department. Its Academic Staff can be considered experts in the Industry and participate in almost all innovative and knowledge-based activities of relevant firms in Greece and Cyprus while they are acquaintant with the most known research institutes and Wood and Furniture Technology Universities in Europe. The plant is occasionally visited by the students of the Department as field trips due to the cutting-edge technology of the plant and the excellent organization.

Interview with one of the two entrepreneurs lasted about 3 hours with a visit to the plant to follow. Additional information has been selected mainly by internet sites and follow-up phone calls.

WCo6 is the oldest and one of the most compound industries in the wood sector in Greece. The main industrial center is located in Kalamaki by Korinth, and includes a private port located in front of the factories. Basic principles of the firm are: high quality and respect for natural resources regarding all local and international regulations. Accordingly a slogan of the company is that they are always against any illegal logging activity. The firm uses Okoume logs originating only from sustainable and well managed forests (West Africa), by choosing suppliers that meet the criteria set by the PEFC certification. They have obtained the FSC® certificate[369] for the production process, thus fulfilling also the production side of the deep commitment to ecology. It is also certified with ISO-9002 (TUV Germany) and has obtained the *KOMO-Certificate by* SKH-Holland and Lloyd's (these is due to the different specification of the various countries).

Basic products: a range of high quality plywood products such as eco-certified plywood, block-board, decorative plywood, solid parquet flooring, and decorative chipboard, as well as sawn timber of various tropical species. Major product of high added value" marine plywood: an expensive, water-resistant grade that is more tightly constructed and glued than ordinary plywood

Competition: In 2010, the only Greek competitor was "Shelman" which closed in 2012. Still it was not that famous as WCo6 for the same quality of marine plywood.

[369] FSC-certified wood is wood that is certified under the standards set by FSC or the Forest Stewardship Council. FSC-certification is given to companies and landowners to verify that they practice forestry that is consistent with FSC standards. The FSC label on wood or paper products guarantees that consumers can trust the sourcesWCo6. is an FSC Certified manufacturer, while all the timber used by the company comes exclusively from sustainably managed forests, subject to reforestation or plantations.

The entrepreneurs: Two brothers raised in an entrepreneurial milieu. The older entered the plant in 1981 together with his studies in the Economic University of Athens (graduated in 1985). Father was responsible for the whole business (central offices in Piraeus) and for the second plant at Renti area. He had meanwhile worked for the German Westafalia for about a year. The business was established by the grandfather who was a carpenter helper at Varaggis plant since the age of 14. He was saving the money to open his own carpentry in 1924 starting with wooden chairs and evolving to woodwork. In 1960 it became an SA company and focused only on flooring. In 1973 the second plant was established which produced plywood and veneers. The location was strategic: the marine was vital for logs' transportation and the main road was close the plant (accessibility). Business was continued by the two sons. Now it was their sons' turn to take over the family business. The cousin had not studied but he had long experience in the plant production. He had developed excellent engineering and theoretical knowledge on wood processing according to the interviewee's sayings.

The company followed a conservative policy regarding investments; they wanted to rely on their own financial resources avoiding exaggerations. They have a strategy of constant investment on technological upgrading.

The Innovation: Initial innovation was mainly technological regarding veneer stitching for two types of expensive veneer.

Innovation/Entrepreneurial process: In 2005, external messages of the increasing weaknesses of the Greek market and the shutdown of many Greek shipyards troubled the entrepreneurs. In parallel, minor production weaknesses of the plywood production system, a need for more control of raw material and for efficiency improvement together with the development of new technologies in the filed led to the redirection of the corporate strategy and a substantial reformation of the firm. The company, already known for its quality in Greece and abroad, decided to stop producing a big number of products and focused its strategy on wooden plywood (50%) with marine plywood and flooring as core products. *"It was far from clear that we had to focus on exports with products of high added value and highly differentiated. We stopped the production of the variety of products we used to and we focused on solid parquet flooring (our second unit) and plywood and tropical timber in this plant"*. Starting from own experience and know-how the entrepreneurs ***redefine quality at global level.*** *"Quality is the spearhead of our competitive advantage – we produce the most expensive plywood in the world. The best raw material should be stitched with the best technology!"* Their new vision towards top quality marine plywood concentrates on **innovative process technology** with the development of novel stitching technology developed by a Swiss machine manufacturer. The pilot use of the innovative machinery created many technological problems that were solved by an excellent co-operation between the two teams. *"We had to specify*

technological parameters and conditions, to achieve the best quality after severe quality controls and to have the best behavior in the extremely expensive yachts it is intended to". (Note: stitching is very important to secure zero "voids," the micro-spaces in between layers, to tightly adhering joints that do not let destructive moisture in. All parameters of finishing, grinding and cutting are done with closer tolerances than standard plywood, accounting for the very high cost of marine plywood).

The whole procedure of *déroulage* veneer stitching took about two years to finish with decorative veneer stitching to follow in 2008.

In order to realize their new strategy, novel production technology was accompanied with handling machinery and SCADA in the existing production lines in order to increase productivity capacity, new store rooms.

Market entrance: Company changes from general *"conventional wood processing"* to *"high value top-class marine plywood manufacturing"*. The company sales team had prepared a campaign to inform customers on the new upgraded quality all along the investment time: *"We wanted them to expect the new products, to really look forward for them!"* The information plan (the campaign) produced the effects wanted. Customers appealed to the new strategy. According to the interviewee's sayings, after two years of the corporate venturing and the new image of the company, they had the highest sales increase ever. The entrepreneur also added later that this reformation created the conditions to survive the crisis.

Appropriability Strategies: Registered trademarks

Knowledge bases: wood processing technology, wood behavior science, chemistry, mechanical engineering (cutting, pressing and processing), chemistry (glues), material engineering, quality management, TQM, marketing, business management. **Knowledge** and long experience on *okume* wood, plywood processes, and conventional technology

Financial resources: *The initial investment was about 2.500.000 Euros funded by own resources*

Suppliers: as mentioned in summary

University and Research Institutes: no relationships

Institutional: The quite small national market of today, despite the fact that Greece is a country with a long maritime history and one of the largest fleets in the world. Greek state should have supported shipyards in Greece as well as the wooden framing against the use of composite materials. The Greek state does not support entrepreneurship. *"Except for specific individuals in public services that have helped our firm, the Greek State is nothing but an obstacle for the firm's evolution. Too much bureaucracy and a negative climate against entrepreneurs and the entrepreneurial environment in general! Whether it regards* employment authorities, finance officers or customs officers, they all come with a rather

hostile attitude towards us!" . Furthermore, WCo6 claims that although it is a clearly export-oriented firm, they have received no support or any information of the relevant State organization *"Their information regards mainly trade shows. However it is a general one – for all types of products. Imagine! They inform us about trade shows in Middle East which is indifferent in our business…"*

The lack of machine manufacturers is also a severe problem for the industry: *"Yes, in Italy and Germany machine manufacturers are next to plants similar to mine. After installing the machinery, they visit them, solve the arising problems, introduce improvements and inform for emerging novelties or about proper service. We, in Greece, are more or less isolated. We have then to develop other mechanisms. For example we build informal cooperation and technology transfer with the erectors and train in-house teams….. When a company installs a new machine there are of course frequent visits – you see I refer to much customized machinery. Our core suppliers are German and Swiss; they come here, they transfer their knowledge; we actually work too close – especially for the innovative stitching machinery"*. The severe crisis makes things more difficult especially for those with heavy loans.

Corporate strategy: WCo6 focuses on extremely high quality all along the value chain and exports. Extroversion regards even production (creation of a saw mill in West Africa). Strategic targets are: a) control of raw material: transport costs are too high for tropical timber. The entrepreneurs think about creating a saw mill in West Africa to transport ready to use material and not the whole trunks. B) eco-production all along the value chain. Several strict controls take place in the production steps and the supplementary activities of WCo6.

Processes/ innovativeness: The initial investment was further accompanied with new ways to innovative uses and complementary products targeting high-value markets:

In 2007, the firm tried to produce plywood covered with melamine which regards an innovative production technology. *"We saw the innovative product and we thought about its application in our case. We used reverse engineering. It took us about three months with a 4-member team."* They co-operated with a French producer of melamine films and together they developed the base panels with a significant durability. *"We made several tests regarding durability. When we thought we were ready we certified the promised durability by offering guaranty. An insurance company would pay the guarantee in case of failure"*. This became the most profitable product for the following years and supported exports (especially shipyards in Holland) in the first difficult years in Greece. Today, there are more than three firms in Europe to produce similar products.

In 2009, technological advances in Greek furniture industry highlighted the supremacy of the novel products of WCo6.

In 2010, the firm works on the development of pre-varnished wood flooring; an investment for the engineering parquet which the entrepreneurs think it enhance value added.

The same year, WCo6 works on an investment in Armenia for fine-line veneers.

Today, WCo6 produces the best and most expensive marine plywood globally and possesses the 4th position in the Greek wood-processing sector (2013). It is also one of the most advanced companies in quality and leadership worldwide. WCo6 was awarded the International Star or Quality Award, Gold Category in 2010 which was the year the interview was contacted. Every year BID presents an international quality award to cutting edge companies from around the world for their firm commitment to excellence, innovation and leadership. http://www.bid-org.com/

> *"Lately we were awarded among the most developed firms regarding quality and leadership worldwide. The criteria were the rate of growth during the last years and the market shares it has acquired. The ceremony will take place in Genève"*

Processes: WCo6 has established a routine of visiting big customers four times a year to collect ideas, suggestions and market tendencies. Comments and feedback is written down, evaluated and elaborated. For example, FSC certification emerged after such a procedure from customers abroad.

A further routine regards the location of weakness within production and as well as of gaps in the market before the big international trade shows in Europe (each May in Italy and once per year in Germany and mainly Frankfurt, Koln and Hannover). Then they try to find solutions in these events either by ready innovations presented or by contacting manufacturers. Decisions are made on a yearly basis and after the visits to customers and trade shows "*We make decisions on what we are going to buy, where to invest and what to make in-house. We are four in decision-making" me, my cousin and two engineers. However, we encourage all our staff to share ideas with us. They will inform the two engineers and they will put the proposals on the table"*

The entrepreneur says that the company watches global competitors closely since it is very important to know them well. *"In our business, quality is 50% the raw material and 50% the technology used. If a competitor makes a significant investment in technology we have to learn it soon enough! For example stitching is of enormous importance in our area. This is why we invested there! It actually controls the level of quality!"*

Business plans are prepared before every technology investment.

WCo6 has a very precise stock management policy especially regarding raw material from West Africa.

There is a well-organized framework for personnel policy and training in order to be absolutely committed in quality and ecological culture. Training courses regard mainly wood, quality, security and productivity. There is a well-organized quality control department and a quality assurance policy with internal and external audits.

The firm participates in WWF actions in order to support its ecological image.

WCo7 case study

Summary
- Legal form: General Partnership
- Year of foundation: 2006
- Number of employees: start with 8 / then 5 /0 (2012)
Educated staff: 2
- Located in: Elateia Larissas
- Product families: wood pellets
- Major customers: Italian retailers until 2011, final consumers afterwards
- Major suppliers: Greek wood providers and farmers
- Sales' structure: 100% exports in Italy until 2011, 100% national since then
- Founder: three initially, the champion: an agronomist, former owner of vegetable greenhouse
-Patents: no
-Trademarks: no
-Awards: no

Object of investigation

The case was suggested by the Department of Wood and Furniture Design and Technology (WFDT), TEI of Thessaly, Greece. The author belongs to the Academic Staff of this Department. Its Academic Staff can be considered experts in the Industry and participate in almost all innovative and knowledge-based activities of relevant firms in Greece and Cyprus while they are acquaintant with the most known research institutes and Wood and Furniture Technology Universities in Europe.

Interview with the entrepreneur lasted about 2 hours with a visit to the plant to follow. Additional information has been selected mainly by colleagues of the Department and internet sites.

WCo7 was the pioneer of the novel wood pellets production which started conquering European market in 2005. It created a new market in Greece and a new industrial branch. Founded in May 2006, the firm was registered for business operations in the area of renewable energy sources. As a leader on the Greek market, in early 2007, the company started the production of wood pellets in its newly built production plant in Elateia, Sykourio, Larissas. The production plant's capacity is 5.000 tons per year. The production plant boasts brand new equipment, obtained in Italy.

Basic products: wood pellets used for furnaces and heating boilers, in houses and flats, as well as in larger users' premises.

Competition: WCo7 was the first to produce wood pellets in Greece and the Balkans and could have the lion's share. However, it proved incapable to handle the mistrust of Greek customers and the negative institutional settings, while it had secured in Italy (100%). Additionally, five new plants followed between 2006 and 2010 and are all in the region of

Thessaly (two in Karditsa, one in Volos and one in Nevrokopi which is an SBU of a big organization situated in Larissa) with much higher production capacities and a wider range of customers and contacts. In 2011 the number of producers increases to eleven with WCo7 to hold the 10th place. Meanwhile, the same year the firm loses the Italian market. They try to attract the Greek market but with no success since the new producers have promoted the product in quite dynamic ways. In 2012 with 14 Greek producers in the game and many imported products mainly from the Balkans, the firm shut down.

The entrepreneurs: Two farmers and an agronomist from Sykourio in their early thirties. They have been involved in farming while the champion runs a vegetable greenhouse since 1998.

The Innovation: First to produce wood pellets in Greece (exploiting Italian patent). Wood pallets appeared back in the 70s as a response to energy crisis. Wood pallets are bio-fuel made of compressed wood which provide consistent and economic heating. Wood pellets are efficient carbon-neutral fuel – one gram of released CO2 engages one gram in the photosynthesis and this maintains the balance of carbon in the environment. Wood pallets combustion is so pure that it is almost impossible to notice any wood smoke coming from the chimneys, with ash content of just 1%.

Innovation/Entrepreneurial process: The agronomist was interested in pellets after a relevant presentation in WFDT Department event. Together with a PhD sylviculturist, external collaborator of the Department, they visit the Italian company which had patented a new processing technology. This was the beginning of the new venture. The Italians have a quite significant market share and need producers to cover it. They provide a turn-key solution and with the sylviculturist they adopt the technology to local conditions for production (e.g. special properties of local wood species, humidity and temperature etc). The Department was offered to further adopt the technology to the local requirements but the entrepreneurs were afraid that changing the product's specifications was dangerous for the Italian market.

Thus, the production was decided in pre-defined controlled conditions and in compliance with European **EN PLUS A2 standards:** 6 mm in diameter, up to 20 mm in length, below 6.9% of moisture, residue remains below 1.1 %.

Market entrance: The agents had a contract with the Italian technology providers for 100% of their production. Although the Laboratory of Applied marketing of the WFDT Department advised them to keep a small percentage for the Greek market, they were hesitant to risk an aggressive market entrance at national level. This was due to certain institutional limitations in the area of Attica which they did not want to try to overcome. Furthermore, at that time, the consumption of wood pellets in Greece was zero since pet-coke was much cheaper and plants

preferred this type of fuel. This was the main reason for the failure of the company; in 2011 the Italians ended the contract and WCo7 tried for almost half a year to find new clientele but with no lack. New producers with higher capacities and strong presence had conquered the national market.

Appropriability Strategies: patented innovative technology (by the Italian provider), Registered trademarks

Knowledge bases: wood processing technology, wood behavior science, chemistry, mechanical engineering (cutting, pressing and processing),

Financial resources: *European regional development fund. The investment was about 1.500.000 Euros.*

University and Research Institutes: So far, WCo7 has mainly collaborated with the WFDT Department for both technology and marketing. It has also participated in one research project of the University of Thessaly (School of Agricultural Sciences, Department of Agriculture Crop Production and Rural Environment) and one of the Department of Biosystems Engineering (TEI of Thessaly).

Institutional: The entrepreneur complained about the dysfunctional state mechanisms and public services and bureaucracy. Subsidy money are delayed and VAT money is not returned causing significant liquidity problems. He complained about the dysfunctional state mechanisms and public services and bureaucracy. He also discusses the problem of political instability and unreliability that are catastrophic for exports.

The entrepreneur focuses also on the indifference of the Greek state regarding environmental issues and the establishment of relevant regulations as well as incentives for eco-friendlier energy sources. He refers to his hopes when in January 2007, the European Commission launched a plan for a more ambitious and integrated policy for Europe in order to tackle the issues of climate change and energy supply *"Greece is deaf in such calls… In Europe even home boilers are subsidized to be turned from oil to biomass"*.

Corporate strategy: Exploiting wood residues in order to produce eco-friendly energy

Innovativeness / Processes: WCo7 has presented no further novelties. However, he has participated in two research projects. The first one regarded the production of pellets out of cardoon which did not reach a practical result. The second regarded the measurement of the net calorific value of wood pellets.

WCo7 rested on internet, sectoral journals, WFDT (occasionally) and personal contacts.

WCo8 case study

Summary
- Legal form: SA
- Year of foundation: 1998/99
- Number of employees: 32 full-time / start with 30
- Educated staff: 5
- Located in: Chalikidiki (show room in Thessaloniki)
- Product families: kitchen, wardrobe
- Major customers: final consumers, constructors of big projects (hotels, banks, shops, hospitals)
- Major suppliers: Egger (Austria), Akritas (Greece) supplementary materials from Austria and Germany, corian providers
- Sales' structure: 100% national (his motto: "Think globally but act locally"
- Founders: one entrepreneur raised in a similar entrepreneurial milieu
-Patents: no
-Trademarks: yes
-Awards: no

Object of investigation

The case was suggested by the Department of Wood and Furniture Design and Technology (WFDT), TEI of Thessaly, Greece. The author belongs to the Academic Staff of this Department. Its Academic Staff can be considered experts in the Industry and participate in almost all innovative and knowledge-based activities of relevant firms in Greece and Cyprus while they are acquaintant with the most known research institutes and Wood and Furniture Technology Universities in Europe.

Interview with the entrepreneur lasted about 3 hours with a visit to the plant to follow. Additional information has been selected mainly by internet sites and a competitor.

WCo8 was founded in 1999 separating from the very beginning the commercial and production units; the first was located in Thessaloniki comprising of a modern and highly fashioned show room and the administrative offices. The production plant comprises ultramodern facilities of 4000 square meters in the industrial area of Lakomata in Chalkidiki.

Basic products: kitchen furniture, closets, special constructions

Competition is severe with many local, national and imported products to compete WCo8's products and quality and in combination to the Greek crisis. According to the interviewee's sayings, his main competitors are the expensive imported kitchen furniture.

The entrepreneur: He was raised in the family kitchen production business which was among the strongest and biggest in the area of Macedonia (50 employees in the 90s). He studied economics in Boston (USA) and he holds a PhD in business administration. He worked (as a student) in Gillette and Polaroid in the NPD Department as a finance consultant. *"I was amazed by the NPD departments of the two firms, the importance of the marketing department and the application of research in the market and the technological advances. I*

was very interested in the use of CNC on the one hand and the importance of timing on the other", narrates the entrepreneur.

In 1999 he returned in Greece. He was approached by a global investment banking and securities firm to take over derivatives which were quite new for Greece. He chose to stay in the family business. His father was an agronomist but he turned to kitchen carpentry; according to the interviewee, he was among the first to prepare a business plan and to apply some theory of production management. His mother was a fashion model. She went to Paris where she studied interior design. *"She is extremely broadminded and she knows much about design. If she were not with me, I would have moved much slower I think! She was my main financial supporter too!"* confesses the interviewee.

However, the traditional model of the kitchen producer; i.e. a building with the show room in front and the production at the back, with too much craft work and conventional machinery was not included in his dreams and the business he dreamt of. This reaction led to the establishment of WCo8.

The entrepreneur is a member of many associations. He is the Greek consul in Lithuania and he was the youngest member of the Federation of Industries of Northern Greece (FING).He is also a member of the finance consultants association in Massachusetts, member of the Du Pont network, the Greek-American Chamber.

The Innovation: the entrepreneur challenged the established opinion of kitchen as craft-made furniture ("kitchen cabinets *do not* equal furniture") and developed the Novel "box-concept" which required novel production technologies (development of CIM in kitchen with innovative multi-machinery in whose design and realization he participated).

Innovation/Entrepreneurial process: The entrepreneur talked about his plans to his father and mentioned the low productivity and low quality of the existing plant against the money spent and the number of the employees. He also referred to CNC and the fact that micro-carpenters (almost the 92% of the production in 2000) would disappear due to the new trends of big trade shows, ready products and internet. The father was against all this; the entrepreneur understood that he would just lose valuable time. Frustrated enough, the interviewee *advised his father to burn his own plant* which however was one of the best firms in Macedonia at that time.

The entrepreneur decides to create a brand new firm. He buys a plant constructed early in 1980 which belonged to a wood-working co-operative in Chalkidiki. He kept only the building and sold all machinery; conventional kitchen making had different machinery for all production stages. His aim is the achievement of verticalization within the Greek context in combination with differentiation and flexibility. *"I had developed in mind my "boxing concept". All kitchen cabinets no matter the place and the design could be parameterized in "boxes". This meant that there should be some technology to sum up all conventional phases*

in one…I had developed my boxing concept; then I needed to develop the technology to realize it"

In order to realize his idea, he visits the most modern technology provider in Italy[370]*: "I told them: I don't want you to tell me what you have; I want to tell you what I am dreaming and then you may think if we can make it. Actually, I focused on the parametric manufacturing. My business plan turned around this idea. I would use bleeding technology. They were excited with my idea, they helped me and this is how I got the first of the nine innovative pieces of parametric cut in the world in 2000. This cutting machine was initially developed on my ideas and personal work and it incorporated bleeding technology indeed. It actually* ***won the first prize*** *in the manufacturing trade show, the CEBIT in Hannover in 2000. Then the company* ***sold the machinery, of course****, but I was not interested any more…"*

The multi-machinery of 2000 was the first CNC of three axes, fully parameterized. The entrepreneur wanted to go on with research and add the ability to produce curves as well but it would take a long time for his new venture. The multi-machinery is further developed in a well-organized and linked production system and requirements appear one after the other (material handling systems, relevant CIM program, adoption of design to industrial design etc) constantly improving the initial idea. The interviewee discussed his ideas with the engineer team and worked together for the development. He personally worked on the software development. He also participated in the creation of the prototype remembering the big number of tests to suit the specifications set. The entrepreneur was then the first to try the CNC model and man-made raw material in Greece.

The entrepreneur exploited all subsidy opportunities*. "My techno-economic plan impressed the people at the regional public services when applying for funding. However, they were somewhat hesitant due to my age; you see, I was too young!"*

Machinery developed during the planning phases was patented by the manufacturing company with no benefits for the entrepreneur of the case according to his sayings. Although his father denied to support him, his mother became his right hand regarding funding and design. He works on to complete the modern production line All major technologies are developed mainly by European manufacturers. American machine suppliers are also used *: "I had to find technology to link the systems together. Some of them come from Germany and some from USA. I had further to develop in-house machinery; I mean I co-operated with manufacturers for pieces I had in mind. They were small staff to ensure flexibility… It took almost three years"*

In order to run his CIM system, the entrepreneur developd a Autocad-based software programme in collaboration with an IT firm in Athens. He used the first version (2000-2001)

[370] IMA Company (Bologna, Italy)

but a second version followed and was launched in the market. He went further with an IT-based organization of stocks and raw materials.

The entrepreneur focuses also on the development of design capabilities: his mother develops the design department benchmarking three top Italian design leaders in the kitchen sub-sector; WCo8 went on introducing a significant number of new designs at a yearly basis.

Market entrance: The entrepreneur makes his *debut* by designing a kitchen totally out of aluminum. This was promoted by local (Thessalonian) press and in Athens as well. (Author's note: However, according to our opinion, of great importance was the fact that his father's company was well known to Macedonia).

Appropriability Strategies: Registered trademark, no protection for the box concept. On the contrary, the entrepreneur assisted the creation of relevant production lines in two of the biggest and most important competitors of his in Greece. *"When they asked me why I did that, I explained everything because I had built that machine myself indeed with the best manufacturer in Europe on that type of machinery (Germany)…. They (i.e. the two competitors) both saw that I knew to build such production lines at least in the field of kitchen furniture!"*

Knowledge bases: wood processing technology, wood behavior science, mechanical engineering (cutting, pressing and processing), finishing and dyeing chemistry, manufacturing, parameterization, automatization, CIM, programming (software, machine programming), plant design, material engineering and design, market analysis, business management, industrial design, creative design, logistics,

Financial resources: Regional Operational Program, Youth Entrepreneurship Call, *private capital. The investment was about 5.000.000 Euros.*

Suppliers: as mentioned in summary

University and Research Institutes: The entrepreneur had not co-operated with any University department. The WFDT Department was established in 1999. He said that he was approached by a professor of the Aristotelian University to run a project on wood certification but it was not a pleasant experience. He mentioned that he was well ahead in 2003-04 when Greek furniture industry discovered CNC machines.

Institutional: The cumbersome state machinery, the complex and lengthy licensing procedures and the public sector inefficiencies and mistrust were the major barriers for the entrepreneur. *"The most important obstacle was my age! As if young people should not be entrepreneurs!"* Today, it is further the non-functional bank system and the negative image of the Greek economy. On the other hand, the entrepreneur admits that his start-up coincided with the beginning of the time of prosperity for Greece; *"Greek market was growing at an impressive rate until the outburst of the global financial crisis. I derived in 10 years the benefits that a 40-year-old company would normally derive in 30 years!"*

The entrepreneur exploited the highly positive environment and deliberately shaped a new ecosystem in kitchen construction for small companies *based on automatization, parametric design and flexibility* at the same time, taking the leading role in it. This has been appreciated by both customers (in the high-value market the agent strategically chose*). "It was also the time that Greek customers were getting more informed and were not blurred by the Italian brands. I think this had also to do with this general prosperity. In any case, the timing was really excellent!"*

Entering the market with the new millennium, his activities stretched to bank furniture, the cell telephone shops which were highly investing in their image as well as works for the Olympics 2004 besides the luxurious kitchen furniture prepared for high-incomers.

Corporate strategy: Differentiation and design leadership in combination with constant excellent quality at least at national level for the expensive kitchen furniture. WCo8 invests heavily in innovative materials and mechanisms, novel combinations and design. The entrepreneur want to keep the brand name he built well recognizable among design high-value brands in Greece. In order to fulfil their strategy, they perform intense market and technology research.

Innovativeness: After the realization of the "box concept" which ended with the co-development of a machine that offered a patent and good sales to the machine manufacturer, WCo8 went on with technological novelties.

2**001-2002:** CIM introduction

2003 – 2007: many fixtures and installations to solve specific problems of box-concept, introduction of *corian*[371] and artificial plywood in Greece, novel design. "I was the one to urge the manufacturers to dare use innovative materials. I was the first to bring Corian and man-made veneer in Greece. Corian, for example, is a very flexible material but its users must be trained in ways to use it. I encouraged such efforts despite initial rejection. *In the country of marble and granite, why should we use synthetic material*" This was a usual reaction!"

2004: ISO9001:2000 certification

2008-2009: new, cutting-edge technology dyeing plant with many novelties to suit the atomization introduced by the entrepreneur.

[371] DuPont™ *Corian*® is a versatile material for solid k*itchen* countertops and known for its aesthetics and performance; the first product lines entered the European market in 2000 (new product lines were then introduced in 2002, 2005, 2007, 2010 and 2013). The expiration of DuPont's patent on solid surfaces helped facilitate a number of direct solid surface competitors to Corian.

Processes: There are processes of customer feedback and market-shift recognition. Statistics provided by ICAP are combined with other sectoral studies and sectoral journals monitoring European trends and regular visits to international trade shows, benchmarking and best practices adapted by three leading Italian kitchen manufacturers.

There is a well-organized "Creative Department" where processes focus mainly on novel and creative design.

The entrepreneur searches for technology on a regular basis probing innovative elements (such as kitchen mechanisms and materials), as well as novel technology details to enhance value. Occasionally, there was some joint research on process technology but cannot be regarded as a regular process of the company. *"We invest heavily in new products, innovative raw material, mechanisms, and the innovative combinations in general. We go more deeply into creative design. I am personally involved in it. This is the policy that shapes the culture of our company and the attitude of our members: we have to be always in front of the others regarding innovative design"*

WCo8 has a policy of contacting raw and supplementary material suppliers and B2B customers such as architects and decorators in order to broaden co-operation. Collaborations extend from appliances manufacturers to decoration journals.

NPD processes are developed, where "P" stands for products and processes. Thus, development includes creative design (presentation of a new collection at a yearly basis) and new ways to produce; e.g. the novel dyeing installation or the *corian* use entailed equipment and new personnel hiring and training.

Regular appearance in local and Athenian press, in sectoral and decoration journals and shows. WCo8 engaged mainly customer solutions as combinations of base products, specialty products, supporting equipment and services (a practice called "bundling") in order to create unique opportunities for the customers.

The entrepreneur managed to keep staying a pioneer with further novelties for more than a decade presenting fast growth sales and high level of innovativeness. The severe crisis of the last years (2009-2014) hit the company since it covered only local/national markets (*Some hesitation due to the age of the agent? A false interpretation of the "think globally act locally" way the entrepreneur had consciously adopted*?)

In 2011, a new competitor appeared in the upper segment of kitchen production of Northern Greece[372].

[372] The young entrepreneur is a graduate of the WFDT department who turned to luxury kitchen production after his thesis. In 2013 he introduced his brand and has also taken more than 40% of WCo8's market.

WCo9 case study

Summary
- Legal form: SA
- Year of foundation: 1989 – CV (new SBU) 2006
- Number of employees: 11 full-time
- Educated staff: 6
- Located in: Chalkida
- Product families: WPC production (wood-plastic-composite)
- Major customers: decking, fence -frames and flooring makers
- Major suppliers: polyethylene suppliers, color providers
- Sales' structure: 40% national – 60% exports
- Founders: owner of a big furniture company
-Patents: no
-Trademarks: yes
-Awards: no

Object of investigation

The case was suggested by the Department of Wood and Furniture Design and Technology (WFDT), TEI of Thessaly, Greece. The author belongs to the Academic Staff of this Department. Its Academic Staff can be considered experts in the Industry and participate in almost all innovative and knowledge-based activities of relevant firms in Greece and Cyprus while they are acquaintant with the most known research institutes and Wood and Furniture Technology Universities in Europe. Interview with the spin-off CEO and shareholder lasted about 4 hours with a visit to the plant to follow. Additional information has been selected mainly by two colleagues of the Department and internet sites.

WCo9 is part of a big furniture group located in Chalkida with manufacturing facilities to cover 65 acres. The company unfortunately does not exist anymore. According to Department's information, the entrepreneur was strongly advised to transfer the plant in a Balkan country but he did not want to do that. However, the Group used to be one of the strongest in the Greek furniture industry, among the pioneers with cutting edge technology, strong design and innovative culture. The firms was established in 1980 and in 1990 stared exports in Canada where they had seven shops in 2010. They were also exporting in a number of countries such as Cyprus, all Balkans, Ecuador and Belgium.

Basic products (of WCo9): WPC (wood-plastic composite).

Competition: By the time of the establishment there was one main competitor in Europe (France) and 3-4 micro European companies that tried to produce the same product but with no great success. By the time of the interview, another big one (Austria), US imports and many small ones.

The entrepreneur: The entrepreneur is a man that never liked public explosion. He had finished the Diplareios School (a very good carpentry school in Athens). He was a pioneer in his job; iindicatively, he was the first to put edge grains on melamine by ironing them and cut pieces for furniture. His CEO narrates *"All were negative. 'No use', they were whispering. And yet, this was a radical innovation at least in Europe, as far as I know. He was the one to start it"*. (Writer's note: Today there is only a very small percentage of melamine without edge grain. Technology and machinery has been highly developed to excel this process of Wood *grain PVC Edge* Banding).

With a friend of his, the entrepreneur creates a pioneering furniture plant in Menidi Attika in 1980 with significant initial novelties: The firm introduced the famous "element systems" for walls; they were a big success and the firm became the first one in Greece to create flat pack furniture in order to offer integrated furniture syntheses. This concept was further reshaped in 1984; the company moves to its new 3600 m^2 facilities in Basiliko Chalkida. Here the entrepreneurs will develop the "soft forming" technology: partly self-assembling furniture. In 1986 they establish the Group as known today and in 1987 they present their "components" concept which referred to totally self-assembling furniture for integrated modular furniture (however, not to be sold in the IKEA type). In parallel, they adopt franchising for Greece.

In 1991 the firms introduces novel technologies for curved wood and PVC faces. The growth is rapid; investments on facilities and cutting-edge machinery follow together with the creation of its network abroad. The very same year, the company wins the first price in the most important international furniture exhibition.

A number of new SBUs and joint ventures follow until 2006. The entrepreneur was among the firs in Greece to foresee the danger of IKEA which would take a significant market share of Greek firms. New products and product families based on design and new technologies, new facilities (the second plant in Greece and new ones in Russia and Romania), further investment in the existing plants in Greece. In 2006-2007 the Group establishes WCo9.

The innovation: Wood plastic composite is a hybrid material composed of natural wood and plastic fiber. Saw dust from fiber fillers like pulp, peanut hulls, and bamboo are mixed with new or waste plastic powder, from materials such as polyethylene, polyvinyl chloride, polypropylene, and acrylonitrile butadiene styrene. The material is used for outdoor deck floors, railings, fences, landscaping timbers siding, park benches, and even window and door frames. Wood-plastic composites were first introduced into the decking market in the early 1990s. Manufacturers claim that wood-plastic composite is more environmentally friendly and requires less maintenance than the alternatives of solid wood treated with preservatives or solid wood of rot-resistant species.

The company started with WPC decking to develop several other products as well. .

Innovation/Entrepreneurial process: In 2004, the entrepreneur visits an exhibition and gets interested in a recyclable product which was presented; WPC. The product was known in USA since the 80s but it was not accepted due to many deficiencies. Yet, a strong R&D technology US company developed a patented technology which appeared to be successful and plants started appearing in USA. *"He liked innovations but there was no market for it. He was approached by the firm but he rejected discussions"*. However, the very same year the Chinese needed more timber to satisfy the new open global markets. This led to wood shortage and increase of timber prices in combination with increases in transports due to the fuel games at that time. *"We needed a significant number of ships per year bringing timber from Canada and it was getting too expensive. On the other hand, there was that enormous waste of sawdust. Then Mr A remembered S (the technology provider)"*

The entrepreneur created a team of four to run the new investment idea. *"We were only four… with good chemistry. We would not stereotype, we ought to get out of the mood of mother-company, and we should cut through its red tape wherever possible. No one else should interfere. This was quite clear. We were well out of the group's routines and processes. We had to find the suitable raw material, we should form the mode of co-operation with USA; this had to be direct; no hierarchies; then we would lose communication and flexibility – for example in cases of trouble or when changes were en route… Then the new venture was totally disconnected from the mother company's processes and routines. This fact helped us to establish the new plant within a very short time frame. Decision making was very fast, you know. When there is a large group and you want to do something new and innovative you have to take it out of the established way of thinking; this is the only way to oil the wheels of decision – making to make the whole system as easy as possible at every level. This was the founder's idea – to take the whole thing out of the system – I think it was very important for the new venture; he had done it again in the past…*"

The team comprised of the entrepreneur, the General Director of the Group, a mechanical engineer with a former experience in extruders and the WCo9's CEO (interviewee) The CEO had a long experience in timber; he had studied economics and marketing in Canada and a long experience in multinationals and big Greek wood-processing companies. *"We knew that Greek market was very small for such an investment. I run a market research in Europe. By that time there were two big European WPC producers which could count as competitors (Note: the technology spread very fast in Europe at that time due to the reasons mentioned above). There were also about 25 micro-producers with one single extruder to satisfy local needs but their product was not satisfactory since they tried to develop their own technologies"*

The four-member team tried to learn whatever existed in literature for the new material and tis technology. *"We read papers, we saw patents, we searched the internet, and we examined*

and evaluated the products produced in Europe; after all we were furniture makers". The techno-economic study reveal a potential for future growth for the new technology and product and the technology provided by S attractive.

Commitment to the vision was very important for the team. "*What Mr A has is that once he believes in some new idea, he will invest and be involved and will stay firm even when obstacles appear. He transferred his belief in us and he trusted us! Mr A would never adapt an idea just to solve a problem but in order to create an opportunity!"*

Works were very fast. The plant was ready in a year and produced immediately. The entrepreneur supported the view that they had to enter the market as soon as possible (Note: and he was right because within the following years a significant number of new WPC plants emerged in Europe.

The **patented technology**, howeve, had to be modified to suit local conditions and raw material. An almost "turn-key solution" turned to a new research project; problems of the pilot production led to a formal European research project (COST). This case denotes a further direction towards the potential hidden behind the so-called "purchase of embodied technologies". All constructions were performed by a Greek constructions company. Executive engineers were trained about a month in USA before installation while after erection works, an American team stayed a month to solve pilot production problems. Further solutions were supplied by mails and telephone calls (The author has personal experience of this process –spring 2006).

Market entrance: First production was simple solid decking profiles. WCo9 managed to train customers and open markets: "We had to persuade customers about the product; it is good, it is green, it is ecologic! It needs no maintenance! It has extreme durability! However, they would answer: ok in USA, but where can I see it here, in Greece?" WCo9 co-operated with forward-looking timber traders (no more than a handful) who made some installations in cafeterias and taverns. *"Of course it was almost free and we paid for the installation as well. We sent customers to see them. The first year was really difficult!"* The product was highly acceptable and the first two years growth was significant. The product has a guarantee of 25 years.

The interviewee used the S offices in London and his own networking by his former work and made a strong sales network in Europe (by the time of the interview the product was sold in 14 European countries). WCo9 participated in exhibitions in Greece and Europe too.

WCo9 introduced patented technology for innovative products into Greece and Balkans. The first year WCo9 had sales of 76, 2 million Euros and profits before taxes around 4 million.

> *"The truth is that he envisaged a new market. There was too much talk about wood, too many problems. And yet he (note: the entrepreneur) was the only one. WPC was*

totally unknown but even when he introduced it, there was no interest in the sector. They wanted to ignore it. But he did not allow it. He trained them…"

Appropriability Strategies: bought patented innovative technology, WCo9 has rengistered the trademark worldwide. Appropriability contracts in the plant and with raw material providers.

Knowledge bases: wood processing technology, composite materials behavior, profile design, knowledge on polyethylene and recycling, colors and their mixtures, installation technology and techniques , testing product's composition, process methods, Core know how from S. (WPC technology), extruding technology, constructions and machine installation, process methods, customer training, marketing, test control. It should be mentioned that most knowledge bases are well out of the company's core knowledge bases and competencies (a furniture maker)

Financial resources: only private capital. The investment was about 5000.000 Euros.

Suppliers / customers: WCo9 caused certain alterations of the business ecosystem at national level and partly at European level**.** By the time of the establishment, the technology was new for European standards. The novel WPC (Wood-Plastic-Composite) products create niche markets as well as ***new suppliers and activities*** and mainly plastic recycling providers to produce raw material (polyethylene), wood dust producers and specific color producers (after testing and matching of new colors to suit Greek and Balkan tastes). Two Polyethylene providers were quite difficult to provide constant quality of the product. WCo9 trained them and the two NPD departments co-operated on quality and control issues

There are also ***new B2B "customers"*** created who have to be trained by the company to use the products; deck and fence makers, architects and decorators are some examples. The company has to survive the initial mistrust and ignorance (which is a characteristic of the woodworking and furniture sector) as well as to invest in customer training to avoid mistakes in the use of its novel products. It takes feedback from customers to improve mainly colors

University and Research Institutes: WCo9 spends a 5% of turnover on R&D. There are certain new regulations and standardization. The new product has led to a COST European project on WPC research and has invoked further research in the area of composite wood products. There are collaborations with quality control laboratories in USA, ELKEDE and two Spanish laboratories.

Institutional: A favorable institutional setting combined with wood shortage, increase of timber prices and a trends towards ecology.

However, the State did not support the innovative effort of WCo9. *"They talk about the environment and innovation but they do nothing to support it! And I do not mean only money. They could assist us with the recycling companies…"* says the interviewee.

Corporate strategy: Significant market share of the WPC product in the Greek and European market**.** WCo9 offers alternative solutions to deforestation and world wood shortage with the use of innovative technology and the further improvement of world-level innovative material and products.

Innovativeness: WCo9 was established only in 2006. Still it soon went on investing in R&D, focusing on quality, durability and aesthetics as well as the design and development of new landscaping solutions.

In **2008-2009** it developed R&D on new designs and technical solutions to products such as to make WPC bars lighter or more compact or to improve WPC properties adapted to Greek conditions (quality and durability) and to be able to cope with the Chinese cheaper similar products. Initially design was supplied by the US Company but soon WCo9 developed its own design (e.g. "open pack" type). In parallel, it extended to other products as well such as fences.

There were advances in R&D regarding the durability of colors, technical solutions against expansions-and-contractions and solutions to reported problems.

In **2010** the company developed a new foaming technology (innovative WPC technology)

Processes: WCo9's value framework focuses on people and teamwork: "Our interest on our people is the main source of inspiration and the main planning direction of our actions". The company plans the constant training and development of the employees and encourages experimentations and innovation (from company's records). In 2009, they developed a project on distance learning for the personnel. In 2011, they take part in 6th International Conference on Open and Distance learning. All four companies have trained their personnel on EFQM. All four companies target leadership in Greece and Balkans at least. In 2010, a COST research project was initiated to explore the WPC material reaction under the Mediterranean weather conditions and find solutions to problems that emerge.

Since the establishment of the WPC SBU, WCo9 is being promoted mainly in sectoral journals. In 2011 the company tries to reach the final consumer with advertisements in newspaper leaflets and journals.

In 2014, the group – ranked second in the sector for many years with more than 60 shops in Greece and many abroad, reaching even Nigeria - did not manage to survive. This was not the case in 2010, when the interviews were held. By then, the group enjoyed a turnover of around 88 million euros with the new plant to present spectacular performances. However, crisis had started already by 2008; the seven shops in Canada shut down due to the global crisis leaving a significant debit in the parent company. That very year the Group presented loses fir the first time in its history. The reasons of the failure would be an interesting research topic within the crisis context.

WCo10 case study

Summary
- Legal form: SA
- Year of foundation: 1989 – Corporate venturing 1998
- Number of employees: 180 / starting with 70
- Educated staff: 45
- Located in: Xanthi
- Product families: mattresses, furniture, linen
- Major customers: final consumers
- Major suppliers: wool –cotton- natural rubber - cocofibre – and other natural material providers
- Sales' structure: 55% national – 450% exports
- Founders: two brothers and a friend – one of the brothers the champion
-Patents: no
-Trademarks: yes
-Awards: yes

Object of investigation

The case was suggested by the Department of Wood and Furniture Design and Technology (WFDT), TEI of Thessaly, Greece. The author belongs to the Academic Staff of this Department. Its Academic Staff can be considered experts in the Industry and participate in almost all innovative and knowledge-based activities of relevant firms in Greece and Cyprus while they are acquaintant with the most known research institutes and Wood and Furniture Technology Universities in Europe. There is a long lasting relationship between the company and the WFDT Department.

Interview with the entrepreneur lasted about 4 hours. The plant has been a place of visit many times since today. Additional information has been selected by colleagues of the Department, the press and internet sites. The entrepreneur, Mr PE is actually the one who gave the author the idea of the transcendental capability. *"It is the ability to "see behind" things. Yet, it is a privilege that you must always exercise. Alone it is not enough. You look to the same direction with someone else and you can see opportunities while he sees only difficulties"*.

WCo10 *was originally involved in the production of bed mattresses made of natural raw materials. Since then it has expanded, and in 1992, the company's headquarters relocated to the industrial region of Xanthi. Nowadays, an increased range of products is manufactured in privately owned factories of 26.000 m2 in 123.000 m2 of land in the industrial development park of the area. Machinery is mostly conventional (following the philosophy of the owner for minimum automatization) but CE certified. On the basis of the minimum possible harmful impact on the environment, attention is paid to minimum noise, pollution and energy and water consumption.* The liquid waste of the factory is only that generated by the people and by ordinary cleaning. In addition, all the packaging materials that are used by the company are recyclable and are collected by the company upon delivery of its products to the

customers, for returning to the factory for recycling. It should be pointed out that the percentage of rubber foam purity that is manufactured at the company's premises, reaches a level of 96% - for which WCo10 is proud as it has a worldwide record.

The company has implemented contemporary management methods and made use of results from recent research on the needs of its European customers. The company places great emphasis on **the protection of the environment,** a commitment that is evident in the use of ecological materials and the avoidance of chemical materials even for the packaging. The raw materials used for its products are 100% natural: coco fibres (the fibres covering the coconut fruit which after suitable processing together with natural rubber, produce elastic coco fibres); natural rubber (the juice from the HEVEA tree becomes a foamy layer of natural rubber); wool and cotton (coming from the region of Thrace and considered to be of best quality due to the unique climate conditions and soil composition); seaweed (used to provide extra iodine to customers with asthma and breathing problems), horsehair, silk, linen, solid wood, down and recently natural carbon activated.

New technologies are very important for the company's strategy in order to improve work conditions and reduce waste of energy and of raw materials. A part form the 34 retail outlets in Greece, six in Europe (Limasol, Madrid, Amsterdam, Rotterdam, Arnhem, Antwerben) and 2 in China, a new production unit and distribution center started its operation in China. For these investments the company was able to use its own capital. One of the most interesting aspect of its excellence in management is the employment of "special skilled" (disabled) people not only as staff but also as managers leading the company to its promising future. Giving disabled people equal chances, as they deserve, provided the company with a special advantage which if it is difficult to quantify is, on the contrary, constantly present.

A beautiful Babel of efficiency the factories of the company, where the staff speaks a great variety of different languages, Muslims can pray at their ease and disabled persons can move and work at full capacity, create a very productive and creative atmosphere. Insisting on an interactive management the company achieves the maximum contribution of its employees' skills and ideas to the production process, thus having a better control of the quality of its products and a higher productivity level.

The practices that the company uses places it at the core of the CSR (Corporate Social Responsibility) logic. Seminars, loans, foreign languages courses, social events and so on contribute to innovation in the two areas of CSR concern: The organizing of the human factor and the relation to external environment being social or natural.

Innovation plays a major part in the company's history and it is obvious that this is an ongoing process. According to many researchers who had dealt with the company, its practices, constitute one of the most contemporary and most dedicated and intelligent materialization of CSR principles world -wide.

The opening to novel natural material and a different approach of the sleeping phenomenon and ecology led WCo10 to become a leading global company since this reformation with successful exports and later world recognition. Actually, today, WCo10 is one of the 500 nominated companies of Europe's fastest-growing entrepreneurial and job-creating companies, according to Europe's 500 listing. Furthermore, it is one of the 10 fastest growing companies in Greece (5th in the furniture sector). It can be considered an example of how firms use business models to identify and frame or reshape new markets.

Basic products: mattresses, furniture, linen

Competition: There are about six mattress firms to share the Greek market besides imports. According to a market analysis of 2011, WCo10 holds the second position. The firm is doing well globally. It actually has established the image of:

a) A strong ecological profile as a reference point; according to the company's reports, more than 90% of the customers have connected the tradename with sustainability
b) The high level of quality combined to transparency
c) High prices (they almost start from the highest prices of the other Greek companies) while there are the only mattresses that can be re-sold.

The entrepreneur: With origins from Pontos, the entrepreneur was born in Sparta and grew up in the Greek diaspora community of Munich, Germany. For much of his life he has been a Greek of the world, living and working as a physical education teacher in England, France, Spain, and Holland, where he currently resides with his wife and four children. He goes on studying economics in Greece. A passionate environmentalist and social entrepreneur-- the entrepreneur is also a fitness and biking nut. He recently launched a bike manufacturing company in Greece with a goal to make the "world's greatest bicycles".

There is much said and written for the entrepreneur mainly due to his unconventional nature. Working in Monastiraki, he came across a Dutch who wanted to buy Greek pillows of a certain quality. This was the cause of his interest in mattresses. He used a friend's workshop to produce his first products, his wife's property as a first product storage room and borrowed money from friends as venture capital. Back in 1989 he opens a small mattress factory with his brother and a friend. He provided mattresses with a zip and "everybody was laughing" according to his sayings; still this was a worldwide innovation that introduced transparency and opened a new section in mattress technology by involving nature. The entrepreneur was also the first (at least in Greece) to question the need of a mattress to be hard.

He actually narrated that he spent many years in learning all about sleep, and that he has worked quite hard on conventional mattress production (i.e. cotton and wool) for about a decade.

Innovation: Unique novel business model and methods of promotion together with product innovation on the basis of ecology: The entrepreneur combined the ***phenomenon of sleep*** with nature. Innovation regarded the industrial use of unconventional raw materials that would be manufactured under a complete ecological procedures, the development of unconventional marketing methods and the focus on a differentiated organizational structure. WCo10 caused a total reformation in changing its business model at:

Strategic level:

- attract ecological interest
- build relevant manufacturing and marketing capabilities
- adapt technologies
- redefine market

Operational level:

- License raw material providers and support them to be ISO and eco-certified
- Develop R&D
- Establish new factory
- Involve human-centric policies supporting differentiation in religion, colour and nationality
- Impose energy / emission and water restrictions

Economic value

- Enhance value of products to justify high prices

Marketing

- Innovative marketing practices
- New market segmentation
- Create strong networks abroad

The company today competes in the high end of the mattress market and is a leader in the fast-growing ***'eco-bedding'*** category which leverages both the 'sleep awareness' and 'natural living' trends that are prevalent, especially in export markets. The core of the business activity lies in the motto that *Sleep is a complicated phenomenon, which up to now hasn't been completely decrypted.*

Innovation/Entrepreneurial process: In 1998, almost after a decade of existence as a mattress company with quality and transparency as main characteristics, cotton and wool as main raw materials and the use of zip as innovation, WCo10 decided to build an absolute ecological image (which would later affect the whole value chain) extending at the same time to new natural materials. The innovative focus on environment and ecology included formal R&D on all natural sources for mattresses, furniture and linen, introduction of new ways to transform them to products, human-centric perspectives and use of unorthodox methods in marketing, building a unique business model worldwide. WCo10 started its long journey to new natural raw materials besides the classic ones (i.e.

cotton and wood) by experimenting and many try-and-error loops regarding both processes of elaborating materials for mattresses and reactions of customers. What appears easy, it is difficult in implementation; ecologic production under the strict meaning of the term is not that evident; "*"Let me tell you this example: there is no machine in the world to produce cotton. We are actually "rowing against the mainstream". Such production is always too risky; it is prone to static electricity and fire. Our production is against conventional industrial production. Our efforts for ecological mass production for the world market make us live in isolaton; all adapt easy solutions"*. The method of combining latex with cotton and wood was pioneering worldwide introducing an alternative use of modern technology. On the other hand, the addition of herbs in the pillows was one of the initial innovations in the new production lines.

WCo10 introduced its novel business model at strategic level that is *''the totality of how a company selects its customers, defines and differentiates its offerings, defines the tasks it will perform itself and those it will outsource, configures its resources, goes to market, creates utility for customers and captures profits''* (Slywotzky, 1995). WCo10's venturing reshaped an existing market and framed a new one. Its unique image worldwide is composed by quality, innovation, Corporate Social Responsibility, alternative management and marketing all based on the ideal natural way of living and the proper exploitation of mother nature. Although there are many competitors, the company competes with major global relevant firms and at global level.

The entrepreneur's brother runs the legal department of the firm; he holds a Ph.D. in law at the Sorbonne in Paris. While the champion is a media super-star, he is much more "quite". The friend is now responsible for the production in Xanthi.

The entrepreneur created literally "something out of nothing"; today, novel products made of sea grass and horse-hair are disposed in novel ways promoting a strong commitment to nature and human being. Global energy crisis, ecological problems as well as the financial crisis constitute real challenges triggering the entrepreneur's creativity. WCo10 is known as a leading company worldwide in promoting "eco-bedding" and "sleep awareness" and thus changing the architecture of the mattress-subsector.

Market entrance: They first tried Holland (his wife's homeland). They bought a show room and exposed their unusual methods. *"We went like in soccer! We thought we were good… We had to reconsider our tactics many times"*

In 2012, WCo10 had 70 stores in 11 countries while the company's affiliate in China has been opening shops at the rate of one per month. An outlet inside the ABC Furniture building in Lower Manhattan opened in 2010, and in 2015 there are three stores in USA. Global sales for

2011 were $70 million, 15 percent higher than the year before. Of the 30 stores in Greece, at least five opened in the very teeth of the crisis.

Appropriability strategies: *"You ask me if I have any secrets to protect. No! I haven't, because I built something totally mine. It bears my own, unique hallmark!"*

Knowledge bases: all about the phenomenon of sleep, all about a variety of natural products and ways of treatment, marketing management

Financial resources: The investment for the plant was about 8.000.000 Euros. A relevant investment law (2601/1998) has been used and it was the main reason to choose Xanthi.

Suppliers / customers: wool –cotton- natural rubber – coco fiber – and other natural material providers in Greece, Sri Lanka etc. The strictly followed pre-condition is that they have to be eco- and ISO – certified. The company's relationship with its suppliers is also based on the fundamental condition to primarily comply with the company's requirements on quality, and secondly to work together with the company to a common target of development. Among the unusual raw materials can be mentioned seaweed, horsehair down and cactus next to silk and linen.

The company provides its suppliers with technical support and training, in order for them to effectively support the common goals.

University and Research Institutes: WCo10 did not use any type of academia when established. However, in the aftermath it has developed important co-operation on different levels with many University Departments in Greece and Abroad. Indicatively: Democritus University of Thrace, Economic University of Athens, EFQM organization, Cambridge University, John Hopkins University, Unesco, WWF, etc.

Institutional: WCo10 has exploited the economic growth and the Greek market boom of 2000. They also exploited a very supportive investment law for the area of Xanthi to build the plant. They complain about bureaucracy in Greece and the cumbersome state mechanisms. They admits that thigs got easier when they became famous.

Corporate strategy: *The vision of the founders is to remain in top position worldwide in the manufacture of natural products, and to achieve a working culture of sustainability, embracing all types of human activity - giving equal chances to everybody irrespective of their nationality, colour, religion, or physical disability.*

Innovativeness: WCo10 is eager to present significant innovation every year with time to market to range from one to three and a half years. Indicative activities:

Placing the emphasis on the protection of the environment, WCo10 develops a series of technological novelties such as the achievement of 96% of rubber foam purity which is a worldwide record and the gradual adding of raw materials not formerly used (e.g. algae) after relevant R&D (innovation 2012). Since 1998 175.259 hours of research (till the end of 2011),

product development, learning about nature and interacting with people drives NPD and innovation (company's source).

In 2000, a research project with the Democretus University led to the developmet of ERGOMAT to test the elasticity of mattresses according to the type of the body. New technologies turn mainly around the formation and realization of policy and strategy of environment protection; reducing harmful effects to the environment, waste of energy and of raw materials. R&D has extended to hospitals and reached even Miami hospitals' health research. Research has produced even new terminology as the "orthosomatic mattress": WCo10 has co-operated with a team of John Hopkins University on the "sleep phenomenon" (holistic health program, 2011).

Innovative promotion *trains consumers* on both living with nature and on the phenomenon of sleep. One of the company's latest innovation refers to the concept of boutique hotel to promote products including both hired hotel rooms in eco-hotels as well as the company's own hotels, where customers can stay for a couple of nights to try the product. *"We then invested in hotel-boutique idea. This was not even an integrated business idea till it was completed!"* The company is proud of its continuous diving into knowledge and the orgasm of novelties on business model reformation all around its human capital.

> *"Innovation in NPD and the company's philosophy have strongly supported its commercial success in Greece and abroad"*

WCo10's concept revolutionised the mattress industry, and over the years, the company has won many prestigious awards and distinctions for its eco-friendly product, production and HR practices.

Processes: The Research and Development Office of WCo10 has the responsibility of evaluating information relative to new technologies and stakeholders' innovative ideas. All the above information are recorded and analyzed by the statistics office of the company and taken into account in order to plan the company's strategy. The formal process of collecting and evaluating ideas includes three phases: ideas' collection by the Department Heads, categorization and initial evaluation by the General Director, Presentation of the ideas' evaluation at the Board of Directors and decision making. Indicatively, it was mentioned that in 2002 there were more than 180 ideas selected with 23 of them to be implemented. One of them regarded a new super-mattress and another one set the basis for the establishment of the autonomous HR department.

Projects can be at formal or non-informal level. New technologies are also a focal point for the companies. Their contribution relates to their resolution that they use technology to reduce harmful effects to the environment, improve work conditions and reduce waste of energy and of raw materials.

The company uses *rebranding, bartening*, *experimentation* and *production and technology* changes, in order to create and promote a "holistic approach of natural life". In order to attract customers and "educate them to the "sleep-in-nature" phenomenon and philosophy, they buy nights at hotels, donate mattresses, co-operate with ecology-cultured hotels (and eventually buy hotels), open unconventional corporate shops abroad and use unusual and unconventional promoting methods. The entrepreneur engages customers, partners or even researchers in his projects or ideas making them stakeholders in order to solve problems or make the most of inspirations.

> *"I tell them the truth" he says "and I keep doing the same. I was not afraid when I was in a great need to feed my family and risked to go to jail. Why should I stop now?"*

The entrepreneur trusts his team to improvise and develop their common visions on totally natural living. The HR manager, a person of special skills, has succeeded in promoting strong CSR culture outside the company under the entrepreneur's guidance and inspiration but after high-level training as well. Employee involvement in the decision-making process is actually considered important. Motivation incentives are inspired by the entrepreneurs and well communicated by the executives. It is a case where individual characteristics of the entrepreneur turn into values and routines of the whole company.

The company has a process called "personal dinner" known as "30 minutes" before 2001: the general director has a personal meeting for dinner with each employee to talk about issues of professional or personal interest.

Training is deemed as very important. There are regular programs at different levels for all personnel while executive members visit international trade shows and attend seminars on technology, management and sectoral innovation. Knowledge and information diffusion meetings are held especially on innovation and new technology issues. WCo10 underlines the significance of its employees; they are the biggest investment for the company and receive a number of benefits such as continuous training, recognition and reward of personal achievements (in the form of salary bonuses, promotions and gifts). The head of the Human Resources Office makes different educational plans for each department according to its needs. She keeps a file containing personnel training charts for each department and a Personnel Training Record. WCo10 is considered by employees as a *learning institution*. The company's policy is to communicate "best practices" outside the organization through its co-operation with social and educational institutions and the exchange of knowledge and experiences on a theoretical and practical basis (from WCo10's records).

The company keeps updated on market trends. However, they do not work on market statistics. The entrepreneur's motto is: *"No market research. I know what I sell. I know that it is perfect! This is my job: to excel my products and to prepare the market. I am the one to*

train the market. We are going to train the customer – he himself does not really know he wants!"

The company has invested heavily in quality and this is the reason for having earned an impressive number of relevant awards. It applies Total Quality Management with a religious devotion.

Some of the interviewee's quotes that impressed the author:

> "I tried many things. I did not know if I could make something out of them. I could not tell about the market. When I put a zip in my mattresses, everybody was laughing. Now everybody wants transparency. It is the same with the seaweed. The raw material does not cost – for the time being-but *one has to think of industrial production* and this is not easy. Still, I go on experimenting!"
>
> "WCo10 is my way of living!"
>
> "Knowledge pre-exists inside us, it is stored in us and waits to come out as a reaction… You should observe things and see why they exist. So do I! I start …and here we go! At this path, this same myself guides me to do this or that!"
>
> "Even my partner called me crazy to waste money in zips!"

Quoting the author:

> Παίρνουμε... σβάρνα εκθέσεις, βιομηχανίες, πανεπιστήμια, βιβλιογραφίες, ειδικούς και κάθε λογής πηγή γνώσης και απάντησης των ερωτημάτων μας. Ταξιδεύουμε μέχρι και τη Σρι Λάνκα όπου η καλλιέργεια του κοκοφοίνικα είναι επιστήμη αλλά και καθημερινότητα. Αμέσως εγκαθιστούμε δική μας μονάδα αξιοποίησής του. Το καουτσούκ, το μαλλί, το βαμβάκι είναι τα υλικά που θα επιλέξουμε, αρχικά, για να πλαισιώσουν τον κοκοφοίνικα. Εως και πόσα πρόβατα ζουν στην ελληνική επικράτεια μάθαμε.
>
> Οι δυσκολίες πολλές, τώρα, δε, που τις βλέπω από απόσταση μού φαίνονται ανυπέρβλητες! Το αδιαπέραστο τείχος της γραφειοκρατίας, η αυτοκαταστροφική εσωστρέφεια, η τερατώδης φοβία για το καινούργιο, η γενικευμένη ακεφιά, εν τέλει, που δέρνει διαχρονικά τα «κέντρα λήψης αποφάσεων» στη χώρα μας. Αλλά και η σχεδόν παντελής έλλειψη παιδείας για το φαινόμενο του ύπνου και η πλήρης απαξίωση του στρώματος ως προϊόντος που συνδέεται αμεσότατα με την υγεία μας
>
> **Για μένα όταν υπάρχει κάτι θα πρέπει να βλέπουμε το λόγο της ύπαρξής του.**

b) Food and beverages Sector

FCo1 Case Study

Summary
- Legal form: Limited Company
- Year of foundation: 2003 (new)
- Number of employees: 58 full-time
-Located in : Larissa
- Product family: antipasti, olives, spreads
- Manufacturing: mass production
- Major customers: large super markets chains in Europe
- Major suppliers: farmers, package industry
- Sales' structure: exports 100%
- Entrepreneurs: 3 brothers
- Educated staff: 4 with a University degree
- Patents: no
– Awards: yes
- Trademarks: no

Object of investigation

This case study was chosen after investigation in start-ups of the region of Thessalia. The interviewee was known by one of the interviewers. There was an interview of 4 hours has been conducted with one of the owners who is the CEO and responsible for marketing, sales, R&D and product launching. There was also a visit of the plant for ½ hour. Additional information has been collected through completion of a questionnaire by the same interviewee and an informal conversation at some other time.

The company is operating in the food manufacturing, producing antipasti (45%), spreads (25%) and packing olives (30%). The company was founded in 2003 by four brothers and is 100% family owned. It is a 100% exporting company to the international market, and the structure of its sales is EU 55%, Russia 15%, USA – Canada 20% and the rest of the world 10%. The turnover has reached 5 million euros in 2009 with rapid growth.

The total number of full time employees reaches 58 persons. In 2009 there were 78% semi-skilled employees, 15% skilled, 2% with a master degree and 5% with MBA.

R&D corresponds mainly to new product development. Three people are involved in this process, one chemist and two of the owners (the CEO and the production manager). If needed, they cooperate with a food technology expert.

Entrepreneur(s) : The company was founded in 2003 by four brothers that were grown up in an entrepreneurial milieu. Their father is one of the big owners of a canning industry of peach compote. His company is a leader in Europe, where as Greece has 65% of global production of peach.

The four young boys had a high level education on economics and business. Mr A-N has obtained his MBA from St Joseph's University in Philadelphia with specialisation to food marketing. The others obtained their master degree from USC in California.

The children wanted to do something on their own, to try something new that could be established in Greece and in the international market. They saw the opportunity in creating a company that would not base its competitiveness on cheap labor. In a globalised context in which Greece does not compete on low wages they should find something that would combine quality, originality and their knowledge and experience in the food industry. Thus the idea came for the combination of Greek products and tastes and orientation to the end consumer. In general Greek products, especially agricultural, are exported in bulk and a big part of the value chain, such as packing, design etc., is added by companies abroad (a typical example for that is the olive oil).

In fact the entrepreneurs combined their education with family experience, social ties and knowledge they acquired from their suppliers.

They firstly started with a typical and low risk product, olives, as a base for their production. But at the same time they experimented with new products and tastes and went through trials and errors in order to create original concepts. The concept of the Greek Mediterranean "meze" named "antipasti" that could be easily introduced to the international market was born and materialised. The idea of producing high value-added was the cornerstone for building their competitive strategy.

Currently, Mr A-N is the CEO and responsible for marketing, sales, R&D and product launching. The second brother, Mr B-N, is the production manager, participating also to the new product development and to the development of productive processes. The third brother is working mostly in a third family owned company specialised in software but is also involved in FCO1 operations, especially in sales and preparation of their participation in international trade fairs. The fourth brother is younger and working in the company.

Entrepreneurs combine some specific traits that yet remain context specific. More precisely they are characterised by an innovative spirit, proactiveness and entrepreneurial alertness. However these traits seem to be leveraged by the fact that entrepreneurs have grown up in an entrepreneurial milieu with experience in the food industry and especially with relations with agricultural suppliers, they have obtained a good level of education and have benefited from social ties of the family. In addition they also had access to financial resources of the family.

The evolution of the idea: The preparation phase took two years with careful steps and a business plan that underestimated final success. Their first investment was 2.1 million euros and after one year and a half they expanded their productive capacity with an investment of 1.3 million euros. The third investment was 2.6 million euros and the new plant and equipment will start production in approximately three months.

Financial resources were 40% from private equity, 30% from loans and 30% from subsidies.
The choice of geographic location of the company was influenced by the proximity to raw materials and the existing relations with local community.
They started with pure Greek agricultural products combining them and creating new products e.g. olive or pepper stuffed with feta cheese, then other combinations of vegetables (vegetables mix). They created a general category of vegetables stuffed or simple. They developed this general category of antipasti by adding typical Greek fruits stuffed with cheese and then created new subcategories within it such as fig or mushroom stuffed with cheese. Greek raw materials had the advantage of low cost.
A new change was introduced in 2004, when they started using imported agricultural products (e.g. African pepper, mushroom or artichoke). They then started customizing their products according to the customers' taste habits. French customers prefer different tastes than Irish or Russian. This drove to a further differentiation of products.
The emphasis on high-quality, required well selected high-quality raw materials and original and attractive design that would justify a premium price. There was however a problem with waste. Thus, a new product category has been created, spreads, to exploit economies of scope. Today they are envisaging to start producing compote of fruits in glassy package with totally new combinations of taste.
Innovative activity: The innovation activity of the firm consists of two different types.
The first relates to the introduction of new categories and new products to the market. According to the interviewee, there were no such products before but competitors appeared as followers. After a small investigation via internet, it was confirmed that a few other Greek companies exist in the same market.
The new product development takes place within the company. There is no R&D department but a quality control department employing one chemist. The process of new product development involves the chemist, Mr A-N and Mr B-N (the production manager). Firstly, the idea comes up and then experimentation starts through trial and error until they end up with a new product which has the characteristics required. This process may involve trial for many recipes before ending up with two or three new products. They prepare the mix, they wait and monitor maturation, they interact with clients and finally launch the product. They don't do however market research but use their imagination and observe taste habits of foreign markets.
Eventually they cooperate with a food technologist in order to develop specific solutions. Here we enter the second type of innovative activity. It consists of developing specific solutions to product development problems. Until today they have worked on two specific problems.

a. the first had to do with stuffed vegetables and fruits conserved in oil and how they could manage to keep the cheese inside without leaking. They had to find a stabilizer that would keep the product intact. They cooperated with an external expert and started using modified starch. As this has not been positively accepted by clients they tried to find a natural starch and the solution was found in the potato starch. Then they had to find out the exact portion of cheese that would give the better result in terms of taste and design.
b. the second solution they developed was a new plastic bag for packing olives. This new packing solution had to answer to specific customer requirements, namely small portions, saltless taste and recycling. They firstly recognized that exported olives in bulk were not attractive for the final consumer. In addition as olives were conserved in salt this discouraged many prospective clients from consuming them because of health reasons. Packing olives in a barrel of five or ten kilos with almost 50% of salted water has also a higher transportation cost. They searched (at the internet) for a well known manufacturer of plastic bags for packing and they found him in Italy. They provided him with all necessary specifications that is an oxygen barrier and UPV free transparent plastic bag for packing ready to eat olives. The knowledge base for packing is similar with that used for dried fruits that are conserved in modified atmosphere using azote. In cooperation with the food technology expert, they bought from Greek representatives a new machine which was until then used for dried fruits from Greek representatives and used it in the productive process. The development phase lasted a year and a half. There are various benefits from this process innovation. One is the reduction of transportation cost especially important for overseas exports. Another benefit was the possibility to reach end consumers. Many bars and restaurants serve olives as starters in small portions. They provided them with a ready to eat solution packed in recyclable bags. An American chain of 1000 restaurants became their client and there was also a new market opportunity in Canada. FCO1 used this technology to broaden its list of products, by seasoning with Greek spices or mixing with other vegetables.

The catalyst for FCO1 innovative activity is market opportunities that from one point of view are shaped from the company but from another point of view they are out there ready to be exploited by innovative and active entrepreneurs.

What seems crucial in developing high value added products is combining market knowledge with existing process technologies and transforming them to economic value. However, it has to be stressed that personal involvement and imagination keeps a central role in the whole process as there are no other systematic and organizational routines and procedures to ensure continuity and/or sustainability.

Corporate strategy: One important element in FCo1's strategy is the emphasis given to high value added, to quality and to recognition and understanding of very specific consumer needs and latent demand in the context of a niche-market strategy. New product development is integrated to this line of action and ensures a first mover action line and high profit margins.
The company operates with just in time procedures and on contract basis orders. This ensures zero stock and a less risky market environment.
Mr A-N insisted on "small is beautiful", as it ensures flexibility as well as building and deepening specific competences. Their strategy vis-à-vis suppliers of raw materials falls in this line as they don't wish to expand their activities backwards because this would need totally different competences and engagement.
Appropriability strategy: In order to appropriate returns of new product development FCo1 insists to be the first mover and to secrecy. The pace of new product development is a barrier for competitors to copy as by the time they would succeed new products would appear.
Marketing strategy: FCo1 is producing 95% private label products. One main reason is that most of its clients are more recognizable (visible) than the company is. In addition operation cost is lower when producing private label products as it has lower cost for marketing, design and public relation (FCO1 does not have independent departments for these functions).
They however care a lot for design and product appearance. This is the reason why they use glassy package and transparent etiquettes so the consumer might be more attracted.
As already described in a previous section, there is no market research conducted. Market monitoring is one of the main tasks of Mr A-N, who uses his imagination and observation competences to come up with new ideas and new combinations of taste. The company seeks to address specific needs and types of clients like for example singles that consume small portions and ready to eat type of food.
The company participates to international trade fairs as the main channel to promote its products and find new clients. Mr A-N insisted on the importance of always having something new to attract clients. Trade fairs are also one communication channel to get feedback from clients. Another channel for feedback is internet. Feedback concerns taste, recipe and packing.
Human resources strategy: The company builds on loyalty and long term engagement of employees. Most workers are unskilled or semi-skilled women coming from the local region. Working in a safe, rewarding and family environment gives them an opportunity to improve their life conditions and gain social recognition and autonomy. All workers are trained as production process is very demanding in terms of hygiene, sort-out and presentation of the product within its packing.
Linkages – co-operations – networks : *User-producer relationships:* Clients come mainly from the retail sector, big super-markets (ALDI, Carrefour, Sainsbury's Taste & Difference,

Oil and Vinegar), restaurant chains, bars and pubs e.t.c. Most of them require high standards for quality and hygiene. To this end FCO1 has established high standard procedures and obtained many certifications (HACCP, British Retail Consortium, International Food Standard). It has been already mentioned that Mr A-N monitors customers' needs and preferences and integrates feedback. However customers are not involved in innovation or product development.

Supplier-producer relationships: There are two types of suppliers; suppliers of agricultural raw materials and suppliers of different types of equipment. The former operate mostly in a traditional context. In general agricultural sector in Greece demonstrates a very low transformation in terms of competitiveness and introduction of new cultivations. The company created new activities/markets for some of the suppliers requiring processed raw materials (sort-out. cut in pieces or cooked) resulting to a slight yet increase of their value added. Greek farmers are risk averse. They do not easily accept to try new or more sophisticated products.

The second type of suppliers, are manufacturers. Linkages with packing suppliers are more sophisticated. The company sets specifications and sometimes (as described earlier) participates in the development of a new product (e.g. the plastic bag for packing).

Financing resources: Entrepreneurs used two types of funding programmes, national and European. Mr A-N made two points regarding funding in Greece. The first one relates to delays of payments and the second to the absence of project evaluations. Regarding the latter it is obvious that no real impact of such programmes can be estimated as there is no monitoring of the implementation of the business plan.

Determinant factors:. Although Mr A-N made reference to some of the usual problems envisaged by Greek entrepreneurs (lack of financial resources, bureaucracy, corruption), these problems didn't seem to concern them. One of the main reasons for that is their endowment of social capital. Local environment was more supportive because of previous family social ties and a well-established reputation. In addition the young entrepreneurs had their family support in terms of financial capital as a basis to implement their idea. In Figure 1 there is a schematic version of the elements that interplay in the entrepreneurial process.

Firstly, there is good market knowledge and the utilisation of food technology techniques. Entrepreneurs' personality is characterised by traits that are considered to be catalysts for entrepreneurial and innovative activity. However, contextual factors seem to capitalize these traits, such as educational background, family support and reputation and financial resources. The role of the entrepreneurs appears to be crucial for new product development and the creation of economic value and at this point the company dynamic seems totally dependent on their initiatives and personal involvement.

FCo2 – case study (pilot case study)

Summary
- Legal form: SA
- Year of foundation: 2002 (new)
- Starting year of producing the new product: 2003
- Number of employees: 9 full-time; up to 20 part time in high season
-Located in: Larissa
- Product family: cucumbers
- Manufacturing: mass production
- Major customers: Greek supermarkets and vegetable wholesalers
- Major supplier: seed suppliers
- Sales' structure: national 100%
-Entrepreneurs: 5 friends, 2- of them farmers for more than 10 years, an expert on Finance and corporate and organization management with a Master and long experience, an expert on ICT and a former draper (the economist left two years after installation)
The champion: Mr D. - Personal traits: autonomy, imagination, entrepreneurial alertness, innovative spirit, synthesizing competencies, risk taking ability and a belief in his ability to control the environment
Educated staff: 1- responsible for ICT solutions, 1- geoponics
Patents – awards: no
Trademarks: yes

Object of investigation

This is the pilot interview which opened the case study research. It lasted 3 hours and actually tested the general outlines of the research questions. It was suggested by a big consultant company in Larissa; however the researcher chose it only after searching in internet and press for the innovativeness of the idea.

FCo2 is the first greenhouse unit in Greece that produced and packaged high quality vegetable products using the hydroponic cultivation method. Its products are certified by Global Cap and are packaged exclusively in cardboards in their own modern packaging and fringing facility. The greenhouse facilities have a productivity potential of twelve months per year. All the necessary procedures of the supplying of the nutritional solutions, the regulation of the climatic conditions (heat-cold) and the watering of the plants are fully automated. All the above guarantee the best possible production and quality of the products. The packaging facility of a total footprint of 600 sq. meters, with a 250 sq. meter integrated freezing chamber ensures the potency of guaranteed freshness until the final delivery of products.

Innovation: pioneers in Greece in the use of hydroponics in cucumber cultivation. **Hydroponics** is a method of growing plants using mineral nutrient solutions, in water, without soil. Terrestrial plants may be grown with their roots in the mineral nutrient solution only or in an inert medium, such as perlite, gravel, mineral wool , or coconut husk. The first hydroponics plant in Greece was in Corfu with tomato planting (30.000 sq.m - 1990). Very

small tomato plant units (up to 5.000 sq.m) were established since 1996 mainly in Peloponnese addressing local street markets. FCo2 was the first high tech equipped cucumber plant. Since then there are about 2000000 sq. m in Greece with hydroponics but still 4-5 organized companies.

Innovation/Entrepreneurial process: Mr D is one of the 4 partners (today) in this agro – enterprise. He is 43 years old and a farmer, while the rest are between 38 and 45 years and are: another farmer, a clothes dealer who closed his clothing store due to the crisis of the sector. And an electronics technician.

Long family tradition in agriculture: *"I am a farmer since my childhood. I was very young when I decided to deal with intensive farming, the greenhouses. I do believe that this is the future of rural farming. I am a 4th generation farmer and I wanted to make a step beyond the conventional ways of land cultivation which, as we see, today it is rather in a tragic situation".* Mr D. shared his dream for a conventional greenhouse with his two friends (not the electronics technician) after his personal view that greenhouse products are the future of farming. In order to find the best installation, the 3 (initially) partners studied a lot about greenhouses and visited many of them all over Greece. Among others, they saw a greenhouse with tank farming in Koufalia, Thessaloniki. The farmer had no intention to turn it to an enterprise but it was rather a hobby for him. They returned impressed but also confused. They turned to an expert in the sector, Mr M., an agricultural scientist and consultant with a long experience and a lot of innovative ideas. He explained the entire concept and introduced them to the world of hydroponics and its advantages.

The partners spend a long time studying an unknown type of cultivation, specific requirements, the products and the type of the greenhouse, as well as the efficiency of each one. In their search Mr M was next to them. When trying to decide on the type of the greenhouse, the help of Dr K., Professor of the Thessaly University of Agriculture Science was decisive. Together they turn to Spanish equipment suppliers and Italian installation suppliers. Several problems are set such as providing the optimum air/water ratio to plant root systems, the correct water/nutrient level for superior growth etc. They decide on perlite method which was found to provide the best results in so far as ease of maintenance was concerned. Greenhouse installations are of special specifications and are ordered in Italy. The extremely high costs (almost a thousand per cent above a conventional) were a strong point of hesitation. They all decided that the risk was enormous but it was worth taking it.

In 2002, they start the establishment of a modern, vertical unit with a cooling and packing room at Omorfochori of Larissa which would produce the easiest vegetables, tomato and cucumber. The investment surpasses the one million euros and it is covered by a 35% loan, 30% self-funding and 35% subsidy (law 2601).

Hydroponics, although known as a science since 1929, is practically unknown in Greece. So the 3 entrepreneurs face many problems when trying to plant in water. Besides theory, there is no-one to show them practically how to plant or consult on the proper climate conditions and ingredient analogies. While they think of turning to foreign producers, they are lucky to find a woman who had worked in a similar greenhouse in Holland[373]. *"She taught us how to plant the seeds. That was very important of course, but that was all she could tell us. Conditions and balances were not determined by her – she was just a worker".* They lost two productions due to unbalance cultivation and Mr M has to turn to Germany and Holland for more details. After the disaster of the first year, **they abandon the tomato production and manage to cope with the cucumber** cultivation and other technical problems and reach the one million cucumbers per year.

Market entry strategy: participation in national trade fairs for eco – bio products and direct sales to a big Greek supermarket chain and local wholesalers in the areas of high value bio-food products.

They have also turned to modern ways of product promotion and try to use new technology and develop communication through Internet.

"We had big problems with knowhow, since all knew about the method, but nobody could tell us how to apply it! Then the biggest problem was the financing, since although our business plan was the best among 94 other, the bank did not want to give us a loan. Furthermore, the whole process of asking for the subsidy was time consuming, expensive and soul destroying. We were told that people working in the relevant posts within the offices of the Region were betting about when we will bankrupt!" Mr Dis very upset when he remembers the loneliness one feels, when trying to do something innovative and wonders if innovative entrepreneurs are treated in the same way in other European countries. *"Now the TV channels and the newspapers come and ask about our ideas and methods, but then it was a really hard time for us!"*

The preparation phase took two years before foundation and 2 years after The entrepreneurs encountered high uncertainty for technology (e.g. for cultivation methods and conditions such as the lack of practical knowledge at least within Greek borders) and market as well as regarding the high risk of the investment due to many unknown parameters and high initial costs. They encountered difficulties in finding capital and business associates since their idea was conceived as "crazy".

Focusing on the call for environmental protection and the added value of products that comply with such demands, FCo2 goes on with fungus elimination, energy and water saving

[373]The Dutch are the recognized world leaders in commercial hydroponics

as well as traceability methods, trying to continue innovation and succeed in growing more and exporting certified products. It is also certified for integrated management. Now it produces more than 1000000 cucumbers per year which is mostly sold in the local market. They have further invested in plant transportation systems and a modern packaging line which is flexible enough to cover all types of products and corresponds to the ecological image of the firm.

Knowledge bases: Geoponics, hydroponics, engineering, electronics and ICT were some of the knowledge bases the 3 partners had to become familiar to and mix in the most proper way in order to run a viable innovative enterprise in the agro food sector.

Competitors: cheap conventional agricultural products (the sector today in a tragic position)

Corporate strategy: Emphasis given to: high value added, quality recognition and differentiation of production with many advantages for consumers and the environment - niche market strategy.

Marketing strategy: Niche market, Value added strategy with emphasis on quality, green lash and appearance. Personal involvement in market monitoring, marketing and promotion – no intermediaries. No market research was conducted to estimate consumer preferences for such products.

Appropriability strategy: high initial capital expenditure and Greek mentality in agro-food sector safeguard the competitive advantages of the company.

Social capital - Linkages and co-operation (networks):

Bonding social capital based on strong ties, since all entrepreneurs have grown up in the local agricultural environment, which easily opened the way to wholesalers and a connection to a well-known supermarket chain.

Business networks: a good knowledge of the products' whole value chain. Consultants, experts and Academics who were invited to help due to former acquaintance (academic) or co-operation (Mr M) on agricultural matters. Exchange effects ranged from intangible resources such as various information on the method, technologies, search for science etc. (both University and consultant), to concrete resources such as raw material (consultant) and first equipment (academic).

Informal networks mainly as loose ties with customers and experts seem to play some role, since they result in constant knowledge diffusion which in turn facilitates the improvement of methods and techniques, the further plant modernization, the adaptation of innovative methods through the whole value chain (information, promotion, knowledge exchange through internet, energy saving, disease elimination etc), emergence of new ideas (e.g. on packing) and products (start tomato and squash), as well as technical solutions to automation etc.

Financial resources : 30% from private equity, 35% from loans and 35% from subsidies (Investment Law 2601/98) / financing constraints due to high initial capital (surpassed 1.000.000 euros) which increased even more since it was combined with controlled environment agriculture.

Firm-specific knowledge base :Focus on hydroponics which is still a dynamically developing plant growing method (introduced as highly suggested in Science Tech Entrepreneur[374]) , Process/procedural knowledge (Geoponics, hydroponics, engineering, electronics and ICT), market knowledge/ Acquaintance to the use of technology / high degree of management skills, necessary for the maintenance of favorable condition inside protected structures.

Environmental factors

Market : saturation of the existing market with conventional agro -products / a fragmented and mature industry /function in an open world network of products, distribution networks and investments/high costs / Intensive price competition / Unfavorable payment terms by the distribution networks /Consumer and market needs are essential / a rather unfavorable internal financing situation / Low sectoral R&D & innovation activities / no direct competitors at national level/ Customer awareness / perception/ factors that play a role in shaping future demand include changes in demography and the socio-economic environment, increased awareness about the relation between health and nutrition, environmental and safety concerns

Institutional **:** Trade liberalization / a high number of regulatory and legislative constrains, often a hampering factor for innovation / EU food legislation on food safety, information and fair market conditions, resulting in increased administrative burdens and compliance costs for firms, / Ignorance of food consumers / Innovation and relative funding programs are considered to be the privilege of large companies of the sector / general supporting founding programs (subsidies) but time – consuming, soul –destroying and without support (according to entrepreneurs' opinion)

Linkages & co-operation : Supply chain relations -seed providers and packing suppliers / Linkages with high-tech companies (automations, energy saving, e-commerce), University of Volos (Department of Agriculture Crop Production and Rural Environment, School of Agricultural Sciences), agronomists, and a company of business consultants in the private

[374] *Science Tech Entrepreneur (STE) is a monthly e-magazine of the Department of Science & Technology (DST), National Science & Technology Entrepreneurship Development Board (NSTEDB), Government of India. The e-magazine is an effort to promote entrepreneurial opportunities.

and public sectors as well as local administration, rural enterprises, agricultural cooperatives and producers groups.

The entrepreneurs have developed the ability to scan the environment to evaluate the markets and competitors, through *informal routines*. The company focuses on plant improvements in order to eliminate the disease dangers, increase productivity and add value. Occasional meetings with packaging supplier to improve packaging – cooperation with automatism companies on more advanced monitoring and management of the plant. Cooperation with experts (University and consultant) on novel seed varieties and process improvements
So far, the entrepreneurs seek to obtain ideas from experts, *local and international suppliers, trade fairs, exhibitions, conferences, scientific and business journals and Internet*. They talk a lot with customers ("you can hear different things from the super market CEO and the actors of the wholesale fruit and vegetable markets")
They work on continuous productivity improvement including cost control and therefore decreasing unit cost price. However, marketing based on product quality rather than hydroponics as a production system. Exploitation of social pressure for a product that is produced without chemicals[375], "in-harmony" with nature ('clean and green' image), use of IPM (Integrated Pest Management). Full automation of glasshouses, research on energy efficiency. Focus on direct approach of consumers (with no middlemen). They are constantly seeking for novelties:
"Product branding may be one way of capturing this market but we are not ready for it. We still have to learn a lot. This can be knowledge on climate control or crop environmental requirements and IPM programs within greenhouses. It can be the use of IT in our plant or more modern methods of energy sufficiency – photovoltaic for example! We have to constantly search for knowledge - nothing is static. We seek best practices too".

Entrepreneurial opportunities
Technological: Hydroponics, the development of energy saving solutions, ICT, e-business
Market: created by the entrepreneurs at a national level –especially for cucumbers
Institutional: promoting programs, University and consultant networking

[375] Attention to a constantly shifting and evermore sophisticated market, including one that is starting to demand the low chemical, sustainably produced product that is the industry's strength. "Product branding may be one way of capturing this market but we are not ready for it"

FCo3 Case study

Summary
- Legal form: SA
- Year of foundation: 1998 (new)
- Starting year of producing the new product: 1998
- Number of employees: 6 full-time; 1 external consultant
-Located in : Larissa
- Product family: (I) whole egg (70% of turnover), (II) yolk (3 TYPES -20%), (III) albumin (10%) - new product : omelet
- Manufacturing: mass production
- Major customers: mass catering, food processing companies (national), Hotels, Catering, Food Industry, Bakeries, Patisseries, Mini stores, and Convenience stores, Organic Products Outlets, etc.
- Major supplier: egg producers (Europe, national), packing companies (national)
- Sales' structure: National – 97% , local – 3%
- Entrepreneurs: 2 brothers highly educated but in irrelevant fields (a teacher and a computer engineer), with primer entrepreneurial experience, both with innovative spirit, synthesizing competencies, risk taking ability
-Educated staff: 4 with a University degree
-Patents – Awards: no
-Trademarks: yes

Object of investigation

The company was suggested by a professor of the University of Thessaly. The interview with one of the two entrepreneurs (brothers) lasted around 2.5 hours. Two phone conversations added some additional information

FCo3 is among Europe's most modern and automated factories, producing pasteurized whole egg, yolk, egg albumin, chilled or frozen, with a capacity of 13 TN per shift, processing eggs of Greek origin only.

The production line consists of state of the art equipment. The desired pasteurizing temperature is guaranteed by an automated system, which monitors the temperature at four key points of the pasteurizer and records continuously on a PLC. The Factory has its own fully equipped chemical and microbiological laboratories, and its HACCP scheme is approved by TUV.

Innovation: pioneers in Greece in producing pasteurized whole egg, yolk, egg albumin and relative products. Method used occasionally since 1930, fully experimented since 1960 by the British Egg Marketing Board and USA and further elaborated and patented in USA in the early 90s but not known in Greece. Two established egg-producing companies imitated the pioneers within the following 2 years ; one with a subsidiary of the most important egg producer and the second through Megafarm one of the 3 main egg producers in Greece.

Innovation/Entrepreneurial process: The two entrepreneurs had significant entrepreneurial experience but in irrelevant fields. However, they had understood that conventional (low-tech) entrepreneurship cannot produce value easily. They kept on searching for an innovative

idea exploring opportunities of high potential. The accidental discussion with an Italian friend's gave the idea. They contacted a thorough market research through internet, personal phone calls and food expert's assistance (mainly in Athens) in order to estimate the market potential and the innovativeness of the idea. They actually verified their hypothesis that pasteurized whole egg, yolk, egg albumin and relative products were not known in the Greek market. Thus, the two brothers:

- *Verified the gap in the Greek market (market opportunity)*: no egg processing companies in Greece
- *Saw the technological opportunity* –homogenization and pasteurization of eggs was a relatively new method in Greece, although already used in Europe and USA.

In order to get the necessary know-how, they visit two Italian producers who allow them to visit the plants. They then contact the most known Italian manufacturing company to provide them a turnkey solution and a foods expert from Athens (friend of them) to support installation, due to their complete ignorance of the technology, the market and the sub-sector in general. The entrepreneur narrated that they passed four months studying and searching in order to understand the field they wanted to get involved in.

Training by the Italian manufacturer followed product line installation; however problems with product quality led to search for specific scientific knowledge which due to the innovative technology used could not be solved by the consultant. The later contacted a friend of his, a University Professor (University of Thessaly – Department of Hygiene of Foods of Animal Origin) in order to solve the emerging problems. This was the beginning of a long lasting collaboration on quality, improvements and innovative products (such as the ready-to-eat- omelette).

Market entrance: The two brothers found it difficult to enter the mass market because they had no contacts or ready network; on the other hand, they had to compete against a strong competitive product; the egg powder, known, easy to use and long-time used by all professionals. The first production was sold to a big food processing company by the mediation of the food consultant.

The two brothers made a new contract with the food consultant who introduced the new company to big customers. They spent time "educating" customers about the potential benefits of the innovative products and then by training users (e.g. cooks and pastry makers) how to use and store the products). FCo3 actually created a niche market of high quality in Greece from scratch.

Furthermore, competitors appeared the very first year of market entry; they were two well-established by big egg producing companies who, having their own raw materials (eggs) created an environment of intense price competition.

Marketing strategy: Emphasis on quality, fast delivery, flexibility in order volumes and appearance. The new firms continued the co-operation with the food consultant especially when trying to enter new products or expand abroad. The two brothers are also personally involved in market monitoring, marketing and promotion.

The entrepreneurs had prepared a well-structured business plan with market research to be conducted by them and the food consultant. Besides the turn-key solution they engaged much try and error in order to solve emerging production, storage and even maintenance and failure problems due to the uniqueness of the equipment in Greece (egg pasteurisation). They also employed a chemist employed with specialization in milk pasteurisation just after complete installation. Besides the above mentioned problems they encountered unexpected problems with egg producers who were not used to sell exact quantities at specific time intervals. The firm went on with further investments and new products, as well as novel packing to suit Greek conditions.

Corporate strategy: Emphasis given to: quality recognition, time delivery and service combined with reasonable prices. Innovative products add to the company's value. Niche market strategy.

Appropriability strategy: informal commitment of the chemist consultant. The entrepreneurs were not interested in patenting the products in Greece.

Human Resources: Complementing capabilities of entrepreneurs: educational background (irrelevant), long entrepreneurial experience (but on irrelevant business too) - Strong entrepreneurial drive - motivation/ use of experts *("the right people – the right moment")* such as the food consultant and the chemist who was specialized in similar processes / University acquaintances

Social capital - Linkages and co-operation (networks): *Bonding social capital* based on quite strong ties, since the idea came by the Italian friend who helped the two brothers to contact the Italian pasteurized egg producers and find the technology provider and machine manufacturer. Another friend (the food consultant) was the one to contact market research, introduce the University professor (who at the beginning came as an individual in order to help "*a friend's friend*"). A friend economist made the business plan.

Business networks: The acquaintance with the Professor led to further collaboration with the University of Thessaly; the firm participated in two research programs on certain processes and innovative products. Cooperation with local machine shops in order to solve technical problems of equipment.

Informal networks mainly as loose ties with customers, equipment suppliers and experts seem to play some role, since they result in constant knowledge diffusion which in turn facilitates the improvement of methods and techniques, the further plant modernization, the adaptation of innovative methods through the whole value chain (information, promotion, knowledge

exchange through internet, energy saving, disease elimination etc), emergence of new ideas (e.g. on packing) and products (start omelet), as well as technical solutions to automation etc. According to the entrepreneurs there is a constant communication with suppliers/customers by e-mail/internet/phone call or personal contact, continuous search for collaborators for building competence, frequent contact with University and regular preparation of strategies to confront threats and exploit opportunities (e.g. the threat of local egg producers, the price competition, bakery industries that used to brake the eggs were an opportunity but had to be persuaded and even trained etc.)

Financial resources: 30% from private equity, 40% from loans and 30% from regional subsidies / financing constraints due to difficulties in collecting the subsidy.

Firm-specific knowledge base: Process/procedural knowledge (mainly egg homogenization – pasteurization, advanced quality control) / Food chemistry, Food processing and engineering / Acquaintance to the use of the specific technology / chemicals for cleaning /practical technical knowledge on the repair and parts replacement of equipment.

Market: The Greek egg industry is fragmented with the 15 main producer/packers accounting for less than 30% of total egg production. Most eggs for the processing and food service (catering) sector are derived from traditional caged production.

The three main producer/packers are Golden Eggs (approximately 15%), Blahaki (3%) and Megafarm (5%). Greece has 107 approved packing stations. Egg processing in Greece is extremely limited with a value of no more than €5 million in total and accounts for just 0.5% of total egg production and a for only second quality eggs from large packers with seconds from smaller production/packing units simply being discarded. There are no egg drying facilities in Greece with processors producing liquid and frozen whole eggs, egg white and egg yolks. The Greek processing sector utilizes only second quality eggs (around 8% of total eggs amongst commercial producers) and there is no differentiation by production system. It represents around 0.5% of total egg production. There are three main egg processors with Sovimo in Attica region, (a subsidiary of the packer Golden Eggs although it is operated by the French egg processor SOVIMO (Société Vimoise d'Ovoproduits), with around the 60% of market share.

There is no domestic production of egg powder in Greece and all requirements are met through imports. The Greek egg processing sector mainly serves the domestic market. Trade in shell eggs and egg products is extremely limited. Greece mainly imports shell eggs (53% of the combined trade). Imports of dried egg yolks account for 35% of total imports of egg products, followed by liquid egg yolks with 28%, dried egg albumin (15%) and dried whole eggs (12%).

Primary demand: Processed eggs are mainly destined for the catering, bakery and food industry markets. Consumption of processed eggs is extremely low in Greece, however some

industry specialists estimate that it will grow in the future. This growth is mainly expected from the switch from fresh eggs to processed eggs in the catering and bakery industry

The Greek consumer is also very much influenced by health concerns, although there have not been any major scares in Greece. Cholesterol remains a factor in the low consumption figures.

Institutional: The implementation of the 2012 battery cage ban in line with Directive 1999/74/EC and other potential changes (e.g. to border protection, input costs) for the future evolution of the sector will affect the sector to a certain extent. Directive 1999/74/EC was only transposed into national legislation through a Presidential Decree in July 2003 (it should have been enacted in May 2002). Whilst assistance will be provided to producers wishing to invest in enriched cages through Material Improvement Plans, these have yet to be instigated. Only one producer has so far invested in enriched cages. Greek producers are expected to delay investment in enriched cages until they need to. Furthermore, a high number of regulatory and legislative constrains constitutes often a hampering factor for innovation. Especially EU food legislation on food safety, information and fair market conditions results in increased administrative burdens and compliance costs for firms, Other difficulties regard conservatism of food consumers, the time-consuming funding programmes (subsidies (according to entrepreneurs' opinion) and trade liberalization which produces scenarios for imports from third countries. The entrepreneur thinks that Universities can offer real help.

A law that allowed the use of egg powder is still active in Greece although it contains no proteins due to high temperatures of the processes.

Further linkages & co-operation: Supply chain relations - egg providers, cleaning material and packing suppliers. Linkages with equipment companies, University of Thessaly (Faculty of Veterinary Science, Department of Food Hygiene) and a food expert (external) consultant.

Entrepreneurial opportunities:

Technological: the egg homogenization – pasteurisation method. The use of University labs

Market: created by the entrepreneurs at a national level – two competitors followed almost immediately

Institutional: promoting programmes, University and expert networking, eggs from Europe much cheaper than Greek eggs, limited production of eggs in Greece.

Hampering factors: the delay in collecting the subsidy money and the unstable electric power although the plant was in an industrial zone. Greek mentality in two ways: Greeks are not ready to buy pasteurised whole eggs instead of fresh ones and the Greek consumers are not very active in order to demand the egg powder ban.

FCo4 – case study

Summary
- Legal form: GP – family owned
- Year of foundation: 2003 (new)
- Number of employees: initially 9 full-time / today 11
Educated staff: 2: 1 with academic diploma and 1 with a MSc
-Located in: Korinthos
- Product family: Organic, quasi- pharmaceutical chocolate
- Manufacturing: mass production
- Major suppliers Cocoa from Ghana and Central America countries (Ecuador), other ingredients from Greece and Germany, Greek bio-nuts or imported from USA and Spain, imported stevia and mastic of Chios
- Major customers: Organic stores, Delicatessens, Traditional Foods stores, Liquor stores, Pharmacy stores, Supermarkets, Grocery stores, Para-pharmaceutical trades, Distributors and trades abroad.
- Sales' structure: exports 7%, 93% national (mainly England, Bulgaria, Germany, Cyprus, Kazakhstan, Denmark, Romania and lately Australia)
-Entrepreneurs: a family consisted of parents, son and daughter.
-Patents: no
-Trademarks: yes (9 snack codes in 3 years)
-Awards: yes

Object of investigation

The case was recommended by a representative of The Food Industrial Research and Technological Development Company (ETAT SA). Interview with the three family members (parents and son) lasted about 3.5 hours with a visit to the plant to follow. Additional information has been conducted through articles and papers and further information on the firm's events mainly by internet sites. Understanding gaps were filled by several phone calls. The researcher keeps contact with the entrepreneur and has co-operated in the preparation of a proposal.

FCo4 is a small family-owned company with a modern and flexible plant in Loutraki of Korinthia with state of the art machinery and novel production methods. It produces mainly chocolate products; however, lately (after the interview) introduced a series of sugar-free organic jams and superfoods. The company operates in the sugarless food sub-sector, bringing a number of innovations.I t is a completely qualified unit that fulfils all the HACCP designated instructions. The company ensures the high quality of its products by following strict hygiene conditions and keeping an ISO 22000:2005 record and is being regularly checked and certified for its organic products from the "Q-Ways" (Quality Ways) Operator and it will soon obtain the "Kosher certification", too.

Basic products (at the time of the interview): chocolates with natural sweeteners for quasi-pharmaceutical use, organic products, sugarless products and classic chocolate

The company was the first to: a) use transparent packages for chocolate bars and individual consumption chocolates; b) Produce organic farming chocolate in Greece and continues to be

the only producing company in Greece; c) Establish for sale the "sugarless chocolate" for diabetics in pharmacy stores and d) Produce sugarless chocolate using the sweetener Stevia in Greece.

Competition regards conventional chocolate and imported products for the quasi - pharmaceutical products. There is also one Greek organic chocolate producer but it is rather under the craft and not industrial mode. The company is doing very well despite the crisis.

The entrepreneurs: The parents who started the company have no University degree; however, the father has a certificate of a private confectionary school and a great passion for pastry making and former entrepreneurial experience in the family company (a weaving mill). At the time of the start-up decision, the son had just entered the business management Department in order to take over the new firm. However, he was already involved in the new business plans. *"We worked as a team. I was just the head of the team. We had all ideas and we discussed them but decisions had to be accepted by all"* says the father. In 2010 (at the time of the interview) the son had also finished the electronics department of TEI of Patras and was working in the company. Today (2015) he is in charge of FCo4, is very active, has managed to enrich the innovative products and to promote exports in Australia and to promote the image of the company increasing sales. He is also very active in the business environment of Patras. He is a strong believer and supporter of knowledge-based innovation. *"But for something innovative, there is no point to add another conventional food company. You can bet that it won't survive, unless you can offer something not only different but exceptional as well. It's a matter of knowledge then…"*

The innovation: The initial innovation that re-directed the company's course was the production of purely biological chocolate and the use of stevia instead of sugar. This was combined with the transparent packing (wife's idea) and the approach of pharmacies in order to sell the product as a quasi-pharmaceutical use.

Innovation/Entrepreneurial process: FCo4 emerged from a confectionary shop where besides confectionary, hand-made chocolate was made and sold with success; in 2002 the family decided to move to an industrial-scale focusing on chocolate. However, they knew that the production of conventional chocolate would never succeed no matter the quality due to the severe competition of both Greek and imported relevant products. They started with the use of fructose; the idea came of fructose biscuits abroad. By then fructose chocolate bars were products of Teuscher Company in USA (origins from Switzerland), while Jacobs Suchard's R&D Dpt had prepared such chocolate for an experimental research work of Johnson et al in the end of the 80's (cross Internet information and interviewees' relevant data).

The production process was quite similar to the one with sugar although there were certain changes in temperatures and pressures. The products were sold to the same stores (in the

region o Korinthos) that bought the conventional chocolate the entrepreneurs produced as a confectionery but in a new place in different packing and name. The entrepreneur contacted sales himself; he placed fructose chocolate in 2-3 pharmacies in Korinthos and he personally advised diabetic patients that they could eat the chocolate only after their doctor's approval. He noticed that diabetic consumers liked the product and created the idea of selling it directly to pharmacies. In order to escape health-claims and trouble with the National Organization for Medicines, the notice "After doctor's approval" was added on the packing.

On the other hand, the family noticed the trend towards the bio-products and the lack of relevant Greek chocolates. They found suppliers of bio-cocoa from Ghana and Ecuador and produced purely biological chocolates as well.

However, the entrepreneurs were not satisfied. A search in internet by the wife brought up the idea of sugarless chocolate with the use of stevia. Due to limited knowledge on the issue, they contacted a Professor of the University of Thessaly, School of Agriculture. The entrepreneurs had tried before to contact a professor of the Bio-technology Department but with no success.

The entrepreneur's wife admits that it was not easy; *"We had to learn everything; from food technology to design and marketing. We studied through internet and by consulting Dr L (the professor) on stevia use"*. However, even he could not answer all questions and they had to try many times to reach satisfactory results and achieve the tastes and flavors they wanted.

She personally attended a short course on **design** which is deemed as very important for branding. She has created all design concepts while the graphic designer engaged in the project would only improve them in details.

A major problem is to transfer ideas in industrial production. At first they discussed technological solutions with an Italian firm that produced relevant machinery. Due to the uniqueness of the needed machine, the firm considered it as rather unprofitable and withdrew. However, this solution would also be rather expensive for FCo4 as well. *"It would be too expensive if we tried to co-operate with a foreign company and there is no direct technical support. Think on the easiness regarding such machine co-development for Germans, Swiss and Italians. They do whatever they wish."* In accordance, production lines are almost 90% manufactured in Greece; 20% regards conventional general purpose machinery bought by Italian, German and Greek companies while the rest are products of **machine co-development or even in-built machinery.**

> *"the existing equipment does not fit our plans since we want to create some other unique characteristics. Furthermore, it is extremely difficult to explain what exactly you need duw to lack of prior experience. We have constructed many parts of our production line by ourselves with Greek machine shops".*

"Our production lines are mostly customized. There is only a 20% of conventional machinery. All the rest bear our own design and have been manufactured exclusively for us, for our requirements and our needs. […] The refrigerating equipment is of significant importance for the production line. It is our own patent. The rolling machine was also a co-development project. When it started working we had many problems. Now we have solved almost all of them. Actually we have further noted certain improvement tips now that we watch it at every-day work. You see, there are no commercial equipment to satisfy our requirements."

The entrepreneur put also emphasis on **packing and product design** which changed significantly after the initial product presentation. Transparency in packing was partly an inspiration of wife which was soon confirmed by the positive comments of sellers, store keepers and consumers.

Market entrance: The entrepreneurs after their first success with the local pharmacies tried to enter the market by contacting the medical society and the pharmacists' association. However, they were both indifferent and they turned to biological stores and chains and they also tried to find other ways to approach pharmacies. They were the first to enter pharmacies and they also managed to create a sales network in Greece while at the time of the interview they tried to export in Cyprus and Bulgaria.

In 2011 FCo4 presented its product in Europe by participating at the international trade show "Tastes like Greece".

Today the national sales network is quite important, they have entered super markets and keep leadership in pharmacies while exports have reached England, Bulgaria, Germany, Cyprus, Kazakhstan, Denmark, Romania and Australia. FCo4 participates in Greek F&B trade shows, in specific eco- and bio-festivals as well as at the pharmaceutical products' trade shows.

Promotion is also facilitated by FCo4's presentation in specialized magazines and participation in taste and flavor contests.

Appropriability Strategies: Registered trademarks and brand names that represent the diverse categories such as for gourmet products, super markets, bio-products and quasi-pharmaceutical.

Knowledge bases: food technology (e.g. chocolate and sweeteners technology and science), plant technology, (main =glycemic index, sugar-free), mechanical engineering, business management, environmental engineering, information -on machinery, know-how, trends etc, , trends towards healthier ways of life (dietary needs and demands and medical advice in general and for special groups) and design principles.

Financial resources: own resources, and a subsidy (3rd CSF). The investment was about 400.000 Euros.

Suppliers: besides the raw material suppliers mentioned in the Summary, collaboration with quality control laboratories, the laboratory of Food Allergens, graphic designers for design and occasionally with consultants for promotion and marketing.

University and Research Institutes: FCo4 seeks co-operation with Academia. So far it has mainly collaborated with the University of Thessaly.

Institutional: The entrepreneurs referred to difficulties in approaching certain University Departments. They also complained about the dysfunctional state mechanisms and public services which sometimes cause vital delays for the new firm's development. They also focus on the importance of personal relations to people working in such positions.

Corporate strategy: differentiation, constant innovation and branding supported by strong marketing.

Marketing strategy: the development of niche markets in Greece and abroad focusing on innovation towards wellbeing and health trends. Marketing capabilities have been developed by the son who started to build a marketing plan around 2012.

FCo4's innovativeness is based upon strong NPD and process advancements There are no distinct processes developed but there are certain activities such as the creation of new – completely different products, use of super- foods, and new marketing methods (direct marketing -phone/mail and social media).

In 2013-2014 it started expanding its networks, collaborations and export activities. FCo4 has relied mostly on personal contacts and internet. Knowledge and information is collected mainly by internet and international trade shows, public organizations like **Hellenic Foreign Trade Board.**

Being almost a monopoly at first, the new micro- company managed to survive with no significant problems in the market since no competitor was actually annoyed. The term "quasi pharmaceutical" solved further institutional problems regarding names and categorization. Strong NPD, technological and process advancement as well as package design assist the company's growth, which presented only a slight sales decline in 2009- when Greeks faced the shock of the severe crisis. Yet, it bounced back in 2010 and presented further sales increase in the subsequent years. It presents rapid growth with increases of turnover even more than 200%.

"The idea was to provide pure "home-made" chocolate bars –uncompromisingly and completely pure chocolate with novel and alluring tastes. So we posed limitations from the very beginning: no lecithin or chemical preservatives, no oleaginous, sugar or preservatives. Searching for alternatives we would crosscheck with Mr L. (the Professor) all possibilities. It is not that easy. You have to find the best balances in many parameters. We became engineers, food technologists and designers. We spent hours in mixing ingredients. Results would be tested and back again. Changes over changes... And when the final product came under our limitations, then it was the problem of equipment for mass production".

FCo5 –Case study

Summary
- Legal form: SA (GP till 2006)
- Year of foundation: 2002 /changed distinctive title and legal form in 2007 (February)
- Starting year of producing the new product: 2004
- Number of employees: 30 full-time
- Product family: (I) conventional and biological wheat flour and semolina (90% of turnover), (II) gluten-free wheat flour (5%), (III) bio-functional flour and relevant foods (5%)
- Manufacturing: continuous process production with variation
- Major customers: market chains – buying groups, pastry and pasta industry, bakeries, confectioneries, restaurants and restaurant suppliers, drugstores and shops of biological products
- Major supplier: wheat farmers (local / national), chemical industries (foreign) and packaging companies (national)
- Sales' structure: Europe – 5%, USA -12%, AUSTRALIA – 2%, other 3% National – 80%
- Patents: worldwide patents for the "feedback" cake and the flour with grape extracts, patent for a packaging form only for Greece
Trademarks: international registered trademarks for all products and the company's trademark
-Awards: "Entrepreneurial Innovation Prize" , "Prize for the most innovative production process", (regional Chamber of Industry and Commerce, 2007). "Ecology prize" (Ecological Association of the region, 2008)

Object of investigation

The case was recommended within an expert interview with a representative of The Food Industrial Research and Technological Development Company (ETAT SA). Interviews with the General Director (4 hours), the Technical Director (2 hours) and the Head of the University Research Team (Department of Biochemistry and Biotechnology) (2.5 hours), a view of the plant with the General Director (about 1.5 hours) have been conducted for this case study. Moreover additional information has been conducted through articles and papers handed by the General Director, research papers on gluten-free products and further information n the firm's events by internet sites. Understanding gaps were filled by several phone calls and a second visit to the Researcher for some further specification on the processes.

FCo5 disposes private industrial plants located close to Serres (North Greece). It started as a conventional flour producer in 2002, but in 2004 due to a series of innovative ideas turned to the niche market of bio-functional foods. It changed distinctive title and legal form in 2007. The company is also activated in biological flours, bakery and semolina products, as well as traditional paste.

The company focuses on differentiation and niche market leadership. The vision of the company is to become a leader in the field of flour and semolina products by combining the traditional production methods with new technology innovations. The company focuses on high –quality products with high nutritional value in the peak of Research and Technology. It is the company that brought the concept of bio-functional food to the Greek F&B Sector.

Although new, it was able to gain a position among the first five Greek mills which are well known established firms.

FCo5 started by trying to replace the existing gluten-free wheat bread (produced by a small number of companies abroad) which was not acceptable by consumers with celiac disease due to its crumbling texture, poor colour and other post-baking quality defects (to be explained in detail later in this report). During their experiments they met Dr K, a Biochemistry University Professor. This meeting was crucial since it facilitated the realization of the entrepreneurs' strategic vision to turn to high technology products.

Basic products: flours, semolina, pasta, bakery and functional products which are sold in pastry and pasta industry, market chains – buying groups, bakeries, confectioneries, restaurants and restaurant suppliers, drugstores and shops of biological products. The products serve the general consumer markets and special-consumer categories (of niche markets such as celiac disease, cancer patients, athletes etc). Bio-functional foods are opening prospering markets and a potential to grow as far as the innovative imagination of the researchers goes, since these niche markets are at an infant level. . There are also other special groups that showed some interest such as the US army. The company sells mostly in Greece and has started exporting in USA, Europe, Australia and China.

The factory is located in Serres, covering 35.000 m^2. There are 4 shareholders who are family members; Mr KS (the father), Mr KJ (Mr KS's son), and Mr T (the innovation champion) with his wife (Mr KS's daughter. The children of Mr T and Mr KJ are now entering the business as well. They have studied chemistry, industrial design, economics and marketing.

FCo5's **competitors** in the conventional products are many and some of them more famous and established than FCo5. In the gluten-free products there are other three companies from Europe and America without a real competition to exist, since the products produced by FCo5 are closer to the Greek tastes. These companies caused some trouble to the introduction of FCo5's gluten free flour in drugstores. Although the product was registered by the General Chemical State Laboratory of Greece and was assured that no other license was required, there were claims for not having a license from the National Organization for Medicines (although it is not a medicine). The company had to pay a fine of 3000 Euros and request the license. There is no competitor till now for the totally innovative products of the company.

The investigated innovation cost about 4.000.000 Euros (300.000 € for R&D). The company spends about 8.5% of its annual turnover on innovation expenditures.

Entrepreneur(s): Mr KS was an entrepreneur long before the establishment of FCO5. He actually has been an experienced entrepreneur for more than 40 years. He is an economist. He was running a construction company, when in 1974 he turned to tomato processing, since it was one of the region' s main cultivations. In 1982 he engages a young chemist who later marries his daughter and becomes partner – Mr T. Meanwhile his son KJ takes his diploma in

Economics and enters the firm in the end of the decade of 90's. In 2000, they all decide to abandon the tomato product foreseeing its slow death. In 2001 a cooperative grain mill went to auction. The family bought it and in June 2002 the first conventional wheat flour was produced. This was the production till 2004. Mr KS is the President of FCO5.

Mr T, general director and co-owner of the firm, studied electronics in Greece and then he went to Canada where he studied Chemistry and took a master in electronics applications in chemistry. He further specialized in Food Technology. In 1982 he entered the tomato company as a chemist but after his marriage to the owner's daughter his role changed. He took over the General Direction of the factory. In order to be effective, he attended many courses on food technology specialized in quality, technologies and methods mostly abroad as well as in the customers' companies.

He is the one who turned the family to innovation although they all own a creative culture. The firm's strategy till then was quality. They engaged the system of "contract agriculture" since the very beginning of the new mill, but yet Mr T felt that this was not enough to bare the competition. Very soon he started searching for something new, without having something special in mind. His wife and daughter of Mr KS is an economist and deals mostly with the financial management.

Mr KJ being also an economist is the company's CEO. He co-operates with Mr T in the research projects. They are serial entrepreneurs. They now own 4 companies: two in the Food sector, one in services and a construction company.

"These people are ahead of the others. They own an uncommon culture in Greece, they like risking, they enjoy investing in innovation and be unconventional. And this is very difficult in Greece. Very difficult …." (Dr K. about the entrepreneurs)

The innovation: Because of coeliac disease, some individuals cannot tolerate the protein gliadin present in the gluten fraction of wheat flour. The majority of bread is conventionally produced from wheat flour. Apart from its major constituent starch, wheat flour also contains many other types of substances of which the gluten, the non-starch polysaccharides, and the lipids are the most important in terms of their impact on the processability of the raw material and the quality of the final products.

From a commercial perspective, there was a need for the development of gluten-free bread from wheat, with texture and flavour properties similar to the conventional wheat flour loaf. In the context of bread, the gluten component of wheat has a crucial role in stabilizing the gas-cell structure and maintaining the rheological properties of the bread. The absence of gluten results in liquid batter rather than pre-baking dough, yielding baked bread with a crumbling texture, poor colour and other post-baking quality defects. Most appear to be 'under baked' and dough-like pieces, whereas others have a dense rock-like crumb texture. The liquid batter cannot be processed on the existing production line of baking industry.

Although there are countless gluten-free products in the market, the scientific literature was surprisingly brief on the systematic development of gluten-free breads with properties similar to those of conventional loaves made of wheat flour. A literature search revealed a large number of references for bread texture but the literature surrounding gluten-free bread was more limited perhaps due to commercial secrecy. However, the company found out that commercial gluten free bread would come from: 'Combined use of ispaghula (the milled seed husk of *Plantagoovata*) and HPMC to replace or augment gluten in breadmaking' (Haque & Morris, 1994); soyabean, rice or fish proteins. For example, gluten-free bread developed by using rice flour, hydrophilic psyllium husk and HPMC by Haque & Morris (1994) was whiter than wheat bread but had a characteristic rice taste. Breads made with inulin or fish proteins exhibited similar (excess browning with inulin) or different (rapid staling) defects.

The company turned to the solution of the problem: to make white wheat gluten free bread which would resemble normal conventional bread. During the research period they came across several studies such as 'Crust and crumb characteristics of gluten free breads' (Gallagher, Gormley, & Arendt, 2003); 'Production of gluten-free bread using soybean flour' (Ribotta et al., 2004); 'Functionality of rice flour modified with a microbial transglutaminase' (Gujral & Rosell, 2004a); 'Improvement of the breadmaking quality of rice flour by glucose oxidase' (Gujral & Rosell, 2004b); There have also been many methods applied since 1950 in order to separate gluten from wheat (e.g. the Martin process, the modified Fesca process and the batter process- see relevant literature in the end). Most of them were not suitable for commercial use.

The gluten-free bread developed by Gallagher, McCarthy, Gormle, & Arend (2004) using wheat starch, gluten-free flour, milk powder, and milk proteins had, among other problems, a low specific volume, and an excessively dark crust due to Maillard reaction. The addition of cross linking enzymes and HPMC yielded acceptable rice bread as reported by Gujral & Rosell (2004a, 2004b) but failed to produce acceptable non-sticky dough for the industrial production.

Additionally the breads in previous researches were made from batter instead of dough. The batters transform into sticky paste when less water content are used. The sticky paste is not suitable for industrial production due to its stickiness and insufficient hydration of flours leading to tough mixture that fails to rise, whereas, the batter itself is unsuitable for industrial production due to its sticky and liquid state.

Existing gluten-free products generally are denser than conventional loaves, have very poor shelf life properties. To give an example, a typical gluten-free bread is denser than a normal wheat bread (2.5–3 L.kg-1 vs. 6–7 L.kg-1, respectively) and becomes stale within 1–2 hours (Hamer, 2005). Moreover, the products are prepared from a batter and as such cannot be

made on existing bread production equipment, which obviously represents a major capital outlay. Moreover, there is currently no white gluten-free loaf available in the Greek market.

The research started in the middle of 2003 and in 2006 the company presented its innovation which was the development of a gluten-free high quality commercial white loaf with similar quality characteristics to that of standard white bread on the existing processing lines of bakeries. Within this constraint, dough had to be produced with handling and moulding properties similar to those of conventional wheat flour loaves. Moreover the existing types of bread were only intended to cover the basic needs of the patients, without caring about taste or proper nutrition. The innovative method further conserved the taste and enriched the nutritional content of the gluten – free flour.

Experiments on gluten free wheat bread still go on all over the world, since commercial secrecy has not allowed many details to leak but there is also a different approach of conventional bread due to the different tastes in different nations. For example there was the master thesis of Rakkar in 2007 which finally led to a a specific combination of soy flour, maize starch, potato starch, yoghurt powder, milk protein, HPMC (K4M) psyllium husk, microbial transglutaminase, lipase, and fungal α-amylase (and gluten-free bread doughs made from rice flour, corn starch, defatted soy flour and chickpea flour at different levels with addition of 3 % xanthan gum (Hegazy et al. 2009),

Most patents on similar products appear after 2007 (e.g. Jules Shepard, Gluten-free flour composition of gluten-free white rice flour, gluten-free potato starch, gluten-free corn starch, gluten-free tapioca starch, gluten-free corn flour, and xanthan gum U.S. provisional application No. 60/999,955,2007, Marsella DiMare, Forming a gluten – free dough or batter, UK patent application GB 2 447 978 A, 2008 etc).

FCo5 has obtained authorization for health claims for its innovative products submitting applications to the European Food Safety Authority (EFSA) and the Food and Drug Administration (FDA) in USA. Health claims are obtained after very strict processes and must include both clinical and basic research.

Innovation/Entrepreneurial process: The Company's vision had a clear technological orientation. They had already created a stable scientific background with scientific personnel, a lab and a deep knowledge of the chemical side of the flour. The opportunity appeared suddenly after a TV presentation of coeliac disease. A final consumer of the company's flour, citizen of Serres called the information department and asked about gluten –free flour. The request was transferred to Mr T who saw a whole new market in the sector of special diet categories. The family made an internet research to learn more about celiac disease and then turned to market research. They studied the existing literature, the Greek and international market on such products and they also collected all information that seemed to interest the new market segment. For example they found out that a large percentage of Australian

tourists avoid Greece since they cannot find gluten –free product outlets (there is a large percentage of individuals who suffer from coeliac disease in Australia). They also contacted the Panhellenic Association of Patients with Coeliac Disease who accepted to help them by tasting their products and send them their valuable comments.

Experiments started at the middle of 2003. Besides Mr T who is a chemist, the research team was compose by 14 other people: an agriculturist specialized in food technology, 2 other agriculturists, 3 chemists, 2 food technologists and 6 specialized assistants. There were also a number of Dr K's students that were added later (when the collaboration started) and would stay as long as their thesis lasted. One of the research members described the beginning as very difficult, since besides the every day work they had to search and study the existing literature, contact friends of the sector for further scientific information and study. *"I think I could not say how much time we spent on it (i.e. literature research). The manhours we devoted to study cannot be described as simple as that – literature! Most people do not understand. In order to find a component ratio and contact the experiment you may search and finally find nothing to assist you. And then you have to decide by yourself! The existing literature was at infant level"* he narrates. In parallel they kept in contact with the Association of patients with workshops and questionnaires. Although the company's research team was dedicated to it, there were some problems on some delicate analyses which could not be contacted by them. Then in the beginning of 2004 Mr T met accidentally Dr K., a Professor of the Department of Biochemistry and Biotechnology of the University of Thessaly. Since small companies have faced some underestimation by many of the Academic world, Mr T considers it good luck that they met Dr K. *"They usually want to take advantage of your name. They do research just for themselves. They tell us to put our signature –just do it! Then you don't need to do anything at all! But Dr K is different. He is more anxious than us to offer really useful products"*. There was a mutual trust developed and the missing link was found. *"If but Mr K we would not be able to move on! Of course that was also the turning point for us, since this cooperation led to the further development of totally innovative bio-functional products"*. Sharing Mr T's passion for innovation, the rest of the family welcomed Dr K's intervention and ideas. Dr K adds that they shared the same vision and that their collaboration was and is an excellent experience for him. "There was an excellent *crescendo* in our collaboration. They do not simply see the future, they *are* in the future" (Dr K about the entrepreneurs). He further reveals that the research studies for all products were paid by the company. Although working on the gluten free flour, the new team (the company's research staff and the research staff of Dr K) started research on grape extracts. The innovative flour that was the result of these new experiments has the usual taste and can be used as the conventional one but adds to health and prevention. The preparatory work for the new project lasted 4 years, although according the Professor the know how and scientific

knowledge had been preceded by ten years' research activities in the field with many people working their master and PhD Theses on it. Some of them entered the research team of FCO5 as well, and were key drivers in the pilot production.

The experimental results were cooked in lab and the company's own bakery and then were tasted by the researchers' families. The final products were tasted by most of the company's employees in order to improve the taste and find the best recipes not only for bread but also for cakes, pizzas, crepes, pasta, peynerli and pita for souvlaki. Then these products were sent to the association's patients to test their reaction (if the products are tolerable by their body, as well as the taste). After two and a half years the research team succeeded in finding the formula for the gluten-free flour and produced in a bakery they own gluten –free foods.

Introduction to the market: They started by selling flour directly to final consumers (patients of celiac disease). Since the flour can be prescribed in a pharmacy prescription book and the patients take their money back, they started ordering it through drugstores. Consequently, in 2007 the flour was sold in drugstores in its new packaging. Although sold to patients, the product became widely known in 2008. "In the end of 2006 we were talking to market chains for the new flour, but they did not understand. So we did not insist." Last year a pharmaceutical company contacted FCo5 in order to take over the gluten –free flour distribution in Greece.

In 2010 FCo5 announced collaborations in USA and Russia and collaborations with a known market chain on private label products.

The whole research project, the method and the production process was FCo5's success. Although the product existed, the company did not try any type of coping, since they aimed at a completely different final product than the existing ones.

The company did not patent the product, since the existence of similar patents would make it time-consuming as Dr K explained. On the other hand the company went on with entirely innovative bio-functional products which were patented worldwide. The company claims that it is also very difficult for anyone to copy the method for the gluten free wheat flour.

The Board decided to invest in new processing technology in order to fulfil requirements not only for the specific innovative processing method but to cover future needs on bio-functional products. After a further market research and a business plan for the new products they entered the Investment Law 3299/2004 for an investment of 3.500.000 Euros in total. The new investment has today reached 5 million Euros. The following year (beginning of 2007) the company changes its brand name and the legal form (from GP to SA) marking its new vision and directions which are presented in its new strategy.

Appropriability Strategies: The selected niche markets present high barriers for Greek companies, while the concentration on specific tastes prohibits relevant foreign products. Despite this, for "followers" the entry costs would be very high for a relatively exclusive

market segment (research costs, facilities). Still the company has registered all the products as trademarks and gluten-free flour and subsequent products have been registered by the Greek Medicine Organization (although they are not medicines, the company was forced to do so by the foreign competitors).

The company has patented the two innovative bio-functional products worldwide as well as a new type of packaging. The company follows the strategy of preserving industrial secrets and move fast to new innovations when it has to do with already existing products.

Knowledge Resources: although the firm-specific knowledge of this company is relatively young, there is accumulated knowledge on food technology from the previous enterprise. Working with international companies such as Nestle and Heinz, the entrepreneurs had gained a great experience and learned a lot about food quality, specifications, market segments and new methods and processes which further shaped a certain culture on food production.

The firm – specific knowledge is described mostly by the entrepreneurs and their background, the experienced personnel and their social capital. Mr T can be considered the main driver and promoter of innovations at the company, assisted by the managing Director and the external collaborator Dr K.

In-house research is developed by Mr T and Mr M, assisted by the rest research personnel who can also solve alone minor problems (e.g. problems of taste and texture). Dr K runs the scientific part of a project while his lab and acquaintances support special experiments and analyses.

The manufacturing knowledge is developed by the co-operation of Mr T with the company's engineers and main parts are constructed by manufacturing companies abroad. Most parts are custom-made and there is much knowledge transfer among suppliers and customer. Certain parts are designed by Mr T himself and constructed by local companies.

Mr T has got a long experience on planning, designing and realizing custom made technology since he has done it in the past (e.g. developed a new process technology for more flour purity and fluffiness by mixing tomato and flour technology).

After the success of the pilot production there was a concentration **on production technology** which had to fulfill the requirements of the innovative production methods (e.g. the different demand in water when separating gluten, a different type of rollers etc). Since the method was innovative, many parts of the equipment were custom made and there was cooperation with local and foreign companies while the central idea was supported by Mr T and his engineers. The whole activity presented both foreseen and unforeseen difficulties, since the technical knowledge was newly created and the company wished to keep the main technology secret. This was one of the reasons to break the whole process in sub processes with different contractors both Greek and foreigners. Unforeseen difficulties led to a need for further investment (from the initial amount of 3.5 million to 5 million Euros). Meanwhile the

company trained its technical staff to take over the maintenance of the whole process equipment.

The managing group consisted of Mr T, his engineers, a local construction company, Dr K and two of his PhD students and it was supported by the engineers for plant manufacturing and erectors of the plant manufacturing companies. One can recognize a constant bidirectional knowledge flow of both embodied and disembodied knowledge through skilled personnel, training, plant and equipment designs and descriptions, consulting, mutual experimenting, machinery and equipment.

There are no vital changes in the relationships with suppliers but still their cooperation entered a new level, since the company asks for new types of products such as specific enzymes.

Cross-functional activities and associated investments took place concurrently, rather than sequentially, in order the newly launched products to cut time-to-market.

The addition of a completely new unit for innovative products based on chemistry and biotechnology brought several organizational changes as well as a new culture in the company. Furthermore, the establishment of a stable and continuous cooperation with the Department of Biotechnology of the University of Thessaly entered an air of dynamism and developed a culture of innovativeness devoted to cutting edge technology. The image of the previously conventional grain mill had changed forever.

Still, it is the cooperation with the University that facilitates further developments (dynamic capabilities). The company knowledge ranges from the properties and potential of semolina and wheat to the use of biotechnology and food technology. The capacity was developed through training, individual studies and efforts, co-operations with clients and suppliers and the build of a strong research team devoted to the company's vision. FCo5 has developed certain capabilities for networking, collaboration, and effective knowledge transfer and knowledge exploitation. Mr T is the key person while Mr KJ is the one to estimate the economic aspects of the new projects. The transfer and further development of new scientific knowledge is based on formal sources such as research projects with the University of Thessaly and through a spin-off on food technology that FCo5 has established with Dr K. It is worth mentioning that it is the first spin-off in the food sector in Greece devoted to research on bio-functional products. There are always informal sources of knowledge.

Sectoral knowledge base: The tenet "Let food be thy medicine and medicine be thy food," espoused by Hippocrates nearly 2,500 years ago. The first functional food and, arguably, the most important among them as a scientific process was iodized salt. The U.S. began iodizing salt in 1924 and has virtually eliminated the scourge of Iodine Deficiency Disorders, the most preventable cause of mental retardation. Functional foods industry represents the sectoral knowledge base and is rather new. Bio-functional foods based on wheat flour constitute a

specific knowledge base, in which there are plenty of innovative food products (developed using grape extracts, whey, etc.), and process technologies and methods. In the consequence of the energy, water and oil crisis there had been new developments for all processes which in their conventional type are energy and water consuming.

FCo5 used and extended knowledge in the fields of biotechnology and biochemistry (plant bio-actives; antioxidants and ageing; dietary fibre, functional starches; functional lipids; functional food products; molecular nutrition and other relevant aspects of disease prevention and treatment), conventional organic chemistry, general food technology, geoponics, mechanical and chemical engineering.

Financial Resources: All studies and research was financed by the company's own funds. The company entered the Investment Law 3299/2004 for an investment of 3.500.000 Euros in total, in order to build the new unit for the innovative processes (new processing production line). The subsidy was 45% (1.590.000 Euros) and the bank loan 883.500 Euros. The new investment has today reached the 5 million Euros.

The company used no program or subsidy for the initial research. It has realized a project on "Human Research and Technology Education and Training Networks – B Cycle" Measure 8.3, Action 8.3.6 of the Operational Program Competitiveness in collaboration with the University of Thessaly, Department of Biochemistry and Biotechnology.

The first co-operative innovation study on 'Development of bio-functional flour by incorporation of plant extracts enriched in bioactive compounds' with Dr K was funded by 70.000 Euros, while the real costs reached 300.000 Euros. The business plan of the spin off has already been approved by the ***National Strategic*** Reference Framework (NSRF) with a budget of 3 million Euros.

The **innovation culture** nourished and developed in FCo5 led to several innovative products with worldwide patents and further research in the field of bio-functional food products. Clinical research is today extended to cancer patients, athletes and other special categories.

Although this first innovative process (the gluten-free wheat flour) has not been patented, FCo5 has taken measures such as the use of multiple plant manufacturers and the development of a tight informal network between the research staff of the University, the companies and the suppliers. "It is a matter of mutual trust and respect!" says Mr T underlining the existence of an informal secrecy code even with plant manufacturers.

The way the company moves on with research reveals an informal (not officially recorded) organizational routine, which supports and nourishes the absorptive capacity of FCo5. The company gets some information which leads to a new idea. This new idea is assimilated and exploited by forming the needed parameters and when the company gets the desired result it goes on by creating the preconditions for new information. According to Mr T this cycle which led to the establishment of the spin-off is enabled by the co-operation with Dr K. and is

the well-built capability of FCo5 that creates the competitive advantage of differentiation and leads FCo5 ahead of the other sector companies.

The company has also established a routine of sending questionnaires with a personal letter to each patient of the selected team (it started with the patients of celiac disease) in order to get direct and accurate information. If requested there is a company person to call them in order to discuss their aspects. In this way there are more needs arising that would not be mentioned if the company used an intermediary company to collect questionnaires in an impersonal manner. "These people feel that you are close to them and you really want to help and are not just statistical numbers. The pita for souvlaki was a wish of one patient. One cannot easily imagine the problems they encounter with food." New products are sent free of charge to them in order to comment on them.

The company actively uses all routines imposed by ISO9000, ISO22000:2005 (food safety management system), HACCP, as well as GMO management system (according to EU norm 1829/20030) and a well organized training program.

Market: The Greek market is dominated by two associations of undertakings, the 'Greek Flour Millers' Association' and the 'Association of Flour Mills of Greece', which together represent approx. 90% of flour mills in Greece (from a 60% they represented in 1999). There are important pressures due to imports and market linearization.

The functional food industry is one of the several areas of the food industry that is experiencing fast growth in recent years. FCo5 is the first company to present such wheat – based foods in the Greek market besides the gluten-free flour which is still one of the few worldwide made of wheat flour and the only one with the characteristics mentioned above. The new image of the company offers both a European and international perspective, since the innovative products are patented worldwide.

The main **supplier** markets are wheat producers and biochemical industries and of course the mechanical engineering industry. The new products are further improved, adopt to local tastes for foreign consumers while there are further experiments in order to present new concepts in the market (e.g. biscuits and bars for travelers and athletes or appealing to children which presupposes the cooperation with biscuit producing companies). Furthermore FCo5c invests in process technologies, skilled staff and know-how, in order to improve efficiency and quality, raise productivity and enhance flexibility. Its overall strategy enables the formation of high entry barriers for existing or indenting competitors.

Institutional: The entrepreneurial environment in Greece has been described as rather unfriendly. Subsidies are time-consuming and presuppose a financial soundness of the company. The existing mechanisms rather hinder than enable co-operations or innovative efforts and research co-operations: "The academics scorn us. They offer us some money or the chemist's salary for six months. It is not what the food industry desires" says Mr T, while

Dr K adds «Universities in Greece are the most anachronistic institutions. Academics behave as common public servants and believe that they have only to teach and make some papers and presentations in conferences. We are far behind the modern universities that innovate abroad". Mr T details several stories about the hostile environment in which FCo5 developed its innovative products. The fact referring to the ignorance of the General Chemical State Laboratory was mentioned above. Still, although there was no penalty for the public servant, the company had to pay a fine of 3000 Euros. Mr T mentions that after the announcement of the innovation there were many foreign visitors in the plant both from the academic world (European Universities) and the political world (the Embassy of France, USA, representatives of the US Army) but nobody from the Greek state ("not even the local mayor!").

Another story of the indifference of the Greek State is the initial rejection of the company's innovations presentation during a workshop on bio-functional food and gluten-free products. The workshop was an activity of a project named "**Human networks** *of research and technological education.* **Human network** *of education in the field of* **bio-functional foods"** funded by the GSRT with 200000 euros. Due to the many known academics who would present their findings, there were three companies excluded. One of them was FCo5. Mr T visited the Ministry of Development and was able to present the company's findings thanks to a secretary of the Ministry, who was touched by the fervor of Mr T. This was the first public announcement of the innovations and the participants tried products with bioactive ingredients

The state mechanisms are described as cumbersome or completely shadowy especially for companies that are in Northern Greece and far from the urban centers of Greece. There is a geographical isolation which hinders the promotion of the innovative foods." *I suppose the new products would be easier promoted if our headquarters were in Athens*" (Mr T)

There is no information on technology and innovation by any institution although there is a number of public ones that are supposed to offer companies their knowhow. Meanwhile going abroad is also difficult. The so called Export Promotion Agency does not actually help. Dr K adds that it is very complicate to produce innovation in Greek Universities that results to real innovative products.

The collaboration with Dr K and the Department of Biotechnology was the main opportunity to enter a new field of high technology products but also for ongoing innovation activities and the creation of a research spin off. It was partly the reason for the new investment in process technology, which was partly subsidized.

It was not until 2008 that Greek public started to show interest in the innovative activities of FCo5. There were many paper and journal articles, TV presentations and other events in favour of the entrepreneurs and the benefits of their products.

The location of the company creates problems that a company in a city like Athens would never counter such as slow internet, difficulty in finding and keeping skilled personnel and good research staff, networking with markets or promotion in order to make the products widely known.

The most important **suppliers** are selected ***wheat farmers*** who dispose their product exclusively in the company and under the system of "contract agriculture". Mr M runs the agricultural department of the company and is the main responsible for training, technical consulting and checking the farmers' productions. The company has turned to modern farmers and encourages the investments on high tech agricultural machinery. These farmers are classified in the system of "integrated production management " of the company and certified according to standard AGRO2 of AGROCERT (Inspection and Certification Authority in Greek Agriculture. The company is also the only Greek company certified for GMO – free products. The company purchases the biggest percentage of wheat of Northern Greece and is considered a vital customer for all farmers in the region.

Plant manufacturing engaged a network of ***local constructors*** (region of Macedonia). This was possible due to the social network of the family. The family also owns a ***building construction company for both industrial and big public projects*** (actually that was the first company of Mr KS). There was some important networking with plant installation constructors (e.g. for pipelining, electrical installations, transportation lines, automations etc) as well as some machine shops on custom made or self made machinery.

Main production lines were ordered to ***foreign manufacturing companies***. Most parts were custom made. Mr T underlines the need to establish trust with the suppliers. "There is always the equipment supplier's power. They give you a machine and say "*This is it!"* Then it is a matter of networking, it depends on the supplier you have chosen and his will to maintain the relationship with you." (Mr T). The main problem is that innovative equipment may be unique and any malfunction may cost time and money unless the company trains its own personnel and develops safety valves. In general, it is difficult to find already specialized personnel in Greece for the production lines of the food sector, due to the high tech it engages. The individual (referring to entrepreneurs) and company knowledge base is very important in case of machinery modification or custom made equipment. In such cases there are always knowledge flows in the whole process starting form designs till the pilot production. Malfunctions and problems quite often produce new knowledge and sometimes FCo5's solutions are adapted by the manufacturing companies. An example: the new wheat needed somewhere in the process to enter the next step more clean and fluffy that the existing system could offer. That was a major problem which was solved by the FCo5 technical department, while some parts of the machinery of the new product line department was

manufactured by a foreign company which finally engaged the new solution in their production lines (with the permission of the Mills)

During the research as well as the pilot phase Mr T and Mr KS used their social network in order to find *production partners*. Although they own a bakery to prepare bread and cakes, they had to further try their flour in other bakeries (the preparation of gluten free bread is very important for the final product not only in taste and appearance but also the degree of the patient's tolerance against gluten). They also had to try it in small or big industrial production. Therefore networking was again very important and was mostly done with customers who bought conventional flour (pastry and bread industries, bakeries and confectionaries). Mr T mentioned an initial problem of finding a biscuit company to produce biscuits for all the target groups, since it required some important and time-consuming changes in line production and Greek companies in this specific sector are very introvert.

The business networking with the chemical industry, which already existed due to the previous industrial activity of the family, enabled co-operations in preparing the desired reagents and enzymes for the innovative methods.

FCo5 builds long lasting relations with its suppliers on the basis of mutual trust, support and cooperation.

There was also the personal contact of Mr T with the patient of coeliac disease and his strong networking capabilities that led to the collaboration with the Panhellenic Association of Patients with coeliac disease. This first collaboration established trust and respect and led to further collaborations with other special teams (such as cancer patients with an 8-year boy as the mascot of the collaborating group). A larger scale clinical research was enabled through the social and business networking of Dr. K.

A very important link was Dr K which actually opened the way to totally innovative products through his own research and his own networking in the research community.

The company used its already existing commercial network in Greece and abroad (social capital) – mostly for non-final consumers, but it had also to develop a new one since the new products are sold in drugstores and shops with biological products. This was enabled through personal contacts and with the help of customers – patients. Hence FCo5 had to bypass the direct hierarchical business relations within the supply chain and sell to the final consumer, since it would be very difficult to enter the market by selling such products directly to industry or small –scale bakeries. It was also rather difficult to place the products on super-market selves since they have no preservatives and are rather delicate with too short expire dates. "Greek super markets are unwilling to build a system -like the one they have for milk – for a product with such a limited demand" comments Mr T. The company still works on the products in order to find ways to make them last longer and be acceptable in super market chains.

Linkages to high –tech companies: There are some important formal linkages with specialized quality control laboratories for all new products testing, such as a lab for allergens in Crete, a lab in an American University (a link of Dr K) for the certification of the gluten extraction, etc. The only linkage which could be characterized as both formal and informal is the one with the labs of the Department of Biotechnology where Dr K is responsible.

There is also a constant collaboration with big chemical industries in Europe (mostly reagents, enzymes). Last year FCo5 and Dr K prepared a business plan for a modern laboratory on pharmaceutical products (biological controls, anticancer, anti-diabeic, anti-oxidant etc)

There is a constant collaboration with a Greek automation company, formal and informal linkages to the manufacturing companies that supply the company with high tech equipment and there is a knowledge exchange on a constant basis.

One can also mention the cooperation with pharmaceutical companies in marketing, since the products are sold in drugstores as well as some linkages with the medical world especially for the new research projects (e.g. a clinical research on cancer patients in the Diavalkaniko Hospital of Thessaloniki).

Linkages to research centres, universities: There is a strong linkage with the University of Thessaly and the Department of Biochemistry and Biotechnology. The two parts have tightened their relationship with the spin-off which is a research institute on bio-functional foods. Dr K had organized a series of training on technology and knowhow for all the company's executives in order to deepen their knowledge on bio-functional foods. There is also some knowledge exchange among the Department students doing their practicum in FCo5. The students have to teach in short in-house theoretical seminars, while they gain more practical knowledge about the production and the preparation methods. Dr K regards this osmosis as very important for both sides.

Innovativeness: The innovative process of gluten-free flour and relevant food products (four types of flour and ready to eat or precooked bread, cake etc) led to several innovations on bio-functional products due to the new culture that was developed in the company, the enriched knowledge base and the fertile cooperation with Dr K. Since its turn to high tech food products, the company has produced bio-functional flour with grape extracts and the so called *feed back* cake which are both patented worldwide. They now work on wine properties. The company has not till now found a satisfactory sales net and is negotiating with both pharmaceutical companies and super market chains. The first production of the "*feed back*" cake was all bought by the American army. The cake contributes to the restoration of the human body after physical distress by reconstituting the muscle glycogen stores.

FCo5 produces small quantities of the innovative products. They serve niche markets and have to confront the consumers' hesitation on trying them besides the certifications for health claims. The company indents to gradually increase the production after securing markets, fame and brand identifiability. Although their sales started by the end of 2006, the gluten free foods became widely known only in the beginning of 2008. FCo5 goes on with new products made of gluten free flour, while in parallel works on the two other innovative projects in regard to improvements, formation of final products (e.g. the feed back cake is not easy to carry for athletes, so the company prepares bars and biscuits with all further research that has to be done on durability and conservation –the cake should be kept refrigerated because, due to high protein, no preservatives are added). FCo5 further contacts clinical research on the effects of these innovative foods, since they have proved to be well tolerated by cancer patients. In all cases repeated tests and analyses ensure the quality of the products. The world Biomed network in which Dr K is a registered expert enables specialized tests in high tech laboratories.

Each new research project is adding value to FCo5's product portfolio and promotes product innovation and new fields of application. "There is an endless list of innovative ideas in my head. It is impossible to catch up with all of them but some of them! –Yes, I will!" (*Dr K., closing the interview).*

FCo5 was awarded with the "Entrepreneurial Innovation Prize" and the prize for the most innovative production process of the regional Chamber of Industry and Commerce for the gluten-free flour and the bio-functional flour with grape extracts in 2007. In 2008 the company was awarded with the prize of the Ecological Association of the region.

The company's middle - term objectives rely heavily on covering the Greek market as a part of European, American and Australian one with innovative products, while excelling in conventional products in regard to quality, product –, consumer - and environment safety. Its vision further gets off the entrepreneurial side and enters the social responsibility, referring to research for cancer patients ("When we saw little Nicolas (8-year old cancer patient) who would eat nothing, and when he tried our cakes started eating and wanted to take some with him and his mother was smiling with tears in her eyes, we realized that it was more than an undertaking. It was an offer to society. We may not understand it. It is not only the market size…" Mr M).

The short term aim however is the survival, since the Greek market was and still is severely impacted by the financial crisis as well as the country's high fiscal debt, which created a *"lethal cocktail"* for business, with a reduction in consumption of even basic foods (Euromonitor, 2010). In the long run the company aims at being a leader in bio-functional food products.

FCo6 – case study

Summary
- Legal form: SA
- Year of foundation: 1955
- Year of process innovation: 2000
- Number of employees: 180 full time – 60 the SBU / 16 educated
- Product family: (I) parboiled rice (17% of the Group turnover), (II) exotic rice (10%), (III) specialties (1%), (IV) HO.RE.CA. products (20%)
- Manufacturing: continuous process production with variation
- Major customers: market chains – buying groups, catering, restaurants and restaurant suppliers, hotels.
- Major supplier: rice and pulses farmers (local / national) and packaging companies (national)
- Sales' structure: National 80%, Exports 20%
- Patents: in Europe and Greece for the parboiled quick cooking process method, for several specialties (rice mixtures one of which is with saffron from Kozani and is worldwide patented), patent for the installation of an innovative brown rice (global innovation on know-how and process technology), the production process of risottos, results of an eco-innovation research program. They are now in the process of patenting γ-orizanol.
-Trademarks: international registered trademarks for all products and the company's trademark
-Awards: 2002, International prize in SIAL international fair for the Specialités line, based on its innovation and commercial success; Best branded product prize by the Athens Chamber of Commerce and Industry; 2008, TÜV Nord Hellas award for the Group's yearlong dedication to issues concerning the certification and the quality assurance of its products (the only award of its kind given to Greek food company till now); 2009, Kathimerini's Gastronomos magazine awarded the Group for its contribution to the food sector.

Object of investigation

The case was recommended within an expert interview with a representative of The Food Industrial Research and Technological Development Company (ETAT SA). Interviews with the President and CEO of the Group KP (4.5 hours), the R&D Managing Director (phone conversation) and a view of the plant with the General Director (about 2 hours) have been conducted for this case study. Moreover additional information has been conducted through articles and papers handed by the General Director and further information on the firm's history and activities on the internet sites. In order to complete and better understand the collected information, a number of telephone calls have been conducted.

FCo6: NACE code 10.61 Manufacture of grain mill products (NACE Rev.2). The mother company disposes private industrial plants located in Agrinio (W. Greece) and Thessaloniki (N. Greece). It was founded in 1955 in Agrinio, a rice producing area in Western Greece. In 1993 the company enters the pulses market, being the first to pack this range in a square bottom, easy-open, transparent bag. Due to the entrance of the new generation in the Group, in 1998 a change of the company's vision leads to the preparation and realization of a state of the art, innovative factory in Thessaloniki by

both private resources and European programs. This becomes the basis of most innovative products based on rice and pulses. The company since then has a successful history on innovations and has won many awards both at national and international level.

The Group today produces several types of rice (both white and parboiled, which are grown in Greece, mainly in the area of Thessaloniki as well as imported rice from Thailand and India under the title exotic), pulses, specialities which include a range of semi-ready meals (convenient food categories), with rice as the basic ingredient and a rich mixture of naturally dehydrated vegetables and condiments. The products serve the general consumer markets and special-consumer categories (catering, hotels, and restaurants through the company's well organized network HO.RE.CA). The company sells mostly in Greece and exports (about 20%) to Sweden, Germany, Holland, Belgium, Switzerland, Austria, UK, France, Estonia, Romania, Bulgaria, Serbia, Albania, Italy, Poland, Hungary, USA and South Africa.

The company is an independent entity with 2 premises and 3 distribution centres, with the legal form of SA (Société anonyme). The factories cover 13.000 out of 30.000m^2 and τhe annual production per year reaches approximately 250.000 tones of rice and 20.000 of pulses. The productive capacity reaches the 12 tones per rice milling hour. The Group employs about 200 full time employees. There are 8 shareholders who are family members; they are the children of the 3 brothers (first generation). The 5 males are all active in the Group. 4 of them have studied economics in Greek universities and the fifth is a mechanical engineer of the NTUA, general director of the FCO6 and vice president of the Group.

FCo6's competitors in the conventional products are two Greek companies, private labels and mainly Uncle Ben –mostly in yellow rice. The Group is the leader in the Greek market (since the 80s) with a share more than 30% in rice products and about 20% in pulses today. In parboiled rice is second in Europe (after Uncle Ben) and first in Greece. Still it is the first in Europe to develop innovative production method.

The company spends about 0.6% of its annual turnover on expenditures for innovation activities.

The Group is the only one in Europe with rice products which are certified to be cultivated based on the principles of Good Agricultural Practice.

Entrepreneur(s): All five stakeholders have been raised in an entrepreneurial environment demonstrating over than 50 years of innovative performance and pioneering in the Greek food industry. They were educated to take over the company and move forward. However, the young successors had to overcome the distrust of the old generation in involving science to rice production. The new generation is between 50 and 40 years old. The main team, responsible for all innovative action consists of the two older cousins AP and KP and the mechanical engineer AP, as well as two company executives, both chemical engineers with a master and a PhD in Food Technology. One can easily notice that it was rather a long period that the descendants tried to prove that they could take over the family business (e.g. Mr KP entered the company in 1987 but took over in 1990, while the 3 founders of the company left for good only in 2005).

When the company had to hire two chemical engineers they were registered for almost a year as students who were working on their masters. The same aversion was present when an economist was hired and the oldest of the company could not fully understand what she could offer in such a company.

Mr KP has actually been the president of the company since 2000 officially starting as the general director of the first plant in 1996, although he was working in the company from childhood. He is an economist. After his graduation in 1984, he starts been responsible successively in all company's departments in 1987, but started his professional career in 1990. He is the first of the second generation to take over the company, as he is the older one. He has a strong profile on both administrative and social action. He is and has been a member and vice president of the local chamber and other associations. He has also been the project leader of more than 15 projects and accordingly scientific responsible for about 10 projects. He is a member of the committee of the W. Greece University in Agrinio. He has been the trainer in many training programs and has given many lectures in Greece.

Mr AP is the marketing and exports director of the Group. He is about 40 years old and also an economist. Mr TP, the mechanical engineer has taken over the new innovative factory in Thessaloniki, while he is the vice president of the Group and the managing director of the NPD department. He is a member of the council of FING (The Federation of Industries of Northern Greece)

It was mostly Mr KP and TP who decided to innovate through the new state –of-the-art factory in Thessaloniki, although the old generation who was still in charge (they left the company for good in 2005) wanted it for two other reasons: to increase productivity and transfer the plant in a place that produced more and better quality of rice (Macedonia). The firm's strategy till then was quality and differentiation. That's why the company had engaged in many innovative actions and was a pioneer in many cases. Still, they were not seen as a main mission. The two new entrepreneurs exploited the prospect of the new plant to change the company's strategy towards innovation and R&D.

The innovation: The most commonly consumed rice variety is the refined white rice. Parboiled rice is "partially "boiled" (i.e. partially cooked rice); in other words, parboiling means precooking of rice within the husk. Till then parboiled rice was mainly yellow rice and it was imported in Europe by USA. That is why it was called rice of "American type". The first generation of the Group had already produced "American type" parboiled rice with the conventional open tank technology in batches. The second generation entrepreneurs thought of producing "European type" parboiled rice which would minimize the disadvantages of the existing production methods and would better suit the local types of rice and especially the white rice which was the weak point of Uncle Ben.

Increased attention in recent years has been directed in more technically advanced societies toward quick cooking rice products which can be conveniently rehydrated in hot or boiling water within a time period of five to ten minutes. Furthermore, it is known that grinding whole rice grain into rice flour for manufacture of quick cooking rice enables a higher percentage of the grain to be utilized in comparison to the usable percentage of grain that is available after, for example, polishing of the rice for transformation into white rice for cooking by the consumer. Several "quick-cooking" rice processes have been developed during the past decades. One can mention the soak-boil-steam-dry, freeze-thaw-drying, expansion–pre-gelatinization, and gun puffing methods. Their disadvantages are described in several patent applications both European and American (e.g. European Patent EP0226375A1, US patent 4769251).. Uncle Ben patented its method on parboiled rice in 1994 and the patent lapsed in 2006. The inventions still go on (e.g. US patent 6416802 of 2002 on a method of making quick cooking and instant rice by Lin et al.) It should be mentioned that in Europe the first patent was filled at the same time that FCo6 was born by Unilever but

for different methods, and processes and not for parboiled rice (Quick cooking method and process to make, EP1146796, 1999-2002)

Hence the entrepreneurs thought of the need of a new innovative technology which would be suitable for white rice, solve the allocated problems and minimize energy and water consumption. They also intended to use the new production lines for further innovative products. Besides the Uncle Ben's technology and a number of patents since 1987 which were not all commercialized, till then some companies in Italy had tried to change parboiled rice process but without success.

The research started in 1997 and in 2000 the company presented the new innovative plant in Thessaloniki and the pilot production. Control tests and comparisons showed that it was a different product than the one produced till now. The first pilot production passed as non -branded as bulk product. Further corrections and improvements followed and the new satisfactory production entered the market under a new name in the beginning of 2001. *"I think we went rather fast. It took us 3-4 years to formalize the initial idea, experiment, make the plant and improve the product. It was quite an adventure!"* (Mr KP)

The company had patented the process for 10 years in Greece and 7 for Europe. Both patents have lapsed (in Greece by the end of 2010). The first outcome is a parboiled 10-minute Greek rice produced with a unique method that overcame the former disadvantages of similar products. It is precooked and gets its yellow colour from the rice husk which is removed further in the production process.

There is no other similar factory in Europe till now (partly due to the patent that elapsed in 2007)

Innovation/Entrepreneurial process: being in the market for almost half a century, the company, had located existing market niches well suited to the changing life style and the every day food trends which were connected to rice and relevant products (market-driven innovation). They wanted to reserve their leadership and at the same time be reinvented in order to suit to the new entrepreneurial international landscape.

The new generation on the other hand needed a success in order to assure the first generation that they can trust them and furthermore enter an area new also to them. So they started searching for new concepts. Meanwhile as Mr KP mentions they had to create in the most secret and soft way a stable New Product Development background with scientific personnel, a lab and a deep knowledge on food technology. That was

due to the old fashioned culture of the 3 company creators who although loved innovation, they could not imagine science involved in rice.

The new plant was a compromise. The old generation wanted a plant close to the best qualities of rice in Macedonia and for the increase of the company's productive capacity. The new generation bet on it in order to innovate. *"The good thing was that our fathers thought that a plant is a plant and we would not have many degrees of freedom to mistake."* (Mr KP) The new generation's vision had a clear technological orientation.

In 1997, they started investigating the new method with Mrs NK, the chemical engineer as scientific champion and later entered PAVET 97 (Programme for the Development of Industrial Research and Technology for new Enterprises) financed by the General Secretariat for Research and Technology for the development of new rice products using extrusion methodology. In 1999 they further enter the EPET II program (Operational Program for Research and Technology) to continue research while they have already started the new plan in cooperation with a big German manufacturing company, a worldwide leader in continuous cooking systems.

In parallel, the new plant is further equipped with modern technology quality equipment while through a research self-funded program with a professor of the Food Technology Department of Athens TEI (Technological Educational Institute) new control methods are developed (eg aflatoxines HPLC). At the same time another self-funded research is carried out on kinetics of rice and artificial aging. By the end of 2000 the new state of the art plant is ready, fully equipped, and innovative while a strong scientific basis has been created for further innovation.

In 2001 the quick cooking rice process of Greek knowhow is ready and the pilot production results in a product quite different of the conventional rice sold till now by the company. Both generations are happy: the old one because the new plant is the most modern one in Greece with increased capacity and efficiency, allows the production doubling and improves quality, enabling exports, while the new plant automation systems improve product consistency and lower the labor cost.

The new one is also happy, because of the development of innovative parboiled rice patented process, knowhow and innovative technology: continuous cooking. This was a worldwide innovation, since this was the first continuous cooking system in cooperation with the German manufacturing company. They have further equipped it with a pilot laboratory, air and water pollution control systems, improved energy

efficiency of parboiling and drying with heat recovery equipment, installed product protection systems including magnets, metal detectors, check-weighers and cleaning systems etc.

In order to use cutting edge technology and carry on their research they enter PEPER 2000 Promotion of Demonstration Projects and Innovation) for the improvements needed in the method (approved budget 1.400.000 €) in cooperation with the TEI of Larissa (2000-2002), followed by a second and a third PEPER 2000 (2002-2004, 2003-20006 TEI of Athens).

Although there was a plethora of external collaborators the core team consisted of the 3 cousins mentioned above and the two chemical engineers though the whole project.

Introduction to the market*:* The pilot production goes to non branded or bulk product, since the market channels are well known to the entrepreneurs. The new product had to go under several control tests, since the process was innovative and no-one could tell the products' properties, its behaviour in boiling etc.

Meanwhile, during 1997-2000 the Group imports the 10-minute parboiled rice from USA in order to prepare the market for it under its own brand name. When the new product was ready they used a different package with the Greek flag and the imported was gradually withdrawn. In the market there are some more similar products imported from USA and an Italian one which was 13-minute parboiled but with a rather out –of-date process method. This improved product covered the market niche of catering under a new name, which till then used yellow rice (the only parboiled till then). The easy acceptance was partly due to the known brand of the company but mostly due to its excellent taste and quality.

The communication of the above advantages was part of the sales department job. Although the product existed, the company did not try any type of coping, since they aimed at a completely different final product than the existing ones.

The company patented the quick cooking process for 10 years in Greece and 7 years in Europe (both patents have elapsed). They have also registered the new brand names and went on with new, innovative products, most of which are patented at national and European level.

The group entered the Investment Law 2601/1998 in 1999, while they also used The operational program for energy (biomass and electric energy) funded by the Ministry of Development.

Business Strategy: the company focuses on differentiation and innovative food products and concepts leadership (e.g. it has launched a unique line of pulses, which are grown in various regions in Greece, in line with the revival of the cultivation of pulses in Greece. The name of the grower and the cultivation area are mentioned on the package).

The vision of the company is to be established in the food market as a company that produces and distributes both traditional and innovative products of the highest quality and safety, with respect to the environment and the modern nutritional values. The company focuses on high-quality products with high nutritional value in the peak of Research and Technology. It is the first company in Europe to produce parboiled rice while further introducing innovative processes and methods in doing so. It is also the first private company that was certified with P.G.E. (Protected Geographic Clue) in Europe.

It is worth mentioning that there was already an innovation culture established in the company, since the first generation had already acted as innovators. The company was the first in Greece to produce standardized branded rice. Moreover it is the company that invented the upright paper bag with the see through window which is used up to day and it is considered healthy and friendly to environment. In the beginning of the 70s they start rice of "American type" being again the first in Europe. They further innovate by being the first to produce rice husk thermal energy in cooperation with a Greek manufacturing company in 1973 which is enough to cover the thermal needs of the whole company. In the middle of 80's was the first company in Greece to become the sponsors of the only musical program on the Greek TV.

The main strategy is to become the experts on rice and pulses by deepening knowledge and research on these products. The CEO characterized it as knowledge verticalization instead of a plateau of products under the brand of the Group.

The Group wants to keep the leadership in the Greek market and increase its share in the international market. The mission statement supports the triptych innovation at all stages, product, environment and consumer safety (including social responsibility) and top quality. "All the above for the whole course. As our slogan says, "*Innovation – Safety – Quality from the field to the self!*"" *(Mr KP)*

Appropriability Strategies: In general the group being a market leader has being copied many times even in trade marks which are registered but used with slight changes. The company has registered three trademarks till now and several packages.
However, since LT-KIE, the appropriability strategy is patenting. Besides the above mentioned patents, the company has patented several specialties (rice mixtures one of which is with saffron from Kozani and is worldwide patented), the installation of an innovative brown rice (global innovation on know-how and process technology – 6 years research), the production process of risottos, innovative usages of rice hust-ash, results of an eco-innovation research program with the department of Chemical Engineers of NTUA, etc. They are now in the process of patenting γ-orizanol.
The Group enters several research programs claims the trend marks, names and processes exclusiveness, while it ensures appropriablity in research papers and published research work in general.
Resources: There was much **accumulated experience** and firm-specific **knowledge** on rice collected all these years since 1955 which was strengthened after the new generation entered the company. It took them about 10 years (1990-2000) to collect scientific knowledge, diffuse it throughout the company's functions and change the till then existing traditional culture. Knowledge on food technology at a scientific level was obtained mainly by the recruitment of the mechanical engineer who really made the company a second family – her PhD on enriched rice was realized while she was working for the company. Food quality, specifications, market segments and new methods and processes were then a mixture of the old generation's experience and new generation's knowledge and absorptive capacities. To succeed in enriching the knowledge pool and innovating, the entrepreneurs started collaborations with researchers on a constant or a temporary basis
The manufacturing knowledge is developed by the co-operation of the above mentioned actors with leading manufacturing companies abroad. Most parts of the innovative plant are pilot-made and there is much knowledge transfer among suppliers and customer. Certain parts are designed by the entrepreneurs, themselves and constructed by local companies. Due to the innovativeness of the processes there were many problems arising from theory to practice. Most of them were solve by the cooperation with the Greek local manufacturing companies and add to knowledge for all parts. Their contributions are described as very important by Mr KP *"theory and especially new theory were well imprinted on papers and designs but reality posed*

inconsistencies and failures. That's where Greek manufacturing companies would go further and solve the problem". These local companies have been contracted to carry out maintenance after the initial set up till now.

Financial Resources: Company funds and subsidies were used for both research and implementation. The subsidy programs and investment laws have been mentioned above in the innovation / entrepreneurial process section. It is the Group's policy not to publish information regarding the amounts invested.

The managing group consisted of Mrs KP and TP, their engineers, two local construction companies (main contributors), the engineers of the German company and partly of external collaborators. One can recognize a constant bidirectional knowledge flow of both embodied and disembodied knowledge through skilled personnel, training, plant and equipment designs and descriptions, consulting, mutual experimenting, machinery and equipment.

The establishment of a stable and continuous cooperation with the BIC of Patras and the University of W. Greece entered an air of dynamism and developed a culture of innovativeness devoted to cutting edge technology. The transfer and further development of new scientific knowledge is mainly based on formal sources such as research projects with BIC, NTUA and other Departments. There are always informal sources of knowledge.

The innovation culture nourished and developed led to several innovative products, processes, methods and ideas and today the firm enters the research in the field of bio-functional food products (on rice and pulses). This research is extended to hyper-enriched rice for special groups (children, athletes), bio-functional foods based on γ-rizanol, pharmaceutics and the chemical industry advanced and high-added materials from rice husk ash).

The company actively uses all routines imposed by ISO9000, ISO22000:2005 (food safety management system), HACCP, as well as EUREPGAP (Euro Retailer Produce Working Group - Good Agricultural Practice) and bears an agricultural exploitation code, conform to the international specification I.F.A. (Integrated Farm Assurance). It also uses training programs on a regular basis (two ones for the whole personnel, 3 for the executives), followed by personal training in Greece or abroad.

The main customers are final consumers as well as catering, hotels, restaurants and restaurant suppliers. This year they enter the bio- functional foods, opening prospering markets and a potential to grow as far as the innovative imagination of the

researchers goes, since these niche markets are at an infant level. There are also other special groups that show some interest such as children and athletes.

In 2000 there were a few companies in USA and none in Europe that sold parboiled rice in Greece. Uncle Ben has some market share in parboiled but when tried to take a share of the white rice the shares were too small to stay and withdrew. Afterwards there were many companies that turned to parboiled but FCO6 had gone even further.

Problems: An important problem is the ***distance between industry*** – food industry and Universities. *"I can't say whose fault it is*." Mr KP seems to doubt "*There are some successful collaborations, but they are the exceptions and not the rule. And it is usually at a level of personal relations".* One can notice that co-operations and joint research projects are built on personal relations among individuals and not institutions. The state with all public institutions and other institutional bodies such as the chambers is of no help, while there is an urgent need for effective decentralized systems. According to Mr KP entrepreneurs should be involved in state committees, public and academic conferences, institutions etc in order both to be able to dispose their environment with its needs and prospects and to make public relations with academics and other researchers.

There is also ***a lack of a certain institutional framework***, as well as a lack of political will of the proper prevention mechanisms and experts for many issues regarding food products. An important problem is product localization which causes many problems to rice and pulses industry. Rice exists in hundreds of varieties and qualities. Some types are very cheap and when they are imported they are named Greek production with no legal cost at all.

There is ***no map of agricultural production*** and no control mechanisms (e.g. an isotopes analysis laboratory). There is no real mapping of the Greek consumer's will to consume Greek agricultural products or of the Greek producer. There is no support of agriculture –especially on Highlands which further means social consequences.

Current research efforts are directed at developing novel technologies for health-beneficial products from rice bran and hulls. These technologies include for example processes for protein concentrates and isolates for infant formulas, beverages, and ingredient applications and fractions (rice wax, wax-rich fractions, hull and bran extracts) with cholesterol-lowering and anti-oxidative activity for various food applications. Technologies for new low-oil-uptake rice and sweet potato–rice products that suit the need of health-conscious consumers are also being developed. Novel

processes for conventional rice products that improve some properties, add in nutrition or preserve the environment are welcome by mainly large international food companies. Research goes on mainly in USA and partly in Europe. All of these research and applications target the unique nutritional and functional attributes of rice co-products and their components. The processes being pursued to achieve these products are efficient, environmentally friendly, and commercially viable.

Although rice is considered as traditional food it still constitutes a specific knowledge base, in which there are plenty of innovative food products, process technologies and methods. Additionally, in the consequence of the energy, water and oil crisis there had been new developments for all processes which in their conventional type are energy and water consuming. Technological knowledge is a main contributor and the company's privilege and could not have been developed without the new food technology.

The corporate venture used and extended the knowledge in the fields of food technology, chemistry, geoponics, pharmaceutics, as well as mechanical and chemical engineering.

Relations within the value chain: Plant manufacturing engaged a netwok of ***local constructors*** (both of region of Macedonia and of W. Greece). Due to the mother company there was significant networking with the leading plant manufacturing constructors as well as with plant installation constructors (e.g. for pipelining, electrical installations, transportation lines, automations etc) as well as some machine shops on custom made or self made machinery. Since the Group invested a lot in modernization many of the above companies had worked together three years before in the old plant.

Main production lines were ordered to ***foreign manufacturing companies*** with a German company as a leader. Most parts were pilot made. Mr KP underlines the need to establish trust and long lasting relationships with the suppliers. *"We used the leaders. We knew them. We had worked with them. And we trusted them"*. Due to the uniqueness of the equipment any malfunction might cost time and money unless the company trained its own personnel and developed safety valves. There are always knowledge flows when malfunctions and problems occur in the whole process starting from the design phase till the pilot production.

The most important **suppliers** ***are rice (and pulses) farmers*** who dispose their product exclusively in the company and under the system of "contract agriculture" and the EUREPGAP protocol[376]. It should be mentioned that the company was a pioneer in using the protocol in Europe. Mr TP in cooperation with two agriculturists run the agricultural department of the company and are the main responsible for training, technical consulting and checking the farmers' productions. The company has turned to modern farmers and encourages the investments on high tech agricultural machinery. Training of the production groups (each group consists of 7-8 producers) is vital since they have to engage new cultivation methods avoiding certain fertilizers or other chemical treatment. These farmers are classified in the system of "integrated production management " of the company and certified according to standard AGRO2 of AGROCERT (Inspection and Certification Authority in Greek Agriculture). The Group supports the cultivation of rice which is done on naturally salty soil where only this type of plant can grow, thus contributing to the agricultural economy but also to the preservation of the ecosystem and the wetland habitats. The company is the first rice producing company at a European level that applies the I.F.A. international specification (Integrated Farm Assurance) and mentions the name of the grower and the cultivation area of the product on the package (an idea of Mr KP in order to add value to the rice (and the pulses) in the field, the rise/pulses producers jointly responsible for the production and to solve the problem of doubts on the product's origins). FCO6 purchases the biggest percentage of rice in Northern Greece and is considered a vital customer for all farmers in the region.

The ***packaging industry*** is also an important supplier for the company which further assists the innovativeness of the Group. Together they developed new packaging in terms of safety, transparency, easiness to handle etc. Some of the innovative projects were the triple packaging of the exotic series. The Group invests in packaging which according to Mr KP "*it ensures our innovative picture and quality. Caesar's wife doesn't need to be only honest; she has to look honest!".*

Design is also substantial for the product's appearance. The Group is cooperating with the leading Greek companies or even foreign ones in order to collect and promote the best ideas. "*Designers have to take into consideration the packaging*

[376] a worldwide acknowledged commercial protocol, designed by the international cooperation between European retailers and growers associations, destined to create a common model for good agricultural practice to be implemented worldwide

materials. When they are new products of technology, materials influence design. Some of them are really very expensive."

The firm builds long lasting relations with its suppliers on the basis of mutual trust, support and cooperation.

Linkages to high –tech companies: There are some important formal linkages with specialized quality control laboratories for material and product testing both in Greece and in Germany, besides the two fully equipped and modern laboratories of the Group.

There is a constant collaboration with Greek automation companies, since food industry is mainly continuous - process production and the company invests in further automation and safety improvement. In the same direction there are important formal and informal linkages to the manufacturing companies, since they supply the company with high tech equipment and there is a knowledge exchange on a constant basis.

Linkages to research centres, universities: There is a strong linkage with the University of W. Greece and especially the departments of agricultural products and food, the Department of Environmental and Natural Resources Management. A personal relation to Dr P, chemical engineer, associate professor of this University and member of the committee of the scientific park of Patras enabled the realization of a series of research projects. The relations of both the chemical engineer Mr NK and Dr P with professors in the Department of Chemical Engineers of NTUA led to further research. All new scientific knowledge comes from there as well as other similar collaborations with other Departments (Faculties of Agriculture, Pharmaceutics, TEIs on Food Technology etc) and some of it is the result of long lasting research and studies (5-6 or more years). The two parts have tightened their relationship during the last five years with side benefits such as publications for the professors and deepening of the knowledge pool for the company. One can find strong formal and informal links at all levels which have been built on mutual trust and respect.

The company organizes a series of training for all the company's executives in order to deepen their knowledge on technological matters and support and enhance the innovate and science-based culture. There are also short courses on technology and knowhow subjects for department heads and the technical personnel.

The company used many **programs and subsidies** for both research and implementation which are discussed in the entrepreneurial process section. It goes on with the same policy and has realized a significant number of research and investment programs. Some of them are:

2010: LEADERA, Recycling, Recovery, and Exploitation of Rice Treatment Residuals, funded by EU.

2009: ECO INNOVATION PARTNERSHIP, Techno-economical design and pilot production of advanced and high-added materials from rice husk ash (PYRICE II), funded by EU.

2006-2008: R&D on advanced material of high added value from rice husk ash (PYRICE)

2007-2008: NIR methodology development, self-funded

There are many self-funded projects for R&D, laboratory equipment, systems application, automatization, appliance of environmental friendly processes etc. To name some, FCO6 conducted research to determine optimum drying and storage parameters to maximize rice yields and quality, designed and installed temporary storage facilities for paddy rice and rough rice handling systems, etc.

FCO6 up has further exploited many investment laws such as N.3299/2004 for a further plant modernization on sorting and detecting machinery and equipment (years 2005-2008), "Information Society" 3.2. E-Business (2002-2004), Energy Business Program, funded by the Ministry of Competitiveness for the production of electric power of biomass (2002-2004), N. 1828/89 and a program of the Ministry of Agriculture for machinery of FCO6 (2003) and while preparing the new plant a SME initiative funded by the Ministry of Development for the development of promotion networks and business cooperations (1998-2000).

The severe financial crisis has led to a suspension of many of the strategic development activities. *"In such crises one should think of a superb management and not of development. Management also refers to decrease of sales and shrinkage as well as restructuring. This crisis is a crash test for all enterprises which have a considerable time of existence. You see, I don't mean companies of 10 or 15 years, but the ones that count more than 100 years. It is an unusual situation and when it is over we will be able to say that we went through and won. " (Mr KP)*

Impact of KIE: FCO6 started with semi-cooked with no artificial preservatives in 2001 but the company wanted to differentiate from competition. They started with 20 minutes and till 2009 reached 10 minutes. The tastes and nature are closer to the Greek tastes while the ones imported by USA are not.

After 6 years of research FCO6 invented and developed a process method and technology on a process that reduces the cooking time of brown and wild rice from 45–50 min to 10 min and this is a global success, since the latest method offered a cooking time of 20 min (USDAARS Southern Regional Research Center, Dr Guraya). Brown rice, not widely known to Greeks and with a low consumption in Europe and USA is rich in minerals and vitamins, making it a nutritionally valuable food. A major drawback for brown rice is its long cooking time (45–50 min) because of the slow rate of hydration. Existing commercial methods for producing quick-cooking brown and white rice involve precooking the rice, followed by drying. These methods require a significant input of water and energy, which, in turn, creates significant expense. The invented process reduces the cost of processing to make quick-cooking rice, reduces environmental pollution, and will make nutritious brown rice more appealing to consumers. It is also parboiled, so it has obtained its characteristics (e.g. referring to dextrines). New products are further improved and differentiated while there are further experiments in order to present new concepts in the market (e.g. risottos, pre-cooked meals, enriched rice, brown rice etc).

Innovation is not limited to products FCO6 has invested into making its factory as environmentally friendly as possible, aiming at leaving nothing to be wasted. The kernel's husk which is removed during milling is led to a furnace where it is burned to produce electricity that covers 70-80% of the factory's electricity consumption. The burning takes places under environmentally friendly conditions, since a line of filters, located near all dust generating machines, prevent the ashes from being released into the atmosphere.

The company concept is “nothing is wasted” and that means besides the ash that is used in the industry, the rice by-products that are removed during the production process are not wasted. During the burning of the husk, ash is produced which contains a high percentage of silicon oxide and is suitable for industrial use.

A new research project in cooperation with the Department of Chemical Engineers in NTUA gave three different innovation solutions for the use of ash. The company had already started a pilot production line for three of the research products. The first two

target the chemical industry (high-value added products), while the process sub products are used for further power production. There is another one with the Faculty of Farmacy- Farmacognosy in the University of Athens, which searches other possible uses of rice sub-products. This research has led to two high value added products for pharmaceutical companies and food production companies in the area of biofunctional foods and with γ-rizanol as a basis. Since the products are still under research, no more information can be given.

Soon after its establishment, FCO6 was awarded with the International prize *Sial d´ Or*, in SIAL international fair for the *Specialités* line, based on its innovation and commercial success among products from all over the world.

It should also be mentioned that the mother company has also gone under certain restructuring and modernization and expanded its activities to pulses under the use of Good Agricultural Practice in 2006. Its implementation changed the total production model of the company. The storage changed to horizontal because each product bared the name of its producer (the farmer). The raw material should not be mixed and that required a totally new material production system and enterprise resource planning. The new system enabled another plan of the Group, the cultivation of local traditional pulses under the directions of the company's agriculturists in highlands and semi-highlands. *"The whole action engaged much knowledge both for the cultivation and the production flow management*" says Mr KP.

The company has developed ***market research routines*** with target groups (e.g. working women, or even people who do not eat rice) and trends roadmaps (e.g. the increase of food deliveries in Greece target the need for a very fast product which will be better than the just cooked delivery).

The Group participates in the two most important food fairs worldwide, ANUGA in Cologne and SIAL Paris which are global business platforms.

The Group has also informal but established routines for innovation. Many ideas are selected and discussed. Ideas may by either market or technology driven. The market research provides the information needed for latent consumer desires, which according to Mr KP is the best. *"When you suspect a need you can create a result. Of course you may change the initial idea more than once. All this way comprises knowledge, research as well as imagination"*. On the other hand there are research problems that are discussed with Scientific World in order to exploit resources or solve problems, new ideas which derive from technology and science advances as

well as the very wishes and desires of the innovation team. Each new research project is adding value to FCo6's product portfolio and promotes product innovation and new fields of application.

Market and sectoral knowledge base: The ***sectoral knowledge base*** is enriched with scientific knowledge and new technology knowhow: papers of the Universities and some of the Head of R&D Department of the Group as well as publications of the research projects.

The company was the first in Greece and Europe to develop a new process on parboiled and quick cooking rice and now FCo6 extents its work on bio-functional products and value – added products for other industry sectors. Today there are many companies in Greece that produce parboiled rice but are left behind regarding the Greek market shares and fame.

FCO6 also offers a way for many producers to diversify their agriculture crops and gain in knowledge about modern agricultural technology and knowhow, while they are engaged in a modern way of thinking on agriculture.

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FCo7 – case study

Summary
- Legal form: Industrial and commercial SA – family owned
- Year of foundation: 1960 / CV: 2002
- Number of employees: initially 4 full-time / today 35 and 15 part-time
Educated staff: 4 with University degree
-Located in: Makrakomi Lamia
- Product family: Gourmet dairy 15%, traditional products 35%, cheese 50%
- Manufacturing: mass production
- Major suppliers: farmers (mainly local- regional), packing companies (national)
- Major customers: supermarket chains, restaurants, bars, franchising (mainly Europe)
- Sales' structure: exports 20%, 80% national
-Entrepreneurs: - a degree in Greek literature holder who was the only child of a traditional cheese producer.
Patents: yes at world level
Trademarks: yes
Awards: yes

Object of investigation

The case was recommended within an expert interview with a representative of The Food Industrial Research and Technological Development Company (ETAT SA). Interview with the Entrepreneur and CEO lasted about 3 hours with a visit to the plant to follow. Additional information has been conducted through articles and papers handed by the entrepreneur, and further information on the firm's events mainly by internet sites. Understanding gaps were filled by several phone calls. The researcher visits FCo7 once a year (in August) and has co-operated in a project (with the exception of 2015).

FCo7 disposes an area of 4 acres in the area of Lamia. The plant was purpose built and flexible to cater for diverse production needs. It started with a manufacturing capacity of 5.000 tons milk/year which produces 1500 tons of dairy products with significant growth capabilities as it was soon proven. The company focuses on differentiation and niche market leadership. It owns State-of-the art machinery and production methods. Applying LT-KIE the entrepreneur manage to increase the turnover of an extremely traditional micro -firm from around 100.000 Euros to more than 3 million in less than 10 years.

The entrepreneur of FCo7 realized that "traditional products –no matter the quality- cannot make you differentiate". He tried re-engineering to enter the world of innovative processes. He advanced from imitation to innovation with mainly try-and-error processes and a flexible use of the knowledge gained from re-engineering, visits, trade shows, internet and books in order to react to the traditional character of his products. *"I visited the Fancy Food Show in San Francisco and New York and came in contacts with producers who invited me in their farms in Wisconsin. I visited them and I "saw" opportunities – I mean what I could do".*

There is **intense competition** since the dairy sub-sector is one of the strongest in the Food Industry with a yearly value of more than 1 billion Euros and consumed quantities to surpass 320000 tons. There is a significant variety of cheese products local or imported. However, besides the market share taken by imported products, there is a concentration in no more than five big companies with the rest to be small, introvert and totally traditional craft-mode producers. This is why FCo7 grew so fast; it was among the few dairy producers that invested in innovation, significant differentiation and efforts to enhance value of its products.

Basic products: While most of the production is the traditional feta and other traditional dairy products, the rest are novelties based on two concepts: innovative production technology (patented) and the successful mixture of different natural materials (mainly herbs and fruit or honey) with dairy products in innovative ways that product novel tastes and which constitute the gourmet products of FCo7. The company was the first to invest significantly in these novelties which appear to have found a niche position in the markets since the firm grows in significant rates with new investments and a new spin-off dedicated to innovation.

Some of the differentiated products: Production of Greek *chevre* cheese of fine quality, tsalafouti availability all 12 months (process innovation), the production of novel types of goat cheese (extra light) and *melityros*.

The entrepreneur is a son of a sheep-and-goat breeder. Father had established a traditional farm-based cheese dairy at a mountain village in 1960. In 1995 the dairy was transferred at Makrakomi and became ICSA, due to a modernization subsidy program which was enacted because of the transfer of livestock to lowland. The new firm kept on with its traditional cheese products. The entrepreneur grew in this family business environment helping father until he left to study in the Faculty of Philosophy, Pedagogy and Psychology! He actually worked for about three years at various schools teaching Greek literature. The call for a steady job at public school found the family business in the beginning of the transfer to lowland. Then, the entrepreneur made a major life decision; he decided to take over the family business abandoning his dreams for teaching. *"However, even when I was studying, I was always actively involved in the family business. I recall now that I had visited all dairies in Crete and at the various places I happened to be. I did the same in France and Belgium"* he will confess. He also claims that his studies made him develop alternative and creative ways of thinking broadening horizons and perspectives. Strangely enough, his two executive members own MSc diplomas in Philosophy too…

The innovation: The initial innovation that re-directed the company's course was a soft goat's cheese; a product with Patent for the original way of ripening of cheese mass (No.1006092) that has received numerous distinctions and awards from authoritative

institutions (although the application was submitted in 2002, the final patent license was published in 2008).

Innovation/Entrepreneurial process: In 1997 the son took over the family company and turned it to Industrial and Commercial SA at the age of 29 after a diploma in Philosophy and an effort to teach Greek literature in Crete. Unconventional and restless he seeks to get out of the tight traditional cheese-making, the family. He knows that only knowledge and innovation can make the difference. The young entrepreneur started collecting information about competitors and national cheese market. At that time there were about 1000 traditional dairies in Greece (today there are less than 400); they all produced feta and traditional local products (e.g. graviera in Crete). *"Many micro traditional introversive, old technology cheese-makers and 5-6 big ones who are too big to think of real innovation; their innovations turn around package, logistics and low fat"*.

At the same time, the entrepreneur works hard to find a way to innovation. Market indicates a trend towards cheese paste and spreadable cheese. A relevant local product, *tsalafouti* (with other names in other places), attracted him; it was produced only in summer and was a "gold" product in sales. He starts studying its production and tries to find similar products abroad. Internet research drives him in USA, at two Fancy Food Shows in winter and summer. He meets big farmers and visits farms. The *chevre* type he sees there drives him to France. He tries imitation; however the process could not be adapted for Greek milk and environment. The entrepreneur develops his own production method, and this means much try-and-error processes and lots of raw material to be thrown away. In 2001 he succeeds with the new method, applies for patent and prepares a business plan: In 2002 the young entrepreneur having five good years of total involvement and experience as the head of the company, decides to transform the traditional business into a modern innovative and technology-based firm. They enter the 2nd Community Support Package in order to provide the necessary production lines and equipment as well as to organize research.

In order to apply the developed **production technologies** and advance quality of the existing ones, the entrepreneur buys general purpose machinery from Italian, German and Greek companies. However, when coming to the innovative processes: *"the existing equipment does not fit our plans since we want to create some other unique characteristics. Furthermore, it is extremely difficult to explain what exactly you need duw to lack of prior experience. We have constructed many parts of our production line by ourselves with Greek machine shops"*.

The entrepreneur put also emphasis on **packing and product design** which changed significantly after the initial product presentation.

Market entrance: New products were sold in 2004 and were highly accepted by consumers. The firm had already channels where traditional products were sold such as its own shops and super markets. Meanwhile he starts with his new ideas; i.e. the mixture with herbs.

The entrepreneur estimated that although gourmet products were still a small percentage of the total production it was very important since they opened new avenues for markets. He was justified only some years later and before the end of the present thesis; gourmet products added significant revenues and led to the establishment of the new spin-off dedicated in innovation and a brand new packing unit to add more value to the final product.

An interesting way the entrepreneur used to enter the gourmet market was the use of famous chefs in Athens; in this was way the new products were presented in several official dining tables of politicians (according to press the Russian President Putin was excited to taste them).

In 2008 the products were accepted in the duty free shops of the Eleftherios Venizelos airport; these shops were according to the entrepreneur "the matchmakers" for foreign customers (from Italy and USA).

Appropriability Strategies: patents (at world level), trademarks

Knowledge bases: Dairy Science and Food Technology, starter cultures, probiotics, cheese science and technology, technology of thermal processing and modified atmosphere packaging and labelling, health information including reference to allergy and food intolerance, primary production, mechanical engineering, marketing and later botanology. The entrepreneur claims that he strongly seeks knowledge but through personal visits in foreign advanced relevant business (mainly USA and France), international shows with advanced technology and products, reading, internet search and reverse engineering.

Financial resources: The entrepreneur exploited the Investment Law 3299/2004 for an investment of 1.000.000 Euros in total, in order to build the new unit for the innovative processes (new processing production line). The subsidy was 40% and he had to take also a bank loan. He still applies for subsidies since he is expanding the business.

Suppliers: mainly the packing industry and selected animal breeders. Collaboration with quality control labs, graphic designers for design and occasionally with consultants for promotion and marketing.

University and Research Institutes: The entrepreneur does not co-operate with academics. (His only co-operation was with the author of this thesis)

Institutional: FCo7 encounters bureaucracy problems and finds the Greek entrepreneurial environment as really hostile. He also thinks that the state should not use financial criteria for innovative products and innovative spin-offs. He also supports strongly the thesis that entrepreneurs should be only people with an academic background.

Corporate strategy: differentiation, constant innovation and branding supported by strong marketing. A double vision: a) to promote innovative gourmet products based on milk and cheese and b) to enhance the value of the traditional products by developing modern technology that will solve existing problems and enhance their competitive characteristics

Marketing strategy: the enhancement of traditional value products in Greece and abroad and the development of niche markets; packing and presence in top international trade shows are of great significance.

Innovativeness and expansion: aggressive NPD and regular sector monitoring mostly through internet and trade shows enhanced the innovation ability of FCo7. Monitoring market reactions to new products is also very important. As an example, we could refer to the enormous success of the first gourmet cheese products that turned back too much market information and knowledge.

FCo7 engages research based process and product development to create constantly novel competitive advantages stretching to all kinds of products containing milk. It scans for potential technological opportunities, directs mostly internal R&D activities engaging networking to select knowledge (e.g. on botanology), technology (e.g. new process lines or innovative packaging) and design.

FCo7 presents a series of totally novel products every year which however do not reflect the difficulty in developing the final product. For example, the innovative gourmet product *melityros* was presented at an international trade show in 2006 and it was enthusiastically accepted in Japan. The innovative idea occurred when the entrepreneur noticed Cretans to eat their *graviera* with honey. Yet, according to the entrepreneur, it was a product with much research and try-and-error efforts since it is very difficult to combine honey to cheese due to the tendency of PH to increase

The new FCo7 becomes famous at least in Athenian gourmet restaurants and delicatessen, wins prizes and increases sales. In 2010 the innovation-based spin-off was established and in 2014 the packing unit is ready. The company has not been affected by the severe crisis although it is not clearly export oriented.

Lately (2013), market adaptation was also extended from a simplistic form of customer feedback to advanced market processes such as collecting information about direct and indirect competitors, exploring export opportunities, advertising and promotion.

A new contact with the entrepreneur in summer 2014 revealed extended networking with gourmet cheese producers in Europe, the production of novel products in his spin-off and the creation of the company's own retail network of a unique identity through franchising following the standards of the foreign small 'gourmet boutiques.

FCo8 – case study

Summary
- Legal form: SA
- Year of foundation: 1960 / 2000
- Number of employees: 345
Educated staff: 75
-Located in: Larissa
- Product family: Milk juices yogurts, cheese
- Manufacturing: mass production
- Major suppliers: livestock breeders, technology, fruit providers
- Major customers: super market chains
- Sales' structure: exports 20%, 80% national
-Entrepreneurs: two brothers
-Patents: yes
-Trademarks: yes
-Awards: yes

Object of investigation

The case was recommended by the General Manager of the General Chemical State Laboratory in Larissa. Interview with one of the two entrepreneurs, CEO and President of the Group lasted about 4 hours with a visit to the plant to follow. Additional information has been conducted through articles and papers and further information on the firm's events mainly by internet sites. Understanding gaps were filled by two phone calls.

FCo8 is a dairy company located in a 31000m^2 plot next to the national road junction of the industrial Area of Larissa. The complex includes the production building, the electromechanical plant, the administration buildings and the biological treatment plant. The initial production building covers an area of 5000m^2 and combines functionality by maintaining minimum circulation of raw materials, products and staff, by offering facilities for proper operation/maintenance of equipment and adequate storage with aesthetic design. The building houses the ramps for the milk delivery, the chemical and microbiological laboratories, the personnel's locker rooms, the production engineer's office and the central control office with the computer room, from which all functions of the production line are monitored. Later production facilities will be more than doubled.

Basic products: FCo8 markets a line of products ranging from fresh and micro-filtered milk, cheese and yogurt to butter and fruit juices and also milk and yogurt dessert, organic and lactose-free milk products (the last ones after the interview). Innovation regards mainly quality standards novel recipes and processes.

Competition: Severe competition by around 10 big national milk producers and imported products. However, the company managed to become one of the 10 in less than 5 years after establishment.

The entrepreneurs: A family of stock farmers in a mountain village on the sierra of Pindos, a home cheese-dairy business set up at the their house cellar in 1960, a skilled grandfather with 40 years of experience and then a son following his father's trade and two grandchildren studying the art of traditional creamery just after graduating high school. In 1986 father S. establishes a modern cheese productive unit. The two sons will be totally involved: one in charge of the production and the other in distribution and sales. The firm grows outside Trikala and Thessaly. During the 90s the two brother manage to place their products in super market shelves all over Greece. In 1999 the family selects Romania to build a new productive unit. In the end of 2000 they take over FCo8. According the interviewee's sayings "This venture was a personal bet!"

The innovation: the major concern of the S brothers was how to differentiate with a series of ideas to be realized: a) they *challenge quality* as a first effort to differentiate and create a unique position of high quality[377]. This could be achieved only with innovative technology. At the same time that the leading companies in Greece were creating the segment of functional milk. More precisely, the entrepreneurs posed the simple question *"Why should quality mean just following the set standards? Who makes specifications?"* So they targeted at milk of higher quality standards combining raw material, process technology and innovative package technology[378]. The novel type of milk product opened a new niche market at the same time as functional milks started creating new market segments.

> *"Who decides about the standards of fresh milk… or for the fruit juices? Who decides about the quality? The state had defined a standard of 100.000 TMBC[379]. We asked ourselves what if we tried something better… how we could produce milk - in competitive ways of course - with 50.000 TMBC. We also produce milk with 10.000 TMBC. We actually did not take anything for granted!*

The novelty puzzle included also non MGO food for the milk producing animals, and the installation of an innovative PET bottle production line (investment of around 5.5 million Euros per line compared to 1 million of a relevant paper box line).

Innovation/Entrepreneurial process: FCo8 was a former milk producing co-operative (70% Union of Agricultural Co-operations of Larissa –Tyrnavos – Agia and 30% the Agricultural Bank of Greece) which was faced with accumulated loss and debt in the 90s. In 1999, the bank decided to go bankrupt with a debt more than 10 million Euros. The S. brothers took the bold decision to buy it in 2000. Actually, their offer was 70% higher than the one of the

[377] http://pollymkt.blogspot.gr/2011_04_01_archive.html
[378] The company was the first in Greece and among the three on Europe to buy and use a novel packaging technology
[379] Total Mesophilic Bacteria Count

second candidate buyer! (around 6 million Euros). Investing in knowledge, technology and innovation, FCo8 would spread its wings, maximizing its unique advantages, like the three-generation experience and the passion of S. brothers, offering them the required supply to produce first quality milk with a value system inflicting respect in tradition and with a series of innovative productive.

The two brothers sold even the plot of the old company and moved to the Industrial area of Larissa starting from scratch. The initial investment reached 18 million Euros while in the decade to follow, more than 70 million Euros were invested in further modernization and innovative technologies. The initial ideas of better quality and novel packing had to be translated in innovative production technologies and advanced controls:

> *"We posed the quite simple question:* Why should quality mean just following the set standards? Who makes specifications? *So, we thought of milk of higher quality standards: this meant a combination of high-quality raw material (i.e. milk), process technology and innovative package technology*[380]*. We had to co-operate with the leaders. You see, we target the intelligent consumers".*

Although successful by then, the entrepreneurs knew their weaknesses regarding the knowledge intensiveness of their new undertaking and engaged an impressive number of all kinds of engineers. *"We have an impressive number of engineers for a milk producing company. Knowledge is expensive! ... We bought knowledge through our partners."* Thus, one of their first movements was the hiring of engineers. New FCo8 worked with an extremely limited number of the former milk producing company employees and none by mother-company.

On the other hand, the parent company of FCo8 was one of the strongest in the dairy sector in 1999. With a turnover of 35 million Euros and several large-scale investments in technology, the entrepreneurs encountered no difficulty in working with European technology leaders (e.g. Sidel, Grasso, Tetrapak) and provide the innovative and cutting edge technology needed for the new venture.

> *"If you own a company of a critical size and you have long lasting and credible relationships with the leaders abroad […] then a [production technology development] project contract is not a significant problem, even these companies are not in Greece".*

FCo8 becomes soon one of the strongest milk producing companies in Greece (among the first five after 2010). **Several other investments** in technology and innovation blend each other to enhance production, quality, innovativeness and image efficiency of FCo8 such as:

a) a novel yogurt production method based on a co-operative research project with a Swiss research institute and benchmarking of quark production technology which resulted in a new production line, (note: it has not been yet copied by the major competitors according to the entrepreneur's sayings)

[380] The company was the first in Greece and among the three on Europe to buy and use this novel packaging technology

b) the incorporation of novelties in production lines, micro-filters, and high-quality and very expensive novelties regarding control systems.
c) Installation of innovative UC filters in the yogurt line and a bio-cleaner at the milk production unit (second in Greece to install)
d) The creation of two novel milk types through the development of new technology prolonging life and enhancing quality (the name of the one product led to bureaucratic problems due to no former similar cases)
e) The introduction of the fruit juice production line was a further innovation; production technology was applied for the very first time at world level (2005). It was bought by the producer just after its first presentation at the world trade show of food processing innovative technologies.

The company goes on investing in energy and water saving. Indicatively, it has recently completed a 10 million investment on a pioneering biogas production process in Europe. They actually seem to play with cutting edge technology, innovative machinery and developing technology building bridges for becoming clearly and highly innovative

The entrepreneurs have literally invested on knowledge at all levels. The use of educated staff even in the production lines can be considered a further innovation

> *"We have such personnel – mechanical, electrical and electronic engineers from the Polytechnic School and the TEI – this is a case of our innovation; i.e. all our production lines are run by TEI graduates – mechanics, electricians – whatever this means regarding knowledge. It is quite different if the operator has the knowledge needed. We have applied this policy the last six years and we have felt the improvement in production. Yes, this can be called innovation. We may have to pay them more, but what are you going to say if you have another cheaper operator and the lines stops around ten times the shift?"*

The installation was over in a fast-space; one year later, in the beginning of 2002, the novel milk with the strict quality characteristics in a transparent PET bottle makes its appearance in Attica.

Market entrance was not difficult due to the existing channels of the parent company. However, what is considered a significant success was the high rates of acceptance of the new products which drove the local, formerly bankrupted small milk producing company to become one of the bigger ones in less than five years. Initially promotion was only provided in the form of free products in the super markets. Success led to strong publicity in press and TV.

Appropriability Strategies: Registered trademarks and brand names that represent the diverse categories of products.

Knowledge bases: Dairy Science and Technology, Pasteurization, Special technological and scientific aspects of processing, packaging, storage and distribution, as related to the quality and characteristics of milk, Microstructure of dairy products, Animal Health and Animal

Welfare, Animal Feed & Veterinary Pharmaceuticals, Microbiological hygiene management, Advanced quality control, Monitoring of nutrition-related scientific issues, stretch blow molding for PET bottles - acquisition of both equipment and knowhow, , process automation and integration, engineering.

Financial resources: With an initial investment of 18000000 Euros subsidized by the investment law, FCo8's investments surpass 70 million Euros within the decade. Private capital, reserves and bank loans.

Institutional: bureaucracy seems to annoy the entrepreneurs: e.g. EFET caused trouble with the name of two at least products and imposed fines while not accepting the novel technologies and their effect on milk quality and behavior. He also complained about the civil servants' bad manners, the slow pace of state services and the failure of the Greek state mechanisms and the political systems; entrepreneurs are confronted as criminals in Greece.

University and high-tech co-operation: mainly with the veterinary School, University of Thessaly, Democritus, as well as certified quality control laboratories in Greece and abroad.

FCo8 has **routines** of monitoring social and consumer conditions, best practices around Europe and competitors' movers. Quality procedures are established for almost all stages of the value chain (from live stock to the shelf). For example, its integrated fresh milk administration system addresses a set of strict requirements to the associate livestock farmers, such as the total microbial charge present in raw milk, the wellness of dairy cows and livestock's exclusive nutrition with cereal-based fodder as well as the short distance location of the associate breeding farms.

The company has developed **processes** to select the opinions of the executives every year (a policy of the Group and not of FCo8 alone). These are put forth when curving the firm's strategy.

Training courses are regularly held for all levels of employees.

Strategy: The FCo8 brand is strongly associated with high quality products of Greek origin, and therefore an ideal vehicle for the growth of the international consumer market. The company maintains a strong commitment to hygiene and food safety, utilizing thorough systems to ensure the highest quality standards are followed throughout the production, supply and distribution chain. FCo8 builds on product high quality, integrity and transparency. Value for money is in the center of FCo8's philosophy.

The firm strives to increase brand visibility and extend its market presence worldwide by:

- Acquainting more and more people with the Greek dairy products, the Greek tradition and the brand.
- Forming strategic alliances in order to penetrate new markets.
- Continuously expanding the range of products.

Under this vision FCo8 became more familiar in foreign markets in 2007 (Italy and Germany) and 2012 in USA. It has participated in many international contests and won many awards.
Lately FCo8 develops corporate social responsibility such as: Braille writing, Energy Saving, Rational management of water resources, Recycling, and Bio-Gas production
In 2012, FCo8 held the 10th position among the Greek food companies with the highest sales and 33th among the 500 Greek companies with the highest sales (ICAP, 2012).

Quality Assurance Policy and Certificates: Strong commitment to Hygiene & Food safety. Top quality standards are followed thoroughly from the raw material selection to all production phases & supply chain. To assure product quality FCo8 has adopted: ISO 9001:2008, Quality Management System; ISO 14001:2004, Environmental Management System; ISO 22000:2005, Food Safety Management System; BRC, British Retail Consortium; IFS, International Food Standard and KOSHER

International Awards

- Golden Award in Famous Brands 2013
- Superior Taste Award 2011 for Authentic Greek Stained Yogurt. *International Taste and Quality Institute*
- Superior Taste Award 2011 for Feta Cheese P.D.O., *International Taste and Quality Institute*
- Superior Taste Award 2009 for Gourmet Spread with Feta and Olives , *International Taste and Quality Institute*
- Superior Taste Award 2009 for White Cheese with Olives and Peppers, *International Taste and Quality Institute*
- Superior Taste Award 2007 for Strained Yoghurt, *International Taste and Quality Institute*
- Superior Taste Award 2006 for Feta Cheese, *International Taste and Quality Institute*
- Goldener Preis 2005 for Feta Cheese

FCo8's Mandates

1. We don't want clients…we want knowledgeable and thinking consumers…we want family…
2. We don't care about the cost…as long as the product is perfect...
   We don't mind how much will the raw material cost, the equipment, or our research and development. Our suppliers are our people, with whom we have a very close collaboration, making constant inspections to their units, their animals, and their forage (tests for dioxins, aflatoxins, heavy metals, and pesticide residues), in order to ensure the high quality.

Quoting the entrepreneur:

> *"My brother and I myself did not actually work for the money then (note: after the first plant in Trikala). It is the joy of creation, the desire to create nice products… we bought a plant of 6000 square kilometers and we made it 150000, we wanted to give people a job, to produce wealth in this country. After a number, nobody really cares about numbers anymore…."*

FCo9 – case study

Summary
- Legal form: Industrial and commercial SA – family owned
- Year of foundation: 2006 (new)
- Number of employees: initially 18 full-time / today 35
Educated staff: 2 PhD holders, 5 MSc –holders, 5 with academic diplomas
-Located in: Kilkis
- Product family: snack crackers 50% - snack cheese ups 50% ALL gluten-free products
- Manufacturing: mass production
- Major suppliers: 3 cheese suppliers (Holland – Germany), 2 potato starch producers (Holland)
- Major customers: supermarket chains abroad
- Sales' structure: exports 92%, 8% national
-Entrepreneurs: - 2 brothers (25 and 27 years supported by father) grown up in an entrepreneurial milieu, highly educated – master holders (they occupy 2 PhD holders)
The champions: both brothers
Patents: yes with 2 at world level
Trademarks: yes (9 snack codes in 3 years)
Awards: yes
Certification and approvals: yes

Object of investigation

The case was recommended within an expert interview with a representative of The Food Industrial Research and Technological Development Company (ETAT SA). Interview with the Entrepreneur and CEO lasted about 3 hours with a visit to the plant to follow. Additional information has been conducted through articles and papers handed by the entrepreneur, and further information on the firm's events mainly by internet sites. Understanding gaps were filled by several phone calls.

FCo9 disposes a private owned facility of 3.200 m2 in the industrial area of Kilkis (North Greece). The plant was purpose built and flexible to cater for diverse production needs. It is certified dedicated Gluten Free with a Manufacturing capacity of 2.000 tons/year with significant growth capabilities. The company focuses on differentiation and niche market leadership. It owns State-of-the art machinery and production methods

FCo9 started with a quite conventional idea to produce cheese crackers with cheese to be the basis of the cracker. Testing for quality, behavior and other properties of some of the pilot products led to the gluten-free snack product idea which transformed completely the new business vision. The entrepreneurs exploited the property and turned to the **creation of a globally new niche market** with gluten-free snack-type products which make "medicine food" a pleasure and *are not limited* (due to texture and taste) to people of special dietary needs.

There are **no direct competitors** till now at global level according the sayings of the entrepreneurs. The sales took off when exports started with annual sales rates to be more than 50% even in the fiscal year 2012-2013.

Basic products: gluten and nut free snacks and crackers. The products serve the general consumer markets and special-consumer categories (tailor-made for niche markets such as celiac disease, kinds and toddlers etc). Gluten-free foods are opening prospering markets and a potential to grow as far as the innovative imagination of the researchers goes, since these niche markets are at an infant level. There are also other special groups that showed some interest such as the US army. The company sells mostly abroad exporting in most counties all over the world and mainly USA, Europe, Australia and China.

Although there **are no direct competitors**, the firm monitors competitors in the area of healthy food and snacks.

The investigated innovation cost about 5.000.000 Euros. The company spent more than 12% of its annual turnover on innovation expenditures at least until 2010.

The entrepreneurs: The two brothers followed the family tradition. The father G.S., an economist with a master on management (in Germany) was working as general director in a big Greek food milk company. Taking advantage of the changing law regarding bread market, he created his own bakery business in Thessaloniki. This quickly became the biggest bakery in Northern Greece, producing a range of goods, including 40 different varieties of bread, traditional Koulouri of Thessaloniki, breadsticks and various cookies and dough products. His two sons A & D spent their time there training and helping grow the business. D has studied economics and has a master in finance (City, London). A has studies international management and two masters in business management and logistics. The bakery firm merged with a big bakery firm in 2001; 7 years later the family abandoned the business. The two brothers supported by their father wanted to turn to something innovative.

The innovation: a patented formula and exclusive rights for the production of gluten free snacks and food products based on cheese. However, it was not clear from the very beginning: *"We knew it had to be in the bakery industry. We wanted to find something that it would be innovative, but at the same time not too far from the known staff, something that would have the potential to develop, differentiate and to be produced at industrial level. You know, craft production and industrial production are two totally different issues*."

The **initial idea** was on food compositions that comprise a cheese component with a starch component to produce a crispy snack with high percentage of cheese, since there were no similar products in the markets. A market research had been contacted before at European level to reach this result. The snacks were supposed to be aliments for consuming it during any time of the day and in any quantity without side-effects. The fact that the product turned to be gluten free drove to the addition of a gluten-free flour component and turned the concept

from a differentiated snack to **a gluten free and healthy high quality snack which was however tasty** to be eaten by all ages and groups but also suitable for gluten free product buyers (info tip: related gluten free products are not famous for being tasty...)**.** *"Gluten-free products were not our initial target. It was difficult enough to think on products based on cheese instead of the usual staff – which was our first idea to innovate. Then, when we reached the results in the lab and connected it to cheese as a basis, there was the challenge of mass production and of niche market creation. That became our strategy because we saw a relative strong trend abroad for such products and we reshaped our strategy accordingly. So we reversed our plans and of course we knew the dangers. What I mean… We began to do something and we ended to start a new research for about 10 months till we end up to what we were initially looking for…"*

The idea was really innovative; even to date, there is a shortage of relevant gluten-free food products in the market. For example, those suffering from celiac disease have today few options among crackers, since the majority of the products of this category are produced from flour containing gluten while products specially designed for these groups are usually tasteless as mentioned in several discussions of celiac disease patients.

Innovation/Entrepreneurial process: the efforts of the two brothers focused on gluten-free food compositions that could be used to produce healthy food alternatives for the gluten-intolerant population as well as methods and systems for creating such gluten-free food compositions in industrial mass production. They started by contacting two food technologists known from the bakery business. Ideas had to be realized initially at craft mode. The very first product in its primitive shape was an idea of the technologist; however it had to be many times improved in order to reach the concept they had in mind. Then, it was difficult to produce it in a mass way and the entrepreneurs had to contact relative technology providers. *"We relied on the ability to develop desired novel technology abroad… The developers have an R&D department for such purpose….Although there is a written contract about the exclusive use of the equipment developed; now it is not really important for us".*

Knowledge on food technology and for the purposes of R&D is initially developed by partners, such as food technologists, operations engineers specialized in the field and chemical engineers. Difficult problems are confronted by specialists found in internet "*a leading R&D company abroad which specializes in our sector. We had no relative Greek company in mind then. This option did not belong to our inner cycle of acquaintanceship"*. It is important to mention that in the very beginning the specialists' opinions on the business idea ranged from negative to skeptical. The entrepreneurs narrates: *"Our slogan was: Why not? The more food specialists would persist that our vision was impossible, the more passionately we would work on our idea…. We started to make something without what we*

call R&D and we ended up with 10 months of formal R&D till we could have satisfying results".

However, significant difficulty laid also in the design of industrial scale production in terms of quantity, constant quality, repeatability and successful transfer of texture and taste at mass production.

> *"So how do you translate, let's say that little thought of yours into a product which will be able to be produced in a constant and industrial way? This question was followed by much conversation with machine makers; we had to find out the feasibility of our ideas at industrial level; on the other hand, the machine suppliers had to commit themselves that their machinery can satisfy our requirements; they had to assure us that they could manufacture such machinery.*
> *We have used food technologists, operation engineers for the production line design and the improvements after installation and pilot production and chemical engineers [...] Even if you have make several tests with the manufacturers and you think that you are ready, you do have problems when transferring the production from the laboratory to mass production. So, there were some quite difficult issues and we brought specialists from abroad – a highly specialized company which develops food technology. We found them in internet. We had no Greek company in mind then. Now we decided to co-operate with Universities."*

FCo9's entrepreneur actually argues that it was easier to find foreign specialists than Greeks

Thus they developed technical co-operations with machine manufacturers, packaging companies and suppliers in order to manage production issues. The entrepreneurs had a written privacy contract for the exclusiveness of the machinery created for the specific needs. Furthermore it started the procedures for patenting the production technology.

Plant manufacturing engaged also ***local constructors*** (region of Macedonia and plant installation constructors (e.g. for pipelining, electrical installations, transportation lines, automations etc) as well as some machine shops on custom made or self-made machinery.

Market entrance: Entrepreneurs present their novelty in ANUGA even before mass production to attract foreign customers. Of course the initial target was Greece. Yet, the new venture encounters the problems that follow an innovative product of a mature industry at least in Greece. *Is it a snack?* Greek super markets place it next to other snacks but they are much expensive and fail to be achieved. Moreover, the brand name proves to be quite inappropriate to communicate the intended messages, The Company after this first –and short due to fast strategic response- failure changes its image, creates a new brand name[381] and turns to international markets. It starts with the English super markets which devote separate lines in health products and the innovative products named "cheese-ups" and not "snacks". The firm started by creating new market niches in the area of gluten-free gourmet products. They turned to international market instead of the Greek one, both because of the market size and the well approved mistrust of Greeks to such products. A highly dynamic market niche

[381] It has registered both brands

which opened the way to more than 15 (till 2010) countries and offered to FCo9 an annual development rate of nearly 80% for the first 5 years and global prizes. The company builds on strong distribution channels all over the world and develops advanced marketing and promotion strategies.

> *"It took us 26 months of laboratory work and five million euros initial capital but today we have a patented formula and exclusive rights for the production of gluten free snacks and food products," (GRREPORTER, 20/10/2010)*

Appropriability Strategies: patents (at world level), trademarks and privacy contracts with employees at core positions. Special agreements are signed in joint research projects: *"We prepare a very detailed briefing about our targets, sign an NDA (non-disclosure agreement) and a commercial agreement"*

Knowledge bases: biotechnology and biochemistry (plant bio-actives; antioxidants and ageing; functional starches), conventional organic chemistry, general food technology (e.g. cheese, types of flour, additives, modifiers and starches), gluten intolerance, mechanical and chemical engineering, industrial design, branding, economics and marketing. The various methods and techniques of production provide a number of ways to carry out the inventions

Financial resources: The entrepreneurs entered the Investment Law 3299/2004 for an investment of 5.000.000 Euros in total, in order to build the new unit for the innovative processes (new processing production line) in the industrial area of Kilkis. The subsidy was 40%

Institutional: FCo9 encountered bureaucracy problems regarding the names given to the novel products and with public services related to food safety and regulation, and more precisely, the General Chemical State Laboratory of Greece and the National Organization for Medicines. Due to the fact that the products were radical innovations, authorities were rather confused regarding health claims and licenses. This confusion costed a year's delay in entering the markets.

Corporate strategy: differentiation, constant innovation and branding supported by strong marketing.

Marketing strategy: niche markets served under strong brand name that communicates the nature of the products.

Innovativeness: Innovation is at the heart of FCo9's mission. The new firm complements in-house R&D by co-operating with Universities, research institutes and other firms in diverse areas such as Biotechnology, Chemical engineering and medicine, transcending national or sectoral borders. *"We want to be absolutely international. Our first collaboration was with an American company and a British research institute*[382]*".* The firm develops routines in order to

[382] Contacts were made in an international trade show.

take advantage of every single piece of new information, knowledge, contact and other resource blending cutting edge technologies with lab results and niche market further enrichment.

The entrepreneur of FCo9 claimed further to use Euromonitor on a regular basis, as well as the feedback by the quality system relevant routines (customers are companies as well). The last one played a significant role in the change of the brand name three years later.

FCo9 is technology oriented: international trade shows, technology literature research on general subjects such as gluten and nutrition trends, patent searching, and participation in research projects (with Universities and research institutes) have been mentioned to play a critical role in technology sensing. Well organized accumulation and filtering of information is derived by professional and social contacts and specifically assigned market research provides information on tastes and trends of a targeted country or area. Efficient use of the feedback processes (as described in the firm's written quality system), by interpretation and NPD (capture of new opportunities). In its lifespan, the new firm builds its own strong R&D Department and networking is expanded not only by seeking contacts but by also accepting relative requests. *"We are approached by many University Departments and other institutes.*[383]*. We do know now that our next co-operations show the direction of Academia"*

Knowledge is deemed important: 12 out of 18 employees are higher education diploma holders with 5 of them to hold a PhD, 5 with an MSc and 2 with a University degree. There is a learning culture which expands to capture nutrition specialists, gastroenterologists and customers revealing a constant osmosis of science, technical, technological and practical knowledge. FCo9 develops R&D agreements with academia, chemical industry, food firms, laboratories and other research institutes.

There are some important formal linkages with specialized quality control laboratories for all new products testing in Greece and England.

Certification and approvals

Certified Gluten Free dedicated facility

Products launched in the US certified by the Gluten-Free Certification Organization (GFCO).

Certified to the International Standards to Food Safety Management EN ISO 22000 and BRC

Marks & Spencer Silver Supplier approval

Successfully passed by the Sedex Members Ethical Trade Audit (SMETA)

RSPO Member

Non-GMO certification

EU Crossed Grain GF certification

[383] Examples: R&D project with EKETA and Biotechnology Dpt, New cooperation on an R&D basis for an American company with cooperation with an English research company,

FCo10 – case study

Summary
- Legal form: SA
- Year of foundation: 1995 / 2001 and 2005
- Number of employees: 50
Educated staff: 20
-Located in: Agrinio (plant), Athens (central offices)
- Product family: Oil olives spreads-dips
- Manufacturing: mass production
- Major suppliers: farmers
-Major customers: major super market chains (over85% of business), independent store sand delicatessen
- Sales' structure: exports 82%, 18% national
-Entrepreneur: studied law to follow the family tradition in politics, second MSc in finance and international trade, an Olympian water polo player, a true cosmopolitan
-Patents: no
-Trademarks / Awards: yes

Object of investigation

The case was recommended by the President of the Industrial Chamber of Agrinio. Interview with the entrepreneur took place in Athens and lasted about 2.5 hours while the visit to the plant in Agrinio took place the following summer. Additional information has been conducted through articles and information on the firm's events mainly by internet sites.

FCo10 is a company that started as an innovative type of commercial business in 1995 but the demand of high quality and innovation led soon (2001) in LT-KIE; this was translated to a modern plant of 6.500 square meters in Agrinio situated in a 15.000 m^2 plot of land, with 4 fully automated production lines (in 2010): an olive oil bottling line with hourly capacity of 5000 bottles, an olive bottling line with hourly capacity of 6000 jars, a line for the production of spreads, dips and sauces with an hourly capacity of 3000 jars and a line for the production of the innovative packaging "SP" with an hourly capacity of 3000 pieces. There is also a warehouse of 3000 m^2. The initial investment was around 4.5 million Euros.

Basic products: FCo10 has developed a **Unique Selling Proposition (USP):** Products that are Authentic, Top Quality, All natural, Healthy, Tasty and environmentally aware. Therefore it is extremely important that the product range offers ingredients exclusively of the highest quality: naturally grown in the fertile earth of Greece, sun-ripened and harvested the traditional way. Major products are:

- olive oils (the most awarded olive oils internationally with the lowest salinity levels internationally)
- The 1st Carbon Neutral extra virgin olive oils in the world!
- tapenades. 100% natural, no use of preservatives.

- cooking sauces, free from artificial colors, flavors and preservatives, based on authentic, traditional, regional, Greek recipes, exclusively made for FCo10 by famous Greek chefs.
- several Greek specialties based on authentic Greek tradition
- Vinegars & Dressings
- a wide range of organic products, certified by the Greek Certification & Inspection Organization DIO according to EU regulation as well as the USDA NOP standards.

Competition: FCo10 was the first in Greece new firm that advanced olives and olive oil in gourmet products. Both products are sold in their majority in bulk form; actually, only 27 per cent of Greek olive oil production is distributed as a branded product (compared with 50 per cent of production in Spain and about 80 per cent in Italy). In 2012, 60 percent of Greece's olive oil output was shipped to Italy, packaged in Italian bottles with Italian labels, and then sent around the world. And most of the profits go back to Italy -- according to consultancy McKinsey, Italy captures an extra 50 percent premium on the price of Greek oil. Olive oil alone represents nearly a tenth of Greece's agricultural output, according to Eurostat. Greece is the third largest olive oil producer worldwide (11% of total volume production) and is nearly on par with Italy (14 per cent), which is number two after Spain (40 per cent).

The fragmented nature of Greek olive oil cooperatives and the small size of bottling and labeling companies do not facilitate the standardization of quality control, and do not allow for the successful promotion of branded products.

Focusing on the manufacturing stage of the value chain, there are about 460 companies producing branded olive oil in Greece. Contrary to the farming stage, the sector of branded olive oil is highly concentrated and mainly targets the domestic market. Specifically, consumption in Greece is dominated by two companies, covering more than ½ of branded olive oil sales, while another 20 per cent concerns private label products marketed by large retailers. The export oriented segment of the Greek market is less concentrated, with four companies covering 40 per cent of Greek branded olive oil exports and the rest concerning mainly cooperatives As far as Greek exports are concerned (controlling just 3 per cent of the international market), they are mainly undertaken by four companies (Nutria, Gaea, Elais-Unilever and Minerva). (Information mainly from the**,** Sectoral Report, May 2015, National Bank of Greece).

FCo10 entered the international market aggressively by launching olive oil and olives directly as gourmet products. Major competitors were Italian branded products, but it appears that there is plenty of room for novel tastes and ideas while innovative marketing holds a significant position too. Today, there are two more companies that followed the way of FCo10’s thinking about olive oil and many more in the area of olives, dips and sauces. The

majority present good growth rates which justifies the above mentioned report's suggestions for the potential of the Greek olives.

The entrepreneur: «*The most important driver is a strong vision».* Before the entrepreneur discovered olives, he was a financial adviser in London and then the chief of P. Marine Services (London). Coming from a family of politicians long active in the political arena, he had been destined to follow his family into politics in Crete. He studies law in Athens and his first master is in competition law but then he starts to show his tendency to escape the family's tradition and he studies again to take a second master in finance and international trade at City University in London. He is now clear about his future. He started with selling Greek olives and oil as gourmet products advancing the value of these Greek products abroad. The beginnings of the selling company are rooted in the UK. *"It was there, during my postgraduate studies, that I met M.C., a food gourmet, who expressed surprise that while Greece had so many authentic products you could never find them in English supermarkets. She said: 'That is what you should do.' I was looking for something to do and she was very encouraging. I had a bit of money and I decided to make the move."* The entrepreneur followed her advice and created a commercial company that entered the niche foods market in 1995, long after other Mediterranean countries had moved into the same field and only after a chance encounter in the UK.

FCo10's founder was the pioneer in transferring Greek gourmet tastes in high value products abroad.The entrepreneur is also an Olympian water polo player.

Innovation/Entrepreneurial process: In 1995, FCo10 opened a new high-value niche market with innovative food distribution of branded Greek products focusing on an initially contradictory concept of tradition and innovation. Soon, the new niche market could be well noticed *(at least)* in Greek duty-free shops under the name "Greek gourmet products" where other companies besides FCo10 were also represented. In order to keep on being world leaders in the specific niche market, the entrepreneur made several observations: "*Other companies entered the niche market we had created. We should become pioneers once again in order to keep our leading position", "new trends imposed the need for ecofriendly production, sound messages of healthiness, and besides the concept of the "traditional Greek" we should deliver innovation as well. These requirements showed us the direction we should follow".* Furthermore, existing suppliers could not develop innovation or satisfy the new conditions of the competition: *"we asked for top quality. Our former business model did not allow for that". "Leadership requires top standards, constant quality, variety, surprise through new different products, innovation. Therefore it was also a question of flexibility in a constant evolution of products and ideas. If an idea is good enough we will find a way to make it real".*

In 2001, the entrepreneur decided to change business from a commercial to a productive one. His new firm would be actually based on innovation that would cover technology, processes, marketing and promotion. The corporate venture, thus the shift from trade to production, opened the way to technological innovation and differentiation in order to support the marketing innovation even more.

The first concern was –besides the achievement of strictly constant top quality – the combination of eco-friendly with healthy (e.g. no food preservatives) production (quite new in the beginning of the new millennium for the Greek industry) which meant innovative production lines. They also wanted to create the potential for R&D development. It took two years; *"We brought the best experts for each production line. Imagine, we built the sauces production line while we had reach no decision on the sauces! However, we focused on flexibility and on the ability to develop and implement novel ideas! For example, the fourth line was installed after the development of the SP product which is a global innovation after two years of research with NTUA."* Care was also taken in the choice of the partners *"My executives have enormous experience and a successful background in the food sector"*

Machinery was bought from Italy and Germany; they were not innovative but they had to adapt to the requirements. Later, FCo10 developed a co-operation with a German manufacturer on novel machinery too for a specific production line.

In 2003, the new plant started production. In parallel, the entrepreneur was working on the new image of the company, ways of message communication and reformation of the business model: *"Now we should add innovation and differentiation next to quality and authenticity. This was exactly the message and the target."* The entrepreneur changes also the packaging design; he abandons the design office in London which was introduced by a friend in 1995 and works with a designing team in Germany. The target is the new look to reflect in a clearer way the Greek authenticity. Furthermore, he builds his new communication channel through big companies that bring FCo10 with celebrities and the VIP world in general.

Appropriability Strategies: Registered trademarks and brand names that represent the diverse categories. Appropriability contracts with executives and employees in core positions.

Knowledge bases: branding, marketing, packing, design, network distribution building, Super-High-Density Olive Production, Master Milling, Olive Oil Marketing and Olive Oil Sensory Evaluation, oil chemistry, organic olive production. Food safety, Waste management, Production control, sensory evaluation, culinary application, marketing and technical communication, new culture of olive oil and olive

Financial resources: own resources, loans, subsidy and a friend from Agrinio (the only connection of the entrepreneur with Agrinio). The investment was about 4.500.000 Euros.

Suppliers / collaborations: besides the raw material suppliers mentioned in the Summary, collaboration with quality control laboratories and chefs. Collaboration with marketing offices and designer is of great significance.

University and Research Institutes: NGO (My Planet) in Switzerland, NTUA, ETAT, University of Cyprus, a Mediterranean research project on olive oil

Institutional: Bureaucracy is a major problem since it creates problems. The lack of academic knowledge on olive. The entrepreneur mentions the existence of University Departments dedicated to olive and olive oil abroad; Greece, the third country in olive and olive oil production should establish one to promote research and educate all those who intent to be occupied in production all along the value chain.

Corporate strategy: "To promote and sell in the international markets and Greece a range of authentic Greek Mediterranean products consisting of both innovative value added recipes and traditional ingredients/ commodities that can be produced efficiently and with high quality in Gaea's facilities.

To be the absolute leader of the category of Mediterranean Greek cuisine– meze in the international fine foods arena, synonymous with quality traditional, authentic and innovative Greek specialty food products" (copied by the company's site)

FCo10's innovativeness and procedures: ***"****For a SME involved in "niche" markets, innovation is an essential part of the company's philosophy*". The idea of constant innovation is realized through production and organizational processes. The entrepreneur has established the ***"need-listen (the consumer)/ open up – create value"*** model in applying aggressive NPD and R&D. On that basis, regular executive meetings are held to present ideas selected by a constant monitoring and other parts' proposals. Regular meetings are also held on development issues to exchange knowledge and experience gained by trade show visits, personal contacts, relevant literature search, patent searching and benchmarking. There are certain processes for ideas selection and further elaboration. Some of the ideas are developed either in co-operation with Universities or other stakeholders or by the company alone. Indicative FCo10's innovations:

- *The 1st totally preservative free (and low salinity) olive snack pack in the world:* The healthy aspect of the product is based on its low salinity levels, the total absence of preservatives or additives and to the fact that it is rich in antioxidants. Innovation after 24 months of research, lower price point than conventional glass jars, reduced transportation costs, lower carbon dioxide emissions when transported.
- *1st Carbon Neutral Olive Oil in the World! 1st Carbon Neutral Consumer Product in Greece*: in order to satisfy the need for clean, natural products for a Sustainable environment

- *oxymelo* (barrel aged vinegar & thyme honey) which introduced retro-innovation since it was bases on an ancient Greek recipe.
- *Novel Processes* to eliminate water consumption and the energy footprint (developed by an Israeli expert)
- *the 1st private company and a cooperative joint venture* (50/50) in Greece

Besides product and process innovations, FCo10 works on marketing and business model innovations too:

- The introduction of the "meze" concept to give identity to Greek products and create an umbrella to promote the Greek products through the cultural culinary heritage and lifestyle. The concept was soon adopted by the "kerasma" promotional initiative launched by the Hellenic Foreign Trade Board, under the auspices of the Ministry of Economy and Finance.
- Among the latest successful achievements is *"dual branding*", based on fruitful co-operation with other famous Greek traditional products
- First to have a famous chef in the Board
- First to offer protected destination of origin olive oils out of Greece
- First to create in Greece products based on original famous chefs' recipes
- Product communication by participating in Oscar Award ceremonies (Hollywood) and movie productions or by the co-operation with famous chefs in USA
- Development of *oleotherapy*

In 2001 FCo10 started its long journey to eco- and retro innovation besides its high value luxury gourmet products lines by experimenting and many try-and-error loops. FCo10 builds especially on strong distribution channels all over the world and develops advanced marketing and promotion strategies. Today the company's biggest market remains in the UK where FCo10's products – a mainstay of Waitrose – are sold in every supermarket with the exception of Sainsbury's.

FCo10 is committed to new idea generation covering products, processes and services for the sake of economic and social prosperity, sustainability and environment protection. The company member share values such as team work and constant training *"everyone, from farmers in the olive grove to administrators in Athens, feel part of the collective effort. FCo10 is not my vision but the vision of the team who believe in it. We've placed a lot of emphasis on educating farmers about the products."*

An impressive number of awards abroad and a constantly increasing sales volume follow FCo10 which in 2011 was awarded with the "Ruban D' Honeur" among 15.000 firms of 30 countries. The latest known is the Gold Award in the international "Best olive oils contest" in New York (April, 2014). A list of more than fifty awards can be found in its website.

c) Textiles and Clothing Sector

TCo1 case study

Summary
- Legal form: Industrial and commercial SA (spin off – mother company B SA)
- Year of foundation: 2000 (mother company 1995)
- Starting year of producing the new product: 2000
- Number of employees: 65 full-time
- Located in: Larissa
- Product family: (I) Dyeing –finishing of mother company's products (home textiles) (II) Dyeing – finishing of clothing industry
- Manufacturing: batch production
- Major customers: B (Mother Company), apparel industry
- Major supplier: chemical industry (Europe), packing companies (national)
- Sales' structure: Europe 55-60 %, national 45- 40% (less in 2010)
- Educated staff: 10 with a University degree
- Patents: no
- Trademarks: several trademarks but by the mother company

Object of investigation

The case was known to the author (the author is a friend with the entrepreneur) and was confirmed by the representative of Hellenic Fashion Industry Association (SEPEE), the main representative of the apparel and textile industry in Greece, when he was asked about it. Interviews were held with the General Director and entrepreneur (about 3 hours), the Managing Director, a chemical engineer (1.5 hour), and 1.5 hours with the Production Manager (Mechanical engineer) of the mother company, who was in charge of the realization of the new spin –off in cooperation with the entrepreneur. A view of both the mother company and the spin-off plant with the General Director (about 1 hour each) has been conducted for this case study. Moreover additional information has been gathered through articles and papers handed by the General Director, and further information of the firm's events by internet sites. Understanding gaps were filled by several phone calls and a second visit to the production manager of the mother company.

TCo1: NACE code C13.3 - Finishing of textiles (NACE Rev.2). The company disposes private industrial plants located close to Larissa (Central Greece). The mother company, a bed cloth manufacturing company with knitting and clothing was established in 1995. The factory is located in the Industrial Zone of Larissa, covering 45.000 $m^{2,}$ with buildings over 22000 m^2 and its present capacity is 20.000 sheets daily. Besides the modern production facilities, the mother company has developed a highly organized computerized system which links production in Greece with sales in Germany.

Its year production is 5 million pieces which are mostly exported. Directly integrated in the production process of the mother company came TCo1 one of the most modern clothing

finishing and dyeing factory worldwide. TCo1 was planned to meet all needs of innovative textiles and exploit modern technology in order to have the ability to dye a wide range of colors on cotton and synthetic – mostly innovative – fabrics. The new company was constructed in the Industrial Area of Larissa in site of 25 acres, 10 of which are covered by the production buildings.

The vision of the spin off was to become a leader in innovative finishing and dyeing including the development of the technological capabilities needed to work on innovative fabrics which could not be treated with the conventional finishing and dyeing methods. The reason was twofold: the already existing trend towards the use of innovative fabrics by the mother company which was developed as a strong competitive advantage. That was due to the vertical integration of producing, finishing and dyeing bed cloths with technology known only by themselves offering unique characteristics which constitutes a strong technological advantage. The second reason was the policy to offer only value added finishing and dyeing products to customer clothing industries, which would focus on high value differentiated products (e.g. athletics).

According to their vision, the two entrepreneurs (a Greek and a German one) formed a plan for both innovative production technology which included the design of some entirely new equipment and the adaptation of relevant patents in a form of pilot uses. One should mention here that pilot use means a further research on adaptation to local conditions (e.g. temperatures, pressures, water hardness, mixture changes or adds etc.)

Their main suppliers are the European chemical industry and the main customer is the mother company and local apparel industry which produces high value products (mostly for exports). There are no direct competitors in Greece or Europe. Competition comes mainly from Turkey and other countries of Asia but are not direct ones till now since they use conventional technology. One can find similar dyeing and finishing plants in USA but they are not in the same market share.

The company focuses on differentiation, quality, flexibility and niche market leadership. The company spends occasionally for innovation activities. Expenses cover mainly raw material and working hours.

Entrepreneur(s) : There are two main shareholders Mr R and Mr E. Mr R (the Greek) is a mechanical engineer, with a former experience in the sector (Production manager in a textile industry for 7 years and owner of a similar company for the next 15 years) with entrepreneurial experience, an innovative spirit, synthesizing competencies, initiative and risk taking ability, strong personality, locus of control, reputation, managerial and leadership skills, desire for autonomy, a talent to find and maintain quality people at all levels.

He was president of the Association of Thessalian Enterprises and Industries (STHEV) for 6 years, Vice president of the Executive Committee for 3 years, General Secretary of the Union

of companies in the Industrial Zone of Larissa, Vice President of the Center of Entrepreneurial and Technological Development of Thessaly and a member of many other technological and entrepreneurial associations. He is further the co-owner of another special treating, dyeing –finishing company, a bioenergy company and a photovoltaic plant (2006-today).

Mr E is an entrepreneur in the textile sector for more than 30 years. He is mainly responsible for the marketing since the mother company's production is exported in Germany, Austria, Switzerland and similar countries. His daughter, an economist, has engaged the company the last 10 years. *«Since we are rather small and our business cannot allow too important innovations, we turn to process innovations and cooperation – I mean with chemical companies – to make the difference, besides of course quality, terms of delivery and all that staff that is rather obvious today…. It is good to have good collaborators. Mr E has an excellent knowledge of the market and a fine way to see the future regarding trends and needs. There are two chemical engineers, a textile engineer and two mechanical engineers who work hard to meet the innovative, if you know what I mean…" (Mr R).*

The innovation: The innovative idea that led to the establishment of TCo1 was the provision of state-of the art innovative products for virtually all requirements on innovative fabrics and demands of end users with mother company being the first and more demanding customer. The entrepreneurs decided to invest on exploitation of cutting edge technology (some parts of which would be developed by their own ideas) which would be the basis of working with innovative yarns, fabrics and innovative dyeing – finishing and treating elements and to start the newly established plant by using of a process for finishing and treating textiles with skin-care oils and emulsifiers, patented a year before.

Differentiation was not easy at the present activities of the firm, since it was very difficult to innovate and revealed a need for moving up the value chain. The absence of high quality dyeing plants to cover the needs of the mother company actually created the vision of the competitive advantage that would derive from unique integrated production of its products.

A mixture of ideas and applications has been elaborated with both foreign (mainly from Switzerland and Germany) and national companies. Actually the main innovation was a result of cooperation with a Greek manufacturing company, specialized in the design and manufacturing of fabric dyeing machines, which offers innovative products, usually launched at ITMA. In the early 60's the company started making innovative fabric dyeing machines, i.e. the first stainless steel winches.

The entrepreneurs' ideas became innovative machinery with main characteristics, the automatic settings adjustments and variable loading feature, which was launched at ITMA after two years. Another important innovation was the technology referring to the color and chemicals preparation for automatic mixture and feed, which is a strong competitive

advantage for TCo1, since all relevant companies (local and European) refer to it for special high demand orders.

Other new but existing technologies were firstly adopted by TCo1 at national level such as a system for energy saving, safety mechanisms and mechanisms for feasible tailor made solutions and special effects led to a unique, fully automated plant with high precision in repeatability – safety –flexibility etc. with innovations which solved existing problems in finishing plants.

These process innovations that would lead to unique features were found and developed by the expert team hired by Mr R after the final and formal decision to establish the new company: two chemical engineers, a chemical textiles engineer and a technologist textiles engineer, with Mr R and Mr E being the leaders.

Meanwhile Mr R with the two chemical engineers was searching for new patents and offered the new TCo1 as candidate for pilot uses. «*It was pure luck*" Mr R would comment on the patent choice. "*In USA there were similar patents based on oils and such ingredients tried in relevant plants. This patent was new – it was registered a year before- not yet out and we were the first to show interest*." The patented material based on skin-care oils and emulsifiers, was applied in the brand new plant. After several try and error loops (environmental conditions, water requirements, mixture phases, conventional equipment modifications, process modifications, material quantities, time and speed of the processes etc) the team reached the desired final results and was ready to start normal production with the mother company's products. The finishing and dyeing plant of TCo1 is one of the 3 most innovative ones in Greece and among the 7 ones in Europe.

Entrepreneurial process: vision showed towards differentiation based on innovative characteristics in a sector where innovation is rather difficult. Production and quality demands led to a need for a further vertical integration, combined with a strategy of differentiation in order to capture more value from the new investment. A two way approach was taken by both entrepreneurs: a) cutting edge technology able to satisfy innovative fabrics by the mother company and other customers and b) innovative finishing features able to offer differentiation to clothing companies.

Being already customers of finishing and dyeing plants, the entrepreneurs knew the abilities and capacities of them in Greece and Europe (due to the export orientation of the company) regarding finishing activities aimed at giving fabrics the visual, physical and aesthetic properties which consumers demand – such as bleaching, printing, dyeing, impregnating, coating, plasticising, etc;

They decided that more possibilities for innovation would emerge when moving along the value chain. "*Finishing as the last step in textile processing becomes more and more*

important and offers indeed greater prospects for product differentiation" (Mr B., Chemical Engineer of the company).

Watching the market they had a clear picture of the trends which outlined a variety of demands from end-users, requiring comfort such as softening, easy-care properties, protection, functionality and/or special effects (such as hydrophilic or anti-felting properties) is still growing. Furthermore, the process safety and reliability of the products is a significant issue for the textile finisher. Their own experience in the field of textile finishing as clients also sketched the weak points of the existing plants such as the inability to repeat the same color ("*it was always almost the same*" (Mr B)) or to dye innovative fabrics.

They planned the new plant with a capacity that would cover by a 50% the production of the mother company's needs and the other 50% would be covered by chosen customers.

The installation of the new plant endured 10 months. Mr R. was the main responsible for the realization of a fully automated and innovative finishing and dyeing plant - being already a customer, he knew weaknesses and had precise requests to fulfil, while being a mechanical engineer could evaluate the technology developed and /or offered. The new plant fulfilled all law, environment and quality requests (eg ISO 9000, Öko-Tex Standard 100 Produktklasse 1, REACH requests etc). Since the use of the first patent, the company went on further innovative processes. "*We have to work on the new paints and chemicals that our suppliers send us but there is also the part of the customers. Sometimes they tell us what they have found in a trade show or have heard and we try to do it. Then it is us that we call the suppliers and ask for materials and know-how*" (Mr B)

a) the application of a new process patented by Clariant and invented by a Greek scientist (Kyriazis) about anti smell properties – first to use at least in Europe. Trying to process it, the engineers found out that the fabric should be processed in a different way. That led to some new equipment, while the final products were tested in Clarients labs. The description by the two engineers Mr B and Mr G was long about the problems and the many try and error loops due to the fact that temperature, time of application and other parameters were complicated functions of other parameters such as the length and the velocity of the thermal stabilization machine, while treating very expensive raw material

b) a special process using aloe-vera developed by the company's scientific personnel in order to make the fabric extremely soft,

c) the finishing and dyeing of Lyocel (fabric made of wood) – an Austrian product first introduced in the world's largest sector exhibition in Frankfurt Trade Show 2003,

d) anti – peeling, a rapidly developing process in collaboration with the R&D department of a chemical company which developed a special enzyme, after some clients' request that sold very expensive clothing.

e) trial production of several innovative chemical products in cooperation with chemical industries

TCo1 produces small quantities of the innovative products. They serve niche markets and have to respond immediately to fashion changes, innovation and customers' requests.

Corporate strategy: The spin-off evolved from both financial and corporate reasons: the double strategic target was a) to get self-efficiency in dyeing – verticalization and development through investment and in order to gain more possibilities for innovation which emerges when moving along the value chain.

The financial reason was the possibility to use again the subsidy Law.

The mother company increased their competitiveness by moving up the supply chain. Finishing offers indeed greater prospects for product differentiation. Through interaction with customers and suppliers, it creates new products and enlarges its product competences. Emphasis was given to differentiation and quality recognition. Innovative products add to the company's value. (*"We are trying to locate any market gaps and be the first to satisfy them" (Mr R))*. The company follows a differentiation and niche market strategy. The company's strategy is the introduction of new methods and products every two years

Marketing strategy : Emphasis on quality, fast delivery, flexibility in order volumes and colour ranges – repeatability, door-to door marketing and promotion, niche markets, value added and quality strategy based on innovation leadership against conventional products (conventional products from India, Turkey and Pakistan are much cheaper but cannot compete on the level of the characteristics offered by TCo1)

Appropriability strategy: The mother company has registered all the products as trademarks in Greece and Europe. The company follows the strategy of lead time advantage. There is a further informal commitment of all the engineering team, a "family culture" in the company which has led to long lasting employment relationships.

Resources: There is accumulated knowledge and long entrepreneurial experience on the sector by both entrepreneurs who engage important complementing capabilities.

There seems to be a strong executive team with a simple organisational structure, and few internal borders increasing flexibility. Mr R can be considered the main driver and promoter of innovations at the company, assisted by Mr E in ideas' formation. The direct ownership involvement and low formalization increases the speed of decision making. There is also a culture of constant training.

The manufacturing knowledge is developed by the co-operation of Mr R with the company's engineers and main parts are constructed by manufacturing companies in Greece or abroad. Some parts are custom-made and there is much knowledge transfer among suppliers and customer.

Business networks*:* Mr E's acquaintances and networks in Germany, Austria and Switzerland opened the perspectives of the mother company and led to the establishment of the spin off. On the other hand it was Mr R who exploited the networks within the apparel industry in N. Greece and allowed the realization of the decision for a second use of the new finishing plant (to have customers as well). The company's former relationships with finishing units in Greece and Europe (as a client) enabled the formation of an integrated strategic and business plan for the new plant (technologically, functionally etc) and technological and process innovation (repeatability, safety valves). The company had built up its reputation and consequently enabled the cooperation on new products with big multinational chemical companies (such as Clarient) which was strengthened by several fruitful projects. Networking with equipment suppliers enables the choice and construction of original high tech machinery and its combination in innovative ways using ICT and other techniques (e.g. "safety or bottleneck valves") which solved existing problems in existing finishing units. A formal cooperation with a private quality control laboratory in Thessaloniki should also be mentioned for controls that exceed the control range of the company's labs.

Informal networks mainly as loose ties with customers, equipment suppliers, raw material suppliers and suppliers' technical staff (personal contacts) seem to play some role, since they result in constant knowledge diffusion which in turn facilitates the improvement of methods and techniques, the further plant modernization, the adaptation of innovative methods through the whole value chain (information, promotion, knowledge exchange, energy saving, etc), emergence of new ideas (e.g. anti-smell which was proposed by a customer and realized by a cooperation with a supplier, the need of an "open fabric" machine due to some customers' needs etc.) and products (anti peeling), as well as technical solutions to automation etc.

Financial resources: All studies and research was financed by the company's own funds. The company entered the Investment Law 2601/1998 for an investment of 8.000.000 Euros in total, in order to build the new finishing and dyeing unit for the innovative processes (the subsidy was 30%).

The whole activity of ***the production technology*** installation presented both foreseen and unforeseen difficulties, since the technical knowledge was in many cases newly created in order to cover the specific needs of the company. There was much technology transfer among the company and the manufacturers and a result of it was the innovative machine that the manufacturer presented in ITMA after two years. Once again the whole process was broken in sub processes with different contractors both Greek and foreigners. Unforeseen difficulties led to a need for some further investment (from the initial amount of 5.7 million to 8 million Euros).

Similarly, the process of using the emulsifiers and the skin -oils encountered some important difficulties e.g they had to decide the stage where the new material should enter the process

(in the fular (one machine of the production line) or the final stage at the dyeing machine), since there was no prior suggestion.

Although Mr R and Mr E were in charge of the whole plan, there were two managing groups: one consisted of Mr R, the mechanical engineer and the textiles engineer, the manufacturing companies and their erectors. The second team consisted of the two chemical engineers, a designer of the mother company, the textiles engineer and the technical staff of the company that owned the patent. There can be detected a constant bidirectional knowledge flow of both embodied and disembodied knowledge through skilled personnel, training, plant and equipment designs and descriptions, consulting, mutual experimenting, machinery and equipment. Some employees were further trained by the manufacturers' technical staff on maintenance and problem solving techniques.

The company focuses on chemical and equipment industry for new knowledge and innovation, maybe because there were no serious proposals for their sector till now by universities and other research institutes.

The company has developed a thorough knowledge on conventional and innovative textile and fabric properties and potential to the finishing, dyeing and special treating. The capacity was developed through training, individual studies and efforts, co-operations with clients, suppliers and companies of the sector with a different market orientation (e.g. the second dyeing plant for special dyeing treatment of T-shirts was in collaboration with Staff, a major jeans producer), trade show and company visits. The company uses an informal, not officially recorded organizational routine: it gathers information mainly through the innovations in the main tradeshows of the sector, as well as the related companies (chemical industry, textile and fabric industry and machinery) which leads to innovative ideas. This new idea is assimilated and exploited by forming the needed parameters and when the company gets the desired result it goes on by creating the preconditions for new information.

Mr R claims that the company owns a capability of creating competitive advantages on differentiation. He refers to how the new technology enabled the new firm to create novelty with Lyocel, a manufactured but not synthetic fiber (Lenzing Fibers today) which have expanded its manufacturing and uses and patented them. The properties and production processes were unique enough for the Federal Trade Commission to designate it as a separate fiber group. (Comment: In case to understand the difficulty of successful lyocell dyeing one can see that there is already a patent of lyocell finishing and dyeing, registered in 2005).

The company has also established a routine of collecting present and future requirements of the customers, since colors and fashion in the apparel industry is a completely other sector and the mother company cannot have a direct contact with its trends, although attending the common trade shows (but different events), in order to get direct and accurate information.

Today in Greece there are two other similar plants which belong to big vertically integrated companies which start from cotton buying and finish with clothing of many categories. They are mainly used for the organization's needs.

Institutional: Mr R says that they encountered many difficulties in getting the subsidy money both in 1995 for the mother company and the 2000 for the TCo1 concluding by stressing the fact that things are more difficult today. Although bureaucracy is always a big problem of Greece, Mr R focused on the difficulty to disburse the money, which is becoming even more difficult today

Sectoral knowledge base: Textile Processing involves study of chemistry and manufacture of fibers, their chemical processing such as bleaching, dyeing, printing and finishing. It further encompasses the study of chemistry as well as application of various kinds of chemicals, dyes, thickeners, and finishing auxiliaries which are used in chemical processing of textile fabrics and garments. Textile Processing also involves knowledge of green chemistry, biotechnology and nanotechnology with special reference to chemical processing of textiles.

TCo1 is helping research by offering a very modern plant for pilot uses. That is vital and it is not just luck or good public relations that the company is chosen among the most modern dyeing plants in Europe by Clarient (a leading chemistry company in the field) for many pilot productions. That can be considered a contribution to the sectoral knowledge base, since the transfer from lab to real production encounters many difficulties. The company further offered innovative processes, regarding the patented treating / finishing /dyeing and other elements developed by the R&D of the above mentioned chemical industry, which then could be used as directions for the following users.

The cooperation on building the production lines of the new plant led to at least one successful worldwide innovative dyeing machine and several innovative equipment (such as the "*chemicolour kitchen*" as the chemical engineer had named a system they invented for the mixture and preparation of colors, enzymes and other chemicals which enable a further mixture automatization (TCo1 was not interested in patenting it).

TCo1 enriched and expanded its knowledge along the value chain from yarn (eg Lyocell) to final fabric and linen consumer. It gained product and process - procedural knowledge such as knowledge on finishing – dyeing and treating processes followed by advanced quality control). It expanded its knowledge base on chemistry, textile engineering, processing and machinery engineering, ICT and marketing (since it moved up the value chain).

Further to its acquaintance to the use of the specific technology, CYGR2 engaged in other technologies of other scientific areas such as the full-scale recovery of effluents for reuse in production, waste water treatment, energy saving. The textile dyeing and finishing sector uses large volumes of water and energy, as well as substantial quantities of complex chemicals. Of

course, one should mention that patents originating from textile finishing are registered "elsewhere", i.e. in other sectors like chemicals, machinery and other knowledge intensive sectors with which textile companies cooperate. This inter-sectoral knowledge transfer is supposed to be substantial (Böheim, 2006B).

Relations within the value chain: The most important suppliers are the ***chemical industries*** which play the role of "the lab" for TCo1. "*They perform R&D and then we are there in order to check what they have developed. There are times that we reject their products and they trust us"* (Mr G. Mechanical Engineer, production manager). There is both formal and informal networking and much knowledge transfer.

Plant manufacturing engaged a network of both national and European constructors. This was possible due to the mother company and the fact that both Mr R and Mr E were engaged in the relevant business environment for quite many years. There was much knowledge flow in the whole process starting form designs till the pilot production. They have established trust and respect with suppliers. "*We have worked hard with Sclavos's engineers and that paid us back all these years. I mean when we need some modification, we can have it in really good time. We enjoy it that the company is here in Greece. We had nothing to do with patents. We did not need it*!"

The company used its already existing commercial network abroad and developed a new one in Greece. This was enabled through personal contacts (social and business networks) since Mr R is known in the area of Central and North Greece both because of the mother company and his personal involvement in many associations.

Linkages to high –tech companies: important formal linkages with specialized laboratories for all processes in Greece, Switzerland and Germany (links mainly of Mr E and of the two chemical engineers).

There is a constant collaboration with a Greek automation company, since TCo1 is mainly process production with much automatization and the company invests in further ICT use and safety improvement. In the same direction there are important formal and informal linkages to the manufacturing companies, since they supply the company with high tech equipment and there is a knowledge exchange on a constant basis.

There were some cooperation activities with the University of Thessaly such as within the Innovation Pole and the Thessaly-tex program on water saving and treatment.

Customers in Europe are big home textile companies, while in Greece there are apparel manufacturers who mostly export to Europe. They are in a constant communication with TCo1, since there are two cycles of fashion each year and there are discussions about innovations seen in the two big trade shows of the year in Germany and Italy. They benefit from adding value to their products and extending to niche markets by using the modern capabilities of TCo1.

TCo2 case study

Summary
- Legal form: Limited Company
- Year of foundation: 1961
-Location: Oinofyta of Boeotia
- Year of important changes: 1998: Introduction of new products with innovative characteristics and a suitable and flexible model 2004: introduction of a new product category, the bulletproof vests and helmets, plant in Albania and initialization of e-commerce and B2C
- Number of employees: 158
- Educated: 6
- Product family: special use and high performance fabrics, garments and protective systems, suitable for armed forces, public services, fire brigade and industry. 4 Products Categories which refer to Fire / Rescue, Police / Security, Army and Industry sectors
- Manufacturing: continuous process production with variation
- Major customers: Greek army, Fire brigade, Forest firefighters, Police, individuals
- Major suppliers: DuPont, Gore, 3M
- Sales' structure: Greek market, Italy, Cyprus. Exports 27%-32% of turnover.
- Patents: yes
-Trademarks: yes (IFESTOS®, SIGMA®)

Object of investigation

The case was suggested by the General Director of the Hellenic Fashion Industry Association (SEPEE)**,** the main representative of the apparel and textile industry in Greece. Interview with the two of the three entrepreneurs and their father lasted about 3 hours with a visit to the plant to follow. Additional information has been selected mainly by several phone calls and internet sites.

TCo2 belongs to the manufacture of textiles (weaving, NACE 13.2 and finishing, NACE 13.3) and the manufacture of wearing apparel (workwear, NACE 14.12 and other outerwear NACE 14.13). The firm has a productive facility in Oinofyta of 4200 square meters and a spin off in Albania. TCo2 is considered the only innovative clothing production unit in Greece which develops high R&D and collaborations with significant R&D based firms in Europe. Its production process is integrated and verticalized; it has a beaming-sizing unit of a production capacity of 540 tons annually, a weaving mill anda cutting unit with a production capacity of 3600000 square meters annually, and a manufacturing unit of ballistic products with 64000 pieces of annual capacity. The factory in Albania is ISO 9001:2008 certified by TUV and qualified by NATO. It produces special garments as per EN and NATO standards. It has also a sewing unit.

Basic products: Today the company produces special use and high performance fabrics, garments and protective systems, suitable for armed forces, public services, fire brigade and industry. More precisely there are four product categories, which refer to fire / rescue, police /

security, army and industry sectors. Each category is divided to further sub categories as follows:

i. *Fire / rescue category* comprises flame retardant uniforms, raincoats and various equipment as breathable socks, special masks, gloves etc.

ii. *Police/Security category* comprises flame retardant garments, raincoats, uniforms and jackets with special features (lightweight, waterproof, breathable, for I.R. protection, windproof, hypothermia shock protection, high thermal protection, chemical and biological protection), bulletproof vests and helmets, clothing and various equipments (gloves, boots, balaclava helmet).

iii. *Army category* comprises bulletproof vests and helmets, cotton, cotton/polyester, wool, polyester fabrics, polyamide (high tenacity) monochrome or camouflage with I.R. protection, suitable for clothing and tents, battle uniforms and jackets with I.R. protection, and formal uniforms suitable for military forces, security forces and various organizations as well as various equipment (boots, gloves, multifunctional service shoes).

iv. *Industry category* includes uniforms with special features for heat protection and insulation, antistatic and radiation heat protection, and boots and shoes for specific professional use.

Competition: Only imported products of relevant categories

The Entrepreneurs: The Company was founded by Mr CS, with studies in Economics, an entrepreneur characterized by perspicacity and a positive attitude to change, who is still active. He realised the upcoming changes in the textile industry early enough to move towards more sophisticated and value added activities (products for the army and the health sector). His sons continued in the same line. Today they are managing the company and have taken serious decisions regarding the development of new production activities. Mr MS has a Bachelor in Chemistry from the University of Patras and a Master in Manufacturing System Engineering from Warwick University. He was the one that seized the opportunity of entering the technical textiles and other market niches. He was supported by his younger brother Mr DS, who is an economist and is mainly in charge of the financial affairs.

Both were grown up in a family environment that had allowed them to develop initiatives, even before being officially involved in the management of the company. They experienced all company's important transformation phases since they worked in the production from younger age until they became active members of the management team in the early 90's. They considered challenges from the upcoming crisis in the textile industry as an opportunity to invest in new productive and organisational methods at the same time entering in new fields of the textile industry. They took the risk although they were the only Greek firm investing in technical textiles at that time. They sensed the growing interest in self-protection

products and the upcoming opportunity from relevant European norms regarding self-protection that would become obligatory.

The company's history: The important milestones in the evolution of the company were the following:

1961: year of foundation. Location in Atalanti (150km from Athens, the capital).

1980: specialization in fabrics for the army and the health sector.

1993: fire rescue garments.

1998 -1999: new modern plant in Oinofyta an industrial zone near Athens (57 km).

Introduction of new products with innovative characteristics and more specifically technical textiles (pioneer in Greece). NSPA qualification and ISO 9001. Licensed agreement with Gore, investment and certification of Gore-tex garments.

2000: license and investment for the production of DuPont fabrics and bullet proof vests

2004-2006: new plant in Albania for sewing, introduction of a new product category the bulletproof vests and helmets and initialization of e-commerce and B2C, certified per NATO standards

The company was founded in 1961 as a manufacture of bed sheets. Profit margins were gradually squeezed because of intense competition and the old generation sensed the opportunity of entering the health and army sectors by participating in tenders for public procurement. In 1981 they turned to the production of (conventional) textiles specialized for the army and the health sector. In the early 90's the international sector evolution pointed to a clear message: traditional productive activity was delocalized to eastern countries with low labour cost. Many companies expanded their intensive production into underdeveloped countries and the Mediterranean. Although in Greece this turn occurred with a small delay, the march of events was predetermined. The companies that were not envisaging any restructuring and modernization were condemned to face competition from countries with lower labour cost. In addition many companies took advantage of the rise of the stock market in the late '90s but this was not translated in productive investments but in the creation of a bubble. Today, most of the Greek textile companies have closed or delocalized their production. In this context TCo2 decided to enter the field of personal security products such as fire rescue garments, using special high performance fabrics.

The company is a first mover for the Greek productive system as no other textile company had turned to technical textiles for self-protection products.

Innovative activity: By the time the entrepreneurs realised that the textile industry was experiencing a deep restructuring, they moved forward developing new product categories using new materials and targeting niche markets where there was no production in Greece, competing with imported products. They focused in developing a competitive advantage based on the capability to design, develop and introduce new products of high added value to

the Greek market. These products were specialised garments based on the know-how acquired from their suppliers and on the technology incorporated in the raw materials. They also developed new ways of commercialisation in order to extend their value chain forward. That is why they established direct links to the customers creating in 2004 an e-shop and developing their own retailing network.

Innovation / Entrepreneurial process: After 1993, the entrepreneurs willing to overcome the problems in the textile industry, sensing the opportunity arising from European norms regarding self-protection, developed a series of new products based on technical textiles. They started with flame retardant wearing apparel. Competitiveness in this field is not dependent heavily on labour cost but mostly on technical qualifications and standards and the reliability of materials. In addition the market is much segmented according to specific customer needs. This was new for the Greek productive system. From that day on they constantly introduced new products for the Greek market and invested to innovative products for niche markets. In 1998, the plant was transferred in an industrial zone near Athens, due to localisation advantages (more high skilled personnel availability, administrative and ICT services etc.). ***This change in the location was followed by a complete re-formation of the company.*** They introduced new products with innovative characteristics and more specifically technical textiles (pioneer in Greece) and got NSPA qualification and ISO 9001.

Design and new product development became the core business activities. In addition an administrative restructuring supported more flexible and fast decision making.

The company sought for advanced know-how and to this end cooperates with Gore for waterproof, windproof and breathable fabrics, DuPont for flame retardant fabrics and 3M for reflective material and clothing.

During the years following the construction of the new plant, the company entered new niche markets such as bullet proof and customised products for personal safety and decided to invest in vertical production in order to increase value added.

In 2004 the firm entered the production of final garments for special use that until then they were outsourcing. They developed a cutting department, invested in modern equipment (warping machine for technical textiles) and constructed a new plant in Albania with sewing lines for producing high performance garments such as Nomex®, Gore-Tex®, polyamide etc. The choice of location was based on the availability of skilled workers and the accessibility / neighbouring with big Greek cities. The plant has cutting edge equipment and the possibility for customised products.

Recently they started e-commerce and tried to develop their own retail network in order to develop direct access to the customer.

First introductory innovative products after individual requiring :

- a bulletproof jacket for big sizes ,

- a helmet (R&D started in 2005, now it is certified but there is no commercialization yet)

The company has systematically built **on the technology** and know-how obtained with reverse engineering and in cooperation with technical consultants and suppliers. Their decision was to cooperate with technology leaders in raw materials as these companies look for local partners in order to enter new markets. In cooperation with their suppliers (Du Pont, Gore, 3M) and technical consultants (especially from Israel where they have important know-how), they developed a design and product development capability and in this way the company became a constant innovator (at least for the Greek market) developing innovative products for very small niche markets.

Market entrance: The firm had penetrated in the specific markets step-by-step; public procurement is a very useful mechanism to promote such standards and give the possibility to national players to enter the market. However, in Greece public organizations where very skeptical in trusting a Greek company for high performance fabrics and garments. This was an obstacle to overcome and show that they were reliable. A fortuitous event during the preparations of the Olympic Games in Athens gave them visibility to the Greek market. More precisely in the bullet proof products the product that was imported by Hellenic Defense Systems presented a default and TCo2 gave them a technical solution to the defected products as well as provided them with their products.

However, when speaking about technical standards there is need for expertise when preparing the call for tender. This expertise is missing from many public services that might be considered as potential clients.

Innovativeness: Recent innovations at least for the Greek market were the bullet-proof vest for large size, the bullet-proof helmet and a special flame retardant and radiation protective mask. The two first products have been designed taking into consideration the very specific needs described by customers that came to the company asking for unique solutions. The company's pratique is to listen to these specific needs as they may represent new commercial opportunities. The special mask was developed internally using special material from DuPont. DuPont proposed them to patent this innovation as there was one similar in the US but with less functional facilities, but finally they didn't. Until now they had used secrecy as appropriability method. However this should change because the fear of imitation kept them from selling small quantities of the new product to a Spanish client.

Determining factors/ processes

Internal / organizational factors: From the very beginning there was a creative mindset that nourished the company's evolution and choices towards exploiting new opportunities.

The company has well trained and experienced personnel that are engaged to the company's vision. This ensures to some extent the high standards and continuity in the product quality. In addition the company supports and organizes personnel training although most workers have

time limitations because they need to work in other jobs as well to complement their income. This is the inner contradiction of the evolution of the textile industry as there is a need to develop high quality and value added products in order to compete at the international market at the same time that labour cost should be kept low, at least in Greece. However if the modernization and restructuring of the sector resulted to productivity surpluses this would create the opportunity for better remunerations.

The development of new products is based on R&D that is realized internally and sometimes in cooperation with technical consultants / experts on the specific item to be developed. They spend approximately 150 to 200 thousand euros per year in R&D. Most of the times in addition to the two entrepreneurs, are involved the quality control manager, the CAD designer (if necessary) and the production manager.

The way production is organized gives enough flexibility in order to avoid stocks and provide just in time solutions for specific needs and specific customers.

The brand name is a very strong element determining whether they would easily enter a market. The fact that their products had a Greek label was a problem that was gradually overcome because of the strong reputation of their suppliers. Their suppliers' brand name was a guarantee for their products.

Market searching: The Greek market has a dynamism because of two reasons. First, public services (fire brigade, forest fire fighters etc. are well behind in terms of equipment and this in relation with new standards imposed but the EU creates a potential opportunity to increase sales. The second reason relates to the low level of voluntarism in Greece that starts to increase.

Another market opportunity comes from demand sophistication. The company seeks for opportunities that come from more sophisticated needs of potential customers. For example new generations are also interested to the design of special garments and not only to the functional characteristics.

Appropriability Strategies: patented innovative products, technologies and registered trademarks

Knowledge bases: fibre science, fibre reinforced composites, technical innovative fabrics, textiles, adhesion, technology acquisition for flame retardant compounds for cotton, textile chemistry, polyester, acrylic fibres, and polypropylene, dual membrane technology, technology for durable waterproof protection ("waterproof laminates"), design, ergonomics, production management, logistics, antiballistic technology, composite material technology, plastic deformation technology, operations management, marketing, e-commerce, Human factors, anthropometrics, sizing and fit of apparel

Financial resources: bank loan and private capital.

Linkages: The most important source of external knowledge is their suppliers and namely ***DuPont, 3M and Gore***. Cooperation with these three companies did not only provide them with reliable raw material for their products that increased their credibility in the market but also created a stable channel for knowledge flows regarding technical textiles. It also ensured them to be first to the Greek market in introducing new special use and high performance fabrics, garments and protective systems. In the context of these relationships TCo2 acquired valuable experience on technical textiles that was transformed to specific competencies regarding new product development and improvement of existing products. They worked in parallel to develop their own solutions combining their knowledge of the Greek market with the knowledge on specialized materials and ended up with innovative solutions such us the bullet proof vest and helmet and the protective mask (see above).

Another source of knowledge were ***technical consultants from Israel*** that worked with the company and brought in their specialized know-how on composite materials for armor-plate or bullet-proof.

The company is a member of the Nomex Quality Partner System and certified manufacturer by DuPont for special fabrics and garments.

University and Research Institutes: Networking with national organizations such as Universities or research centers is weak. They cooperated with Clothing Textile & Fibre Technology Development Company (CLOTEFI), which was founded in 1986 to pursue the application and utilization of the results of applied and technological research, and to provide scientific and technological services to businesses and organizations in the textile and clothing sector. They were firstly involved in a research project under STRIDE initiative together with CLOTEFI and the University of Patras that didn't result to a commercial output. More recently they participated in a European pre-competitive research program related to anti-bacterial fabrics. Although the project didn't result to a specific product, it gave however the opportunity to the people involved to acquire knowledge and gain valuable experience.

In general research co-operation with research centers or Universities present a problem of different timing and objectives, at least when the companies involved are mostly interested in commercial output.

Institutional: Regulations in the context of EU, referring to working conditions (e.g. in big industrial units), marked the upcoming needs in terms of protective garments. TCo2 sensed this opportunity and changed the focus of its production. However, national policy initiatives regarding safety and protection regulations are not developed enough to help market development.

Corporate strategy: Their actual aim is diversification based on accumulated know-how and experience that allows them to produce products that were until now imported, in better quality or lower price. In addition they are investing in design as they sense the interest of

customers in design and the opportunity to diversify to the casual and sport wear using their knowledge in special fabrics such as waterproof, windproof etc.

Today TCo2 is able to respond to very specific needs in terms of product characteristics and has established direct links to the market with e-commerce and B2C. The new plant in Albania is organized in such a way to combine mass production with customization. Orders from customers are 70% for big quantities and 30% for customized products. Experienced workers can make the necessary adaptation to any specifications in order to respond to small quantities with specific characteristics.

The company succeeded to develop and sustain an export orientation (35% of the turnover are exports and this performance is increasing) when most of the Greek textile industry was suffering of a deterioration of competitiveness.

TCo3 case study

Summary
- Legal form: Industrial and commercial SA (joint venture)
- Year of foundation: 2005
- Number of employees: 6 full-time
- Educated: 2
- Located in: Larissa
- Product family: I) Dyeing –finishing of clothing industry II) Biodiesel products
- Manufacturing: batch production
- Major customers: (one's of the two entrepreneurs Company), apparel industry, biodiesel buyers
- Major suppliers: chemical industry (Europe), waste cooking oils providers
- Sales' structure: Europe 30 %, national 70%
- Entrepreneurs: two entrepreneurs and the sister on one of them
- Patents: no
- Trademarks: no
- Awards: no

Object of investigation

The case was known to the author (the author is a friend with one of the two entrepreneurs) and was confirmed by the representative of Hellenic Fashion Industry Association (SEPEE), the main representative of the apparel and textile industry in Greece, when he was asked about it, as well as the Thessalian Association of Enterprises and Industries. Interviews were held with the CEO and one of the three entrepreneurs (about 0.5 hours), the Technical Director, a chemical engineer (1.5 hour), and 1.5 hours with the Financial Director of the company. A view of the plant with the Technical Director followed. Moreover additional information has been gathered through press and internet.

TCo3 is located at the Industrial Area of Larissa. Although in one building there are two separate facilities that co-operate in an innovative manner: a green dyeing plant of a 3000 kg capacity per day specialized in piece-dying techniques that uses biodiesel energy which is produced by waste cooking oils in the second plant; this in turn produced biodiesel for the market as well (13000 kiloliters per year). The firm sprang from the cooperation of two strong entrepreneurs within the clothing sector but different sub-sectors (namely white linen manufacturing and branded jeans). It is a new-to-the-world company established on a combination of technology, fashion and ecology, as well as the experience and fine networks of its entrepreneurs. The company's activities are pioneering in Greece and the entrepreneurs claim that it is also in Europe[384]. Even since the very first year of production, the company had gained the 11% of the Greek relevant market. Single-piece dyeing provides fashion treatment (avoiding "straight") and providing "vintage" looking. This is too expensive if done by using conventional dyeing technology per piece. The concept is Italian but individual know-how belongs to the new company. Technology and process modifications were defined after try-and error efforts.

Basic products:

I) Dyeing –finishing of clothing industry – unique techniques of one-piece dyeing

II) Biodiesel products

Competition: TCo3 created a new sub-market, at least in Europe as far as we were told. Today there are 6 other single-piece dyeing plants in Greece and 12 conventional dyeing plants with biodiesel. However, TCo3 did not manage to get the lion's share in Europe or do well after 2006. Conventional dyeing plants can be considered as the competitive substitutes which however cannot offer the value added of the novel and eco-green technologies.

The entrepreneurs: The entrepreneurs are the owner of TCo7 and the Greek owner of TCo1 and his sister. The two first are described in the relative cases. Mrs R is a graduate of Economics School in Athens and has a 33 year experience in the Chamber of Commerce.

The Innovation: Innovative dyeing method based on one and/or total piece dying with ecological processes and by combining the production and usage of biodiesel from *waste cooking oils* under green innovation. All raw materials are natural and mainly phytic acid colors

Innovation/Entrepreneurial process: TCo3 was actually an "offspring" of two successful entrepreneurs at the time of their prospering. It would add further value to the products of their individual companies and let them enter the green energy industry. The entrepreneurs new both sub-markets extremely well and could foresee the success of the non-straight colors and their value added. They used two Academia Units to create the innovative combination of

[384] A search in the Internet however did neither confirm nor reject it.

one-piece dyeing using biodiesel technology to produce the necessary energy and steam needed. The same entrepreneur of TCo1 and one of the two creators of TCo3 admits: "*Of course we have cooperated [i.e. with Academia] for our new plant for bioenergy with the University of Thessaly and the Technological Institute of Thessaly. We are not against that kind of research but it has to be accurate and serious research"*

The non-straight concept came from Italy but the unique techniques were developed in-house. Machinery was made for conventional finishing and dyeing. All transformations were done during installation with a team of engineers of the two entrepreneurs' plants and the new ones of the new company. *"The company should have patented them"* commended the technical director. The biodiesel part was developed by the newly hired mechanical engineer, Mr R 9the Greek entrepreneur of TCo1 who is a mechanical engineer) and a team of the Technological Educational Institute of Thessaly. During the pilot productions the new firm co-operated very closely with a known quality control laboratory in Thessaloniki to test the durability of the colors in light and time for the novel techniques they had developed.

Market entrance: Both entrepreneurs were well known in the Greek and European market. In the very first year they had acquired the 11% of the Greek clothing market while famous fashion houses such as Versace and Armani were approached.

Appropriability Strategies: None mentioned.

Knowledge bases: Besides the knowledge bases of TCo1 and TCo7, chemical engineering, refining science, biodiesel science and technology (industrial process technology used for biodiesel production including consideration for quality assurance and subsequence analytical methods), organic waste treatment and technology in the framework of environmental engineering, textile Processing, washing-prewashing processes, design and garment finishing, phytic color treatments, mechanical /electronic engineering, ICT and design, fabric and yarn quality control

Financial resources: 40% subsidy, 25% bank loan, 35% private capital. The investment was about 2.000.000 Euros.

Institutional: TCo3 grasped the opportunity of the trends towards eco-friendliness and renewable energy institutions and combined it to ecology, flexibility and service novelty (one-piece dying). Fashion trends were also favorable for the undertaking.

Corporate strategy: Differentiation and high value added products combined to ecological production.

Innovativeness: TCo3 became the first clean energy producing dyeing plant in Greece with piece- dyed products (and among the first in Europe). However, it did not manage to create the expected competitive advantage. It rested very soon on it as well as on the existence of a

critical mass of orders (by the two "parent" plants) and did not try to provide novel knowledge and skills along the three axes of a new-to-the-world venture

Processes: selection of suppliers and access to distribution channels do not constitute processes of TCo3. Furthermore, the assistance in arranging taxation, finance and other legal issues as well as the recruitment of human capital are directed by an external consultant engaged by the other two entrepreneurs while there are no advertising and promotion processes.

There are no market research processes either: *"Of course, TCo7 brings the necessary information for the international trends. Feedback is also achieved by big customers – a fashion house like Versace will always give certain information"*

However, there are certain processes of technological adaptation and NPD. The technical director of the company (a chemical engineer) describes a certain process of NPD: it can be either customer driven and then the company's policy is to offer at least three solutions per request or company-developed solutions (called "internal projects"); which are presented to customers twice per year due to the regular two collections per year in the fashion industry.

R&D comprises of research and experimentation regarding combinations of raw material under different conditions of temperature and humidity. Lab results are then tested in a pilot production (there is a simulation machine) and then for proper production. There are also cases of reverse engineering after customer's request. However, even NPD is well supported by the R&D departments of the two "parent" companies; there is a constant knowledge and know how transfer. Although there is significant knowledge generated inside TCo3 referring both to treatment and energy production, the main knowledge management seems to be directed by the two companies of the entrepreneurs.

TCo3 can be regarded a special case since it is a knowledge-intensive innovative joint venture of two successful entrepreneurs which seems to have been treated more than an SBU than a new start-up.

TCo3 is doing very well besides the crisis. In 2014 it reached the highest turnover it ever had.

TCo4 case study

Summary
- Legal form: SA
- Year of foundation: 1988, Corporate venturing 1999-2003
- Starting year of producing the new product: 2003
- Number of employees: 184 full-time (2014)
- Located in: Kilkis
- Product families: tricot, single and double jersey plain and jacquard circular knitted fabrics for apparel and technical applications from cotton viscose polyamide spandex and blends
- Manufacturing: batch production
- Major customers: apparel industry
- Major suppliers: chemical industry (Europe), yarn producers
- Sales' structure: Exports 30 %, national 70%
- Educated staff: 16 with a University degree
- Patents: yes
- Trademarks: yes
- Awards: no

Object of investigation

The case was recommended within an expert interview with a representative of Hellenic Fashion Industry Association (SEPEE), the main representative of the apparel and textile industry in Greece. Interviews were held with the CEO and entrepreneur (about 2 hours) and the General Director and main contributor of the corporate venturing (1.5 hour). A view of the facilities followed with many comments by the General Director. Moreover additional information has been gathered mainly by internet sites as well as from company's reports.

TCo4 is a case of a strong, well-established low-tech, conventional T&C (fabric) company which invested in knowledge and innovation, addressed international high-value markets but these investments seemed not enough for the company to resist the global and the Greek fiscal and economic crisis. It is actually the case that indicated to the author that KIE does not rest only on the development of knowledge-based innovation and investments on cutting edge technology and oriented the present research towards the search of a set of capabilities which could lead to successful LT-KIE.

Today, TCo4 is a Greece-based Group engaged in the textile and clothing industry. Its main activities are the production, processing and distribution of knitted fabrics, as well as dyeing and finishing services to other fabric producers. The Company is also doing research and development; it works on textile innovation such as tailor made products and solutions using new treatments and processes on fiber and color. Its main industrial facilities cover 58000 square meters and are close to the airport and the harbor of Thessaloniki. TCo4 exports its products to Europe, Israel, South America and Hong Kong.

Basic products: Its product range includes garments, fashion outerwear, sportswear and swimwear garments, as well as underwear and sleepwear: tricot, single and double jersey plain and jacquard circular knitted fabrics for apparel and technical applications from cotton viscose polyamide spandex and blends

Competition: TCo4'sw products address mainly EU markets. Most significant competitors are China-based industries and partly Turkish ones mainly with conventional substitutes. Changing trends and the global crisis reduced the expensive requirements of former customers.

The entrepreneur has studied physics and he is the creator and the leader of a globally successful company for more than forty years. He states that he started (with his sister) from zero and passed all the stages of the T&C industry. He became known in Europe and global leading clothing companies.

Innovation: Exploitation of cutting edge technology for differentiation and high value products in finishing and treatment elements. According to the entrepreneur**, the initial idea** was "differentiation based on knowledge and a strong ability to synthesize".

Innovation / entrepreneurial process: ***a) History:*** Established in 1971, TCo4[385] was a conventional fabrics manufacturer for Greek and foreign customers till 1997. The plant engaged highly automated equipment and was well organized achieving consistently high quality, strict delivery times, realization of specially designed fabrics, and high percentages of global leading companies' satisfaction. The firm had well developed DCs: they gathered economic information on their operations and operational environment. It developed complementarities and expanded along the value chain. Seizing was equally strong and mostly technology oriented. In 1988 they moved up the value chain with a dyeing plant of cutting –edge technology. It further created a spin-off to add value to woven fabric, developing in parallel the relevant know-how. The company had also developed certain R&D cooperation on novel applications. They have collaborated with big global customers as well as with big organizations like DuPont and other firms of the chemical industry. *"We were among the best organized companies in Europe and this is why big companies like DuPont or Adidas chose us as their partners. We used to present novel products, products that they were not easy to be found… I don't mean that we were the only to produce them but the producers were really few all over the world. Therefore demand was greater than supply"*

The company, globally known for high-quality products, had long-lasting, strong relationships with many mutual innovation successes in the past (as a conventional one).

[385] By then TCo4 was a single company, today it is a group

b) ***The corporate venturing*****: In 1997**, a fire destroyed the factory completely. The entrepreneurs saw it as an opportunity to change the company's strategy towards more value-adding products. Sensing the global trends the two entrepreneurs (brother and sister) decided **to invest in innovation and knowledge, and produce highly differentiated products**. They chose to invest heavily on technology to make a cutting edge technology fabric plant which would act as a basis to fulfill requirements of highly specialized knowledge and offer *"the impossible for the other firms"*. The entrepreneurs believed that since it addressed the upper and high value segment of the market it would not be affected by mass production in China.

In 1999 they entered the stock market and contracted Werner[386] to reform their business idea. The entrepreneurs being conscious of their lack of relevant knowledge, invested on their suppliers' knowledge (both of machinery and raw material) which by the time were also highly involved in innovation.

Production technologies: A number of workshops were used by TCo4 to assist the building of the novel machinery" "*We chose to collaborate with the leaders – I mean the technological leaders"*. TCo4's team of engineers would develop plans and requirements and would discuss with the engineers mainly of Italian manufacturing companies. The development of machinery required co-operation while they would together confront functional problems. They invested heavily in technological knowledge to intervene in innovative ways to known processes by a) offering novel products; b) increasing productivity; c) developing a basis for innovative processes and technologies (it patented two innovative processes – one for a well-known global leader in athletics clothing); and d) focusing on ecological aspects, energy savings and recycling.

Besides the unique and extremely expensive equipment, combined with high automation and ICT-based systems, the entrepreneur develops:

- ***a strong R&D Department*** with 15 engineers with the majority of them to be chemical engineers (7) and textile specialists,. Advanced R&D collaborations are promoted mainly with suppliers whom he trusted due to long term relationships. The company worked on very specialized areas developing know-how even at scientific research level. E.g. there was research on the parameters that affect certain types of fabric behavior.
- a design department and
- a Quality Control Department with a laboratory of international standards which contacts pilot tests and studies on fabric properties such as twist and oblique garments and adds to knowledge in an out-of-the door, more general sense.

[386] Werner International's extensive team of highly qualified textile and apparel manufacturing experts was by then the best and most expensive consultants worldwide

The plant was ready in end 2002 and ever since the beginning of 2003 three global leaders were attracted by the company's capabilities and became significant customers (**market entrance**).

The reformed firm turned to expensive R&D with foreign companies in the chemistry and machinery sector, committed money in innovative technology with substantial renewal of business processes and designed methods to capture value. It had also engaged the open innovation model and structured knowledge management with constant learning and technology transfer mechanisms.

Being too confident about the processes he engaged, TCo4's entrepreneur did not pay any emphasis in separating the venturing from the rest activities of the organization. Furthermore, he went on believing in the old model of the supremacy of automatization with a religious devotion to technology: *"The main volume of investment regarded equipment. We always wanted to differentiate and this was due to the constant development of know-how, our extreme product specialization and the "impossible" of the other companies".* At the time of the interview, the entrepreneur will admit: *"I have personally a strong belief in the value of technology which today I can admit that actually blew up in my face. I have invested huge amounts of money and then because of the state everything went wrong… All this machinery is brand new, but without value and any significance anymore… " D*uring the interview the statement around ***investing in technology is repeated more than 5 times.*** There is also a confession that this commitment was not the best strategy to follow:

The company became knowledge-intensive but in favor of its existing customers and mainly due to investments on suppliers' knowledge (both of machinery and raw material). E.g. *"A client asked us about some new properties on fabrics. We saw an opportunity and started research in cooperation with chemical industries. When the product was ready the customer was not interested due to the economic recession and there were no other customers either.*

In 2006 the company loses its strongest customer. Since then the innovative manufacturing activities gradually declined, leaving expensive machinery useless and turning back to more conventional activities. *"The only positive outcome was the acquisition of rammers (note: type of equipment), which still offers some value to our products".*

Appropriability Strategies: two patented innovative technologies, registered trademarks worldwide.

Knowledge bases: Textile Processing, chemistry and manufacture of fibers, chemical processing such as bleaching, dyeing, printing and finishing, application of various kinds of chemicals, dyes, thickeners, and finishing auxiliaries' knowledge of green chemistry, biotechnology and nanotechnology with special reference to chemical processing of textiles. Mechanical /electronic engineering, design, fabric and yarn quality control (physical

properties (dimensional stability, width and weight, spirality, pilling, bursting strength, extension and recovery) and color-fastness),,

Financial resources: subsidies and private capital were mentioned

University and Research Institutes: not mentioned

Institutional: Legal, institutional and subsidy reasons led TCo4 to establish the plant in Kilkis. However, the entrepreneur blames the Greek state for its hostile policy against entrepreneurs and its weakness to protect T&C sector: *"When we were advancing T&C in Greece, Spain and Portugal knew nothing about spinning! But the State was an enemy! Remember the case of the five pro-government companies which were taking all the supplies for the army and all public organizations; they bought cheap staff from China and sold it to the Greek public three times more! This is the core problem in Greece and these structures do not change! Today, you are crazy if you want to invest in Greece!"* (2010)

The entrepreneur had difficulties with the subsidy money too, which was delayed (seven years) and actually never given to the firm. He also refers to Turkey's policy that subsidizes participation of Turkish companies in international trade shows and exhibitions (a cost about 200.000 Euros).

Corporate strategy: Differentiation based on R&D: "to surpass the expectations of the customers regarding quality, delivery, innovation and service. TCo4 is defined by its customers' needs. Tailor made products and solutions are our field of specialty and this is the reason we have a large clientele span that includes major sports brands, department stores, mail order companies and big retail chains"

Innovativeness: Since 2003 and for the next three years TCo4 developed high levels of innovativeness which resulted in two patents at European level and many innovative products, such as tailor-made products and solutions using new treatments and processes on fiber and color.

Special attention is paid in the technical excellence of the fabrics with a quality assurance team of highly experienced and qualified technicians in order to raise production procedures to their optimum and control all critical quality variables in production – from step one to the last stage.

They are accredited with the EN ISO 9001:2000 by Bureau Veritas Quality International, assuring consistent high-quality products. According to Oeko-Tex Standard 100 they were granted authorization to use Oeko-Tex mark "Confidence in Textiles, tested for harmful substances" which is a guarantee that the produced articles fulfil the requirement of the existing European legislation regarding the use of azo-dyes, and meet the human – ecological requirements of the standard established for products with direct contact to the skin.

Indicative innovations regard:

- the production of fabrics that due to a hydrophilic finish absorb and evaporate moisture, keeping the body dry (ideal for sports clothes).
- Blends of milk fibers and cotton. Kapok with cotton, thermos-regulator fabrics
- Development of a new fabric that inhibits the bacteria growth and multiplication
- a highly technical product that interacts with the body by stimulating blood microcirculation and thermoregulation (presented at the Munich Fabric Start fair in September 2012)

However, most of the innovations were according the wishes of customers with some of them never to pay back. The general director of the company confesses *"We may have not found the right path to reach customers. It is not easy. You know, we are rather weak in promoting our innovative products"*

TCo4 went on investing in novel technology. The "addiction" to technology followed the entrepreneur even in 2009 when all signs were against such strategies and the entrepreneur himself knew that quite well[387]. *"Just consider the fact that even in 2008 we invested 1,5 million Euros followed by a further investment of 2 million in 2009. Such investments in our sector constitute a continuous process. Trying to become "greener", we replaced some finishing and dyeing machinery with innovative one with dicrease of the dyeing-finishing production cycle and lower energy consumption"*

Today, TCo4 continues to export its products to Europe, Israel, South America and Hong Kong. In 2012 it was ranked in the 9th position of the sector (Greek Financial Directory, 2012), the 7th in 2013

Processes: At the time of the interview and according the entrepreneur's narrations, firm's documents and press, the firm owned significant DCs:

The ***R&D*** department started with fifteen well-educated engineers. Furthermore, the company is a qualified partner in an R&D network. According to the entrepreneur, the R&D department is the core of the business followed by the design team to create unique designs on a two-season basis yearly.

There is strong ***networking*** with suppliers, customers, European designers and the chemical industry. The company organizes meetings with customers' designers, collaborations with European designers and frequent visits abroad (mainly during the fashion weeks in the four fashion capitals of the world).

The company engaged ***open innovation*** resulting in at least two patents at European level and obtained significant flexibility in tailor-made and highly sophisticated products.

The last years ***collaborations*** with external designers along with the research, the information and the ideas that TCo4's creative team daily brings forward, function as a springboard for

[387] *"Since 2006, the European production changed. It is not the production of innovative products anymore. It is complimentary to Chinese production"*

creating and constantly updating its four main fabric collections developed on the preceding five years: fashion, second skin, easy-wear and hi-tech. Even in today's difficult conditions R&D goes on with five projects on innovative fibres development and four regarding new technology adaptation.

Sensing processes regard again mainly cutting edge ***technology***. There are regular meetings of heads of all departments with supplier representatives (such as yarn and color suppliers and companies like Dupont, Dystar and Bayer), as well as regular meetings of the Design Department with customers' designers (which stopped in 2008). The company has developed a significant number of co-operations with all the above mentioned.

Market sensing refers mainly to international trade show visits and meetings with customers. Actually, the relationships with customers were very close until 2008. Regular meetings would be held to discuss special requests or work out new ideas incorporating all value chain stakeholders in the developing innovation. The company is proud of its world famous clientele as well as its two patents at global level. It used to participate in the biggest fabric show worldwide (At least until 2010).

After 2008, there is a more aggressive market monitoring but with less success, according to the sayings of the entrepreneur and the CEO. However, the company insists investing on technology and innovative equipment.

Training regards mainly technical and quality subjects-as well as health and safety issues while know how is mainly achieved by established suppliers. Know how is achieved also by plant equipment installation. Knowledge is restricted to certain areas (especially treatment - dyeing processes) supported by the knowledge of specialist suppliers.

Furthermore, in terms of transforming to adapt to the environmental shifts the company attempted a partial verticalization from yarn to clothing through ***alliances and affiliations*** with known underwear and clothing companies.

We should mention here that the company goes on with heavy investments all years ever till today and tries to catch up with innovative fabric treatment (2013) targeting EU markets in order to survive.

TCo4 tries hard to address demanding global customers against the cost advantages of Asian mass production: *"We have to survive. This requires flexibility and customization to customers' wishes. We also have to produce for them what is too urgent and therefore Asian plants cannot achieve…"*

TCo5 case study

Summary
- Legal form: SA
- Year of foundation: 1978, Corporate venturing 2006-2007

- Number of employees: 45 full-time (2014)
- Located in: Thessaloniki
- Product families: Children's brand clothing
- Manufacturing: batch production
- Major customers: shops
- Major suppliers: fabrics and supplementary materials for clothes
- Sales' structure: Exports 15%, national 85%
- Educated staff: 15 with a University degree
- Patents: no
- Trademarks: yes
- Awards: no

Object of investigation

The case was recommended within an expert interview with a representative of Hellenic Fashion Industry Association (SEPEE), the main representative of the apparel and textile industry in Greece. Interview was held with the CEO and entrepreneur (about 2 hours). A view of the facilities followed. Moreover additional information has been gathered mainly by internet sites as well as from company's reports.

TCo5 is a kid fashion company allocating shops throughout Greece, Cyprus, Poland and in more than 7 countries abroad. It is located in a plot of 12000 m^2 in Thessaloniki. Its facilities cover about 2000 m^2 and in times of prosperity it occupied more than 100 people.

Basic products: kids' fashion

Competition: Severe. The entrepreneur supports the Greek efforts to produce fashion clothes and discusses the big international chains and the imported cheap kids' cloths from Turkey and China. He also commends on the unfair competition of smuggled products.

The entrepreneur: He was raised in an entrepreneurial milieu. His family business was one of the many cloths subcontractors in Thessaloniki. He studied knitting but at the time of decision he chose kids' cloths.

The Innovation: Development of a new business model built around the novel sales model that resembles franchising but with certain alterations on behalf of the company's plans ("*Consignment*"): *"The model was purely theoretic. Even theorists said that it could not be applied. How can a small company make it work?"*

Innovation / entrepreneurial process: ***a) History:*** TCo5 invested on differentiation even since mid-90s, proving multiple times its ability to change. Being one of the many apparel industries that were established in late 70s (the golden age for the sector), its entrepreneur soon realized that he had to build on a distinctive brand and organize a sales network in order

to gain awareness. In 1997 he reorganized the company drastically with distinct departments of NPD, marketing, human resources and the position of Franchising Director. It also restructures ICT and logistics. Its major invest seems to be in the creative part of NPD contacting designers in Greece and abroad (mainly Europe). Although the business environment changes rather dramatically after 2000, in 2002 the brand reaches 90% awareness. Yet, the entrepreneur is not content since he senses the changes in the global landscape; threats of the confusion of target groups where imports of expensive kid fashion (Lapen House, Allouette, Mayoran[388]) are combined with easy-to-wear cheap cloths such as Zahra and H&M, and mass and very cheap clothes sold in all kinds of shops or in open markets. On the other hand there was a clear shrinking of the sector. Big and well established companies disappeared or changed to purely mercantile.

b) *The corporate venturing*: while on former efforts the company was twice reformed to suit better a creative than manufacturing company, in **2006**, it seeks ways to create competitive advantage regarding sales and customer contact. The entrepreneur recognized the need to revitalize sales operations and build new capabilities in order to create value for shareholders. The company uses corporate venturing (in line with Narayanan, Jang and Zahra, 2009) applying KIE and creating a novel corporate identity.

The company was the first (and the only one to our knowledge in Greece) to develop a novel method of partnership which is called "*Consignment*"[389] in order to solve problems created by franchise and company owned shops. The system is built around commission business, placing any material in the hand of another, but retaining ownership until the goods are sold. The system was developed in co-operation with the Department of Management and Technology, Bocconi University. *"We turned to SDA Bocconi in Italy. We participated in two of their training courses in Athens… we understood that what they teach is exactly what we want. We contacted them and we brought them to train some of our company members. Then, they helped us specify what exactly we wanted and supported our effort to reach it"*

The innovative model entails further innovation in inventory systems as well as innovative machinery: *"We could not actually manage our inventories with the new method. We found ourselves trapped into huge trouble with extremely high costs of return. Then the solution came of the University of Piraeus.* ***We developed a semi-automated machine*** *that receives the returned pieces, checks barcodes – we had traced a 3-4% wrong codes and wanted to solve that too – and restructures returns to orders. The machine was developed with a Greek*

[388] Mayoran applies a very aggressive policy since it is backed up by Spanish promotion benefits

[389] An arrangement whereby goods are left in the possession of another party to sell. Typically, the consignor receives a percentage of the sale (sometimes a very large percentage). Consignment deals are made on a variety of products - from artwork, to clothing, to books. In recent years, consignment shops have become rather trendy, especially those offering specialty products, infant wear and high-end fashion items.

manufacturer. We had already had good relationships. Another Greek, local company took over the necessary computerization".

The system reformation of the whole value chain (from design to final consumer with a special emphasis on inventory management) and its principles were according to the entrepreneur *"a combination of theories which contradicted the existing literature".*

The firm developed an innovative distribution system; however we do not know if it had any imitators in Greece. This case is a representative one of the creation of innovation and competitive advantage other than technology which was (and still is) the core of relevant policies for the sector and sets significant questions on the effectiveness of such policies under the existing conditions of the industry.

TCo5's innovative business model had a significant (30 percent or greater) reduction on company's costs. On the other hand, it appeared to have only a minor impact on final consumers. The company survives the crisis with higher percentage of losses in 2010 and 2012. Today it exports to Cyprus, Skopje, S. Arabia, Bulgaria, Romania and Slovenia using the same system.

Appropriability Strategies: registered trademarks

Knowledge bases: logistics, marketing, branding, sales restructuring, continuous shop portfolio management, organization and strategic management, inventory management, network management, public relations, operational information system installation and management, negotiation skills

Suppliers: fabrics are "premier vision"; i.e. novel designs after fashion shows. Most of them come from France, Italy and Spain or Greece.

Financial resources: subsidies and private capital were mentioned. The investment was about 600.000 Euros.

University and Research Institutes: Department of Management and Technology, Bocconi University and University of Piraeus

Institutional: According to the entrepreneur: *Subsidies and investments were only in the productive and technological part of the sector. We did not know to make brands and channels. We did not know how to sell. Then the multinationals found us unprepared. With the first blow we dropped dead!"*

The State is the worst enemy; it is provocative and cumbersome. *"It makes entrepreneurs to pass through all public mechanisms and this is the worst wastage of money, our courage and energy. The trouble extends to strikes; these people wait until the months of most imports to …make money! It is as if the State wants to open the road to imports!"*

Corporate strategy: TCo5's message is "We grow up together!" The firm aims to offer trendy clothes for all ages, clothes that are comfortable, practical and long-lasting, so that the child can be supported at every activity! Moreover, there is the glam line which includes more special clothes for unique appearances.

Processes: TCo5 works on the development of strong branding. R&D is translated into creative design; NPD department consists of ten designers which is a quite impressive number, considering the size of the company and relevant Greek companies according to the entrepreneur's saying.

> *"They receive continuous training and visit fashion fairs. They are the ones to study the books. They have a diploma of designers or modelists. Yes, we have a considerable number of graduates after the reconstruction."*

Knowledge is collected via international fashion shows and industry information. The company has developed strong networking with University and companies for logistics and product management. It further has developed co-operations with the fashion schools of France and Italy,

> *"We buy their "books", which are very-very expensive. They provide us with the norms and the trends for the new fashion trends"*

The company performs individual research at national level, as well as direct and indirect competitor benchmarking.

There is constant training mainly on fashion issues, sales and merchandising. Franchisees are trained to open a shop for a period of two weeks before starting the business and at regular intervals.

The company presents quite interesting *transforming capabilities* as well, in order to capture value through a cycle of knowledge acquisition and diffusion. In 2007 it built a new corporate identity and a new image, and decided to outsource costly operations. In 2010 restructured further the production part. It seems that reconfiguration capabilities allow the company to change roles in the value chain and adapt to the dramatic changes of the clothing sector, in Greece and Europe.

The entrepreneur says…

> *"Πολύ ακριβό το εισιτήριο για τον παράδεισο που λέγεται Ελλάδα!"*

TCo6 case study

Summary
- Legal form: Industrial and commercial SA (joint venture)

- Year of foundation: 1974. Corporate venturing: 1998 (started the effort)
- Number of employees: 197 full-time (319 in 2000)
- Educated: 31
- Located in: Naoussa
- Product family: I Cotton yarn, cellulosic fibers blended yarns multi-ply yarns
- Manufacturing: batch production
- Major customers: (one's of the two entrepreneurs Company), apparel industry, biodiesel buyers
- Major suppliers: chemical industry (Europe), waste cooking oils providers
- Sales' structure: Europe 30 %, national 70%
- Entrepreneurs: two entrepreneurs and the sister on one of them
- Patents: no
- Trademarks: yes
- Awards: yes

Object of investigation

The case was known to the author since 1990, but it was also recommended within an expert interview with a representative of Hellenic Fashion Industry Association (SEPEE), the main representative of the apparel and textile industry in Greece as well as a Professor of the Apparel Design and Technology Department, TEI of Central Macedonia, Serres . It was also found in the work of Leheyda et. al (2008) and in the Innova project report (2006-2008) where the company was characterized as sectoral innovation leader. Interview was held with the CEO and one of the two entrepreneurs (about 2.5 hours), with a view of the plant to follow. Moreover additional information has been gathered through press and internet.

TCo6 is a spinning company first established in 1974 in Naoussa. It has 2 modern spinning mills; the one in the area of Naoussa with facilities of around 35000 square meters in a plot of 119 acres. It has no plant outside Greece. Today it has a capacity of 47000 ring and compact spindles (around 60.000 in 2010). The firm exports in 20 countries. The company is certified with ISO, GOTS and Oeko-Tex.

Basic Products: yarns and more precisely: yarns from man-made fibers**,** Modal and micro-modal, blends of cotton (conventional or biological) and modal, Tencel (since 2005), yarns of special technology, Slub yarns and core spun yarns

Competition: The global competition is more than severe for the textiles sector. Imports increased more after 2010 regarding mainly conventional (and much cheaper) textiles. Furthermore, within the same year costs of cotton, energy (electricity and fuel for both production and transportation) increased. On the other hand, big global customers stopped investing in high added value yarns and have turned to cheaper solutions (it is not the same with technical yarns).

Today there are very few relevant firms in Austria and Italy, and other two in Greece. According to the entrepreneur *"they are the few that promote research, innovation and*

quality". The company was characterized as sectoral innovation leader by Leheyda et. al (2008) and by Innova project (2006-2008).

The entrepreneurs: Mr B. was raised in an entrepreneurial milieu. His father and his grandfather were engineers; they first tried to work with hydro turbines (due to the waters of Naoussa), later with the generators (after the Second World War) and they finally turned to textiles. The entrepreneur was literally raised in the spinning mill and due to the family business he studied spin engineering in Aachen (Germany; one of the best relevant Schools worldwide). His sister (the second engineer) follows him in Aachen and studies chemical engineering. They both do it envisioning the growth of the spinning mill. Studies prove to be a valuable source of ideas for the two young students: *"I tried to locate best practices. It was more than a School – maybe because I knew exactly what I was looking for and I wanted to find successful ways to realize it!"* says the entrepreneur.

Innovation/Entrepreneurial process: a) ***Firm's history:*** Mr B enters the firm officially in 1978 and his sister in 1981. "*We work as a team ever since the very beginning. Today we are seven people and besides the difficult times we keep trying".* In **1988** the team establishes the second spinning mill with conventional technology and 12000 spindles which will be very soon doubled. It was exporting almost 90% of production to Germany. In **1992,** the entrepreneurs sense the sectoral evolution and the requirements of the Global Trade. They develop a Research and New Product Development Department and a pilot yarn laboratory, with the support of external consultants. At the same time they start the production of yarns of special technical specifications and ecological cotton. They also develop a strong marketing department. The two new departments collaborate in order to sense new needs and new technologies in order to develop new products. Most times customers were invited to participate in the projects. *"All projects demanded deep knowledge and coordinated efforts"*

In **1994**, the firm is certified with ÖCO-Tex Standard 100 (by the German Hohenstein Institute) as well as with ISO 9001 and ISO 14001.The two spinning mills export more than 75% of their production. In the beginning of 1998, the plants are equipped with ERP systems. However, the entrepreneurs started sensing the new changes of the yarn market at global level. Greek spinning production is blooming; productions of combed and carded cotton and blended yarns reach high volumes to fulfil orders in Greece (with a significant clothing and linen production) and Europe's clothing industry. Mr B. says that he could see the emerging power of Turkey (author's note: He was right. Germans made significant investments along the Black Sea seashore, due to the very low wages' plants were equipped with very modern automated technology. The author was challenged to go there as a technical supervisor of a group in 1997). At the same time, Spain and Portugal had planned an increase in the T&C sector (note: and they succeeded).

b) *The corporate venturing*: The entrepreneurs think about the future. The two conventional spinning mills are not adequate to realize their first thoughts on innovation-based differentiation. They are already among the leaders in value-added products in Europe. Mr B. struggles to find the new *"I started with my former success; I tried to analyze my collaborations, my former ideas. I visited my customers and tried to understand what they would like to have in the future though long discussions. I went to my University in Aachen to see the advances of the spin engineering department. It was then evident to me that innovation could be realized on the basis of "new raw materials – new machinery – specially trained personnel"*

The team visits ITMA exhibition in Paris and collects information by global manufacturers of machinery and technical fibers. At that period, the textiles sector is prospering in Greece with production increase and total export rate to be over 40%. *"ICAP gave the picture of prosperity and encouraged the cotton combed yarns. It was a sign for us. We envisioned to widen the company by the production of special, high-value added products for the European market with specific high-tech properties. We actually did not know what we were looking for, but we were sure that it was the only way to redefine our existence in the sector and survive. This was our initial target when we visited ITMA. .... Even after the agreement at ITMA we did not actually know what we would produce!"* The new SBU will change the strategy, the image and the area of activities of the firm. The entrepreneurs buy the most innovative **production technologies** and the machinery they involve; indicatively the compact technology which was just patented by the manufacturer. This will be modificated to suit the company's specific requirements. *"We did not know yet the actual novel products; however, we could thought of the potential of the technologies"* The entrepreneur brings two global leading machine manufacturers and the strongest air-conditioning manufacturer[390] together to combine their technologies *"We were strong enough to cause such collaborations"* confesses the entrepreneur. This collaboration led to a famous in the textiles industry system patented by the manufacturers.

In parallel, the marketing team had created a map of emerging needs, among which ecological sensitivity seemed to increase in Europe (note: not that evident in Greece though in 1998-1999).

"After that decision, we started creating a vision about the products; we changed the triptych to "innovative high-value products, other than cotton, for the European markets – ecology – novel production technology for cotton"; green products with high added value could be an alternative to conventional cotton production; our big customers [some mentioned] found the idea interesting I would say…"

[390] Air conditioning is very important in spinning mills. Installations are at least one third of the plant. They do not resemble the commonly known air conditioning systems

Funding: In 1999, the company enters the Stock Exchange and the Investment law of 2000-2003. The new plant will cost around 30 million Euros. Private capital and debt securities cover the funding of the new SBU.

The team consists of the two entrepreneurs (engineers), two more spinning engineers (of Mother Company) while they also hire a mechanical engineer and a project manager who is a chemical engineer with significant experience and a close friend of Mr B as external consultant. They would gather once a day at the beginning and once a week later to discuss the project's course, solve problems and pose new ideas. The idea will gradually take shape getting out of commonalities and familiar ways of thinking in order to produce novelty. In parallel, collaborations start on the basis of novel yarns: TCo6 accepts the challenge of a high-quality man-made cellulose fibers' producer to develop together innovative product and the subsequent technology in the under-erection new plant. *"Starting with erections we sent "signals" in Europe. The German LG approached us to co-operate on some innovative fiber."*[391]

The company had just created a novel fiber and chose the new plant to turn it to yarn. *"The next 2-3 years we will experiment together (with LG) in a place where new buildings are added, machines are erected, and pilot productions of the innovative machinery and compact technology bought at ITMA take place. Germans had to stay all these years in our town. You see they had to be with us every day. It was a beautiful confusion of priorities and decisions which would create the final concept. We should constantly, learn, discover and …search…"*

The new product will be patented by the LG firm and will be soon a great success; in 2005 it will be actually called the "Harry Potter of the yarns"! TCo6 will be the only spinning mill to produce it for a long time *"It was a success indeed!"* recalls the entrepreneur.

The teams for the erections stay at Naoussa all that time. *"The whole process offers significant knowledge exchange for us as well as the other companies which are also using the whole machinery for the very first time. […] We should always learn and then search again. There were frequent meetings for modifications."*

In order to strengthen the new eco-image of the company, the entrepreneurs buy the 57% of a ginning mill which produces cotton of high quality. In the following two years they will organize cotton farmers and manage to produce a very competitive type of cotton of extremely high quality; first yarns of this cotton will be sold in 2003.

When asked why not a shift to advanced technical textiles the entrepreneur mentioned the hesitation due to non-existence of close markets and the newness of relevant fields which introduced a high uncertainty due to the lack of relevant knowledge ("we talked no more

[391] We should however mention that according to the entrepreneur's remark "all this novelty and pioneering potential has been unfortunately swallowed be the Asian sales"

about cotton"), as well as disorientation due to the existence of high promising markets (and existing customers as well).

The corporate venture started with high sales from the very beginning; the entrepreneurs had invested in creating competitive advantage on the triptych ecology-technology-R&D and their strategy appeared to pay back. According to our opinion, it did pay back. The main reason that company faced problems is the fact that it did not get the subsidy money (which was paid by the firm although not planned to do so), it did not take theVAT money back for many years and the significant crisis in Greece and Europe in combination to its policy to stay in Greece and not move to Balkans.

The company managed to maintain a place among the strong ones (ranked 8th position for 2010 and 2012, 6th in 2013 and 3rd in the yarn-production sub-sector in 2013).

Appropriability is not an issue for TCo6.

Knowledge bases ginning and spinning technology, innovative compact technology, agricultural techniques and processes, fiber technology, mechanical / electronic engineering, logistics and marketing

University and Research Institutes: besides Aachen University no others were mentioned

Suppliers: Cotton can be easily found; however the procurement of the high-quality cotton is based on the subsidiary. Furthermore, the special fibers are supplied by LG. TCo6 has a long-lasting co-operation with the company (more than 25 years). The price of cotton is highly vulnerable to global changes.

Institutional: The case of TCo6 is indicative: a subsidy of 14 million Euros was proven for the new investment of 1999-2000. The money had not been given to the company at least till the end of 2011, although the EU had granted it since 2002. VAT has been never returned. In 2006, TCo6 applied to the EU Competition Commission for a subsidy; the monet was approved in 2008 but up to 2011 (At least) the issue has remained caged in the offices of the Ministry of Economy (or whatever its name today*...): "We still fight for survival. The State owns us morethan 14 million Euros. We invested at homeland, not at the Balkans! Yet, whatever we tried, we did not manage to get the money back!"*

The entrepreneur referred also to the uncontrolled, unlimited and indiscriminate imports

Corporate strategy: TCo6 promotes technology, ecology and high quality and differentiation within the framework of sustainable development. It bases its vision on the good knowledge around spinning, fibers and cotton as well the whole value chain up to the clothing of all categories. *"Innovation comes first"* mentions the entrepreneur *"the targets are differentiation, eco-friendliness, high quality, flexibility and accurate delivery times; these all are extremely important if we want to keep our position in the global market!"* Mr B believes that the massive cotton yarn production belongs to the past. *"We have created strong competitive advantages*" he concludes.

Markets targeted: underwear, linen, fashion apparel, fabric for technical use

Processes: According to its annual reports, TCo6 presented DCs even at the beginning of the 90s. ***Sensing and transforming*** had led the company to the creation of the R&D Department and a shift to technical yarns in 1992, at a time when the majority in Greece would produce combed, carded and blended cotton yarns. *"We translated all messages we selected regarding the sectoral development and the requirements of the international trade. Since we had a global view, the prosperity in Greece did not breed complacency."*

Learning and NPD : During its lifespan (till the day of the interview), the company has *sensed* new market trends such as the need for more healthy cloths and has shifted to organic and eco-friendly products; besides the use of relevant raw material it has developed an excellent quality control laboratory, among the best at European level. Exploitation of the new innovative processes and products is significantly due to the focus on the needs of special categories of high value products[392].

The company supports ***training*** at all levels even at "difficult times". In the decade 2000-2010 the firm would realize around 50 training courses per year and implemented around 2500 human hours of training.

Innovativeness: TCo6 develops new products as already mentioned above. It keeps doing it in the middle of the crisis. Indicatively, in 2011 it presented together with the LG company their innovative yarn at the international EXPOFIL exhibition in Paris (the biggest in the world regarding yarns and fabrics). The innovative is a more ecologic type of the famous patented yarn of 2000-2003 and strengthens the eco-friendly image of the company at world level.

The company was certified wit PURE WEAR Systain in 2007, and with GOTS and IMO in 2008. The same year TCo6 was awarded with the Green entrepreneurial innovation Prize in Helexpo.

Quoting the entrepreneur about the main characteristics of the entrepreneur:

"We are living today in the era of multifaceted knowledge and information. This requires significant networking and monitoring. Networking must be towards all directions. Of course experience is important – I believe that merits and experiences direct the entrepreneur. Of course personal traits are also important!"

«Όμως η κρίση είναι μια μορφή πολέμου. Δεν μπορείς να προβλέψεις, κοιτάζεις να επιβιώσεις με την πιο απλή έννοια του όρου και δεν μπορείς να υπολογίσεις τις απώλειες. Καινοτομίες μας, εξαιρετικά ποιοτικά πρωτοπόρα προϊόντα μας που ξεκίνησαν δυναμικά, τα κατάπιαν οι πωλήσεις της Ασίας»

TCo7 case study

Summary

[392] Indicatively, we remind the "Harry Potter of yarns" in 2005, after the presence of compact technology, Q-Cotton and Tencell ®.

- Legal form: SA
- Year of foundation: 1992, Corporate venturing 1998
- Number of employees: 218 full-time (2014)
- Located in: Larissa
- Product families: jeans and T-shirts
- Manufacturing: batch production
- Major customers: apparel industry
- Major suppliers: denim producers in Greece, Italy and Turkey (today even India and China)
- Sales' structure: Exports 45 %, national 55%
- Educated staff: 14 with a University degree
- Patents: no
- Trademarks: yes
- Awards: no

Object of investigation

The case was suggested by a college, PhD student during a meeting at the LIEE in late 2009. The author had collaborated with the company in the past (1993-1997). However, he discussed the case with the President of the Thessalian Association of Enterprises and Industries who also recommended the case. The general manager of CLOTEFI S.A. (the Greek Technological Center for the textile and clothing industry) in Athens also agreed. Interviews were held with the CEO and entrepreneur (about 2 hours) and the Production Manager and main contributor in the physical implementation of the idea (1 hour). A view of the facilities followed with many comments by the Production Manager. Moreover additional information has been gathered mainly by internet sites as well as from company's reports.

TCo7 is the first to brand denim type products in Greece and to develop a strong culture around it, "promoting a whole lifestyle out of them (TCo7 website, 2010)**.** The main factory is located in the Industrial Area of Larissa while it owns plants in Bulgaria, Romania and Italy. 35% of products are exported in Europe. According to the reports of 2010, the company the 60% of exports regard mainly Italy (around 200 points of sales) and Germany[393]. In the middle of the severe crisis the company owns a distribution of over 500 stores throughout Europe, with 15 mono-brand flagship stores in Greece. TCo7's turnover during the last three years appears to be three times bigger than the one of 1999-2000. In 2014, it's one of the fastest growing candidates on the Italian market[394]. At least up to 2010, many Greeks did not know that it was a Greek company.

Basic products: branded fashion jeans, t-shirts, jackets, tops and accessories

[393] Germany, Switzerland, Belgium, the Netherlands, Italy, Serbia, Cyprus and Russia in 2010

[394] http://www.waitfashion.com/en/fashion/brini-vs-wait-recap-staff-jeans.html (accessed 6 May 2014)

Competition: severe competition due to well-established global leaders with famous brands. Today there are three other Greek significant apparel companies which however do not produce only jeans. TCo7 was rated 3rd regarding turnover in 2012 and in 2013.

The entrepreneur graduated from high school and was called up for military service. According to his sayings he joined the area of jeans clothing soon after completing his military service. *"I have studied nothing; neither economics, nor fashion. Practice taught me everything!"* He considers himself a "jeans man" although his firm produces a wide range of apparel today. *"He is a man with a gift"* according to the production manager who knows Mr D since 1985 when he opened the first jeans micro-firm. *"He literally loved jeans! He would go to Italy and search denim makers, fabric makers and fashion makers! He searched for knowledge. He would visit denim producers and look for differentiation. He wanted to be similar to Levis. Jeans was all his life. He learned it step by step. …… I remember an Athenian newspaper calling him the King of jeans from Larissa. He was always one step ahead regarding Greek producers."*

The entrepreneur was also the pioneer in combining single-piece dyeing and special treatment in Europe.

Initial Innovation: Exploitation of cutting edge technology (some parts of which developed by own ideas) on denim dyeing – finishing and treating elements to produce novel uneven jeans (e.g. Rugged washes, *"unblue"*[395] color dyed jeans). This technological dimension of the innovation was combined with the development of unique design and a relevant culture to produce a branded high fashion image.

Some information: The dyeing of a fabric or a particular garment is a complicated and delicate business. Shading, special effects, combinations and variations of color, flash lights, make the composition and calibration of color a real art in its own right. Technology has become the indispensable right arm of the stylist's creativity. Denim became massively popular during the 1950s and in the mid 1980's manufacturers began to use techniques to 'distress' the denim in order to make them look worn. By the 1990's, pre worn-out jeans had become popular throughout the Western world.

Innovation / entrepreneurial process: ***a) History:*** **TCo7** was one of the many similar small companies working under contract for large denim and other clothing organizations during the 80s and 90s. It was the time that all European large branded clothing companies were subcontracting to Greek micro-firms due to very low labor costs. In 1996, the entrepreneur makes his first thoughts on branding*: "We wanted to create added value. Design and branding was the most usual way for companies abroad. On the other hand, Greece is not known for a fashion design culture (I meant the made-in-Italy type) and the Greek market is*

[395] Official term

too small for branding. Think about me; I now have the 80% of the relevant Greek products. Think about this percentage in the USA market… Branding is also very-very expensive and our State does not subsidize extroversion; Turkey has understood the importance of extroversion but not our State. You know, nowadays in Turkey entrepreneurs take money to promote their products in Europe; here money is given only for machinery…"

However, the entrepreneur knew that he would not manage to create a brand unless he could present something new in the market. *"But in this sector, there is not too much space for technological innovation"*. By that time, denim belonged still in the European production and first efforts were emerging regarding its different appearance. It appeared that there was a huge research and treatment potential and the entrepreneur saw it. *"Design may spring from special treatment. This is what I thought and this is what I did."*

b) *The corporate venturing*: In 1998, the entrepreneur decides to establish his own dyeing facilities in order to achieve total verticalization and move upstream the value chain; this would offer him the potential to build his competitive advantage (by novel treatment techniques) to create his own design and develop branding. He started searching for novel technologies and knowhow mainly in Italy, where denim producers had started experimenting on these techniques. He describes this "hunt of knowledge" in a very vivid way:

> "*This innovative treatment was not by then applicable at conventional dying plants. Such innovative procedures had appeared in Italy. So we went there and found ways to acquire such knowledge elements. They were the pioneers in specialty value addition washings and treatment. Then we approached the chemical industry – they were the ones who actually opened our eyes. Besides, they wanted to sell the ideas and then sell the products to implement the ideas. At that time such techniques were at the stage of R&D in Europe but totally unknown in Greece. Therefore, we hired an Italian team who had transferred the Italian novel know-how in Japan and they were real experts in this innovative technology. We were pioneers in Greece and we took the lion's share in the Greek market. We then made a contract with the Italian designers who knew how to apply this innovation on the jeans patterns. We contacted them through Fabiani*[396] *the Italian denim manufacturer, a leader worldwide. Of course we were buying from Greek companies as well… but the Italians would share their knowledge with us. Imagine that even the chemical industry that produced the raw materials that we needed would consult them since they were their main consumers. And this is how we actually met them…"*

Commenting on the approach of the Fabiani House, the Production manager recalls: *"He became a good friend of the CEO and he opened the way to Italian producers. We were very strong customers then… If you are that strong they help you with knowledge and ideas and help you make new contacts"*

[396] An Italian leading company in jeans fabric production which actually leads globally the jeans fashion.

The entrepreneur trusts a friend of his who is a mechanical engineer working as a freelancer by then. He sends him to Italy to excel knowledge on jeans treatment production lines and hires a chemical engineer as well. Yet, he further invests much of his own time (and money) in being "educated" on "all about the sector".

Thus, they approached first denim fashion producers in Italy, and then the chemical industry where the new material for the novel techniques were under development too. TCo7 builds the new impressive plant in the Industrial Zone of Larissa with a new structure. It was time for the machinery and of course Italian manufacturers were world leaders. They made also several modifications. Occasional problems are still sold through an excellent co-operation.

Then it was time to develop design and branding. The entrepreneur creates a design department but not in Greece: "*Our first creative (i.e. Department) was located in Florence. However, since I started developing design, I turned to branding and that brought the inspiration of a unique culture around my own denim".* The entrepreneur adds links to the chain by extending to promotion networks.

Market entrance: It was the time that Levis has a strong position in Greece and Diesel was just entering. Currency was also changing to Euro. The firm tried to introduce the products promoting the fact that they were of equal value regarding design and quality but at half price due to the fact that the company was new. *"It took us 4-5 years to become known. Of course the market knew me but my great concern was my new advanced image; my new products had design, had style, had differentiation and had advanced quality! Consumers should learn that and should understand that the smaller price was only a motive to by my jeans!"* This policy was translated in a significant investment in promotion methods to establish the TCo7 signature and its culture around denim. "*The denim specialists could confirm the quality. It was a matter of communicating this to people. The first years I used to spend more than 10% of the turnover for promotion. Time was needed too."*

In 2003-2004 they entered the Balkan markets.

In 2003 the entrepreneur bought a bankrupt company in Italy which was a very strong brand until mid-90s (stronger than Diesel according to his sayings). In this way he entered the Italian market but it was his passport to other European countries as well since it was known in Europe (known- Italian and brand).

The entrepreneur mentioned that fashion trade shows were of great help to promote TCo7's culture. He believes strongly in networking.

The new venture now can confront the mythical leaders such as Levis and Diesel. From plain jeans sewing for the local market, the new TCo7 moves successfully to fashion, branding and high level fabric treatment.

The entrepreneur invested on the triptych design-branding-technology to add value in Greek products against the giants of Levis and Diesel. He is considered an innovator in denim

distressing techniques and washing, since he developed his own techniques for denim treatment. The company started with 20 employees to reach 280 in 2008.

Appropriability Strategies: registered trademarks worldwide.

Knowledge bases: denim production technology, denim manufacturing methods -assembly lines, denim innovative treatment and finishing methods, washing-prewashing processes, enxyme technology, design, organic waste treatment, quality control, state-of-the-art techniques in denim fabric design and manufacturing techniques, technical knowledge of modern denim manufacturing and garment finishing

Financial resources: use of the laws 1892/90 and a relevant of 1998 (45%). The rest was private capital. The investment was around 2000000 Euros.

University and Research Institutes: They have co-operated with chemical laboratories in Italy and Germany and with ETAKEI in Greece. They provided their own laboratory equipment by a German manufacturers.

Institutional: The time of the corporate venturing was quite favorable; there was active evolvement of the denim markets and knowhow belonged to the very few. However, the Greek state hinders entrepreneurial activities; according to the entrepreneur, the financial system in Greece was dysfunctional with no frameworks and directions to follow. This resulted to a mess where all opportunists grasped valuable money which could serve development.

In parallel, the small size of the Greek market is rather unfavorable for Greek branded products: *"Branding is also very-very expensive and our State does not subsidize extroversion; Turkey has understood the importance of extroversion but not our State. You know, nowadays in Turkey entrepreneurs take money to promote their products in Europe; here money is given only for machinery…"*

Corporate strategy: Promoting Greek branded denim products of the highest quality, innovative design and novel treatment techniques at affordable prices worldwide. TCo7 brand communicates exclusive quality combined to unique lifestyle.

Processes: The new LT-KI venture appears to have developed mechanisms of seeking knowledge and processes to use resources in order to match both intentional and unintentional changes. Experimental culture developed during venturing turns to R&D and open innovation processes: ***New Product Development*****:** Three graduates of Bocconi University and one of a fashion institute of technology in Athens constitute the NPD department of TCo7 while 10 people work on constant market information selection together with TCo7's salesmen: *"Monitoring the international market is very important in order to feel the pulse of the targeted market (main targets are 15-25 years of age). I mean really close monitoring of their habits, the trends they follow etc. … This is also a task of my own sellers; they are all among 25-30 years old. Age is important…"*

The company invests heavily in ***networking*** to learn about and enter desired markets[397]. It has developed strong marketing capabilities with well-communicated culture, messages and branding. It also uses networking for NPD, technology upgrading and new processes.

Collaborations and acquisitions: Such as the acquisition of the Italian "U" in 2003; the company was among the strongest jeans brands in Italy (better than Diesel according to the entrepreneur), a joint venture in Bulgaria etc.

TCo7 has developed formal but not written processes for ***industry innovation monitoring*** on areas such as production management, sales networks and automation and joins research projects regarding activities such as logistics, environmental protection and RFID technology.

Market sensing mechanisms: 10 people work on constant market monitoring while all salesmen who are selected in the ages of the target groups are educated to select information of target groups through customers. Feedback is also collected by the networks achieving a macro and micro environment monitoring on a constant basis. Processes regard also trade show visits (twice a year in Japan and twice in USA) and its strong design team (Italy-Greece).

Innovativeness: "You have to ask yourself what the customer will *dream in the future*" says the entrepreneur to highlight the essence of innovation. Innovation turns around new treatment methods, increase of productivity, better logistics and innovative communication. Design is of course a must. The one piece dyeing was developed in the company's NPD department in parallel with Europe.

TCo7 is also one of the four companies that have applied RFID (radio frequency identification) together with Gerry Weber, Levi Strauss and America Apparel, since the product cost can bear the additional cost of RFID application (see Ruile and Wunderlin, 2011). The company initially implemented RFID in late 2008 for warehouse management in Larissa. The company spent about six months to extend its use in all items it produces.

http://www.rfidjournal.com/articles/view?7899

Quoting the entrepreneur:

"On the job, things come up that introduce innovation. The special is added to the general. This is the one that will add value and you often meet it on the "road". Yes, improvisation is a matter of the team, of the entrepreneurs… Business and vision go together"

"Everything is networks"

It has been said:

Για τα στενά όρια της ελληνικής αγοράς η προσπάθεια του ΔΧΧΧ να φτάσει την Ιταλική αγορά το 98 φάνταζε ουτοπία. Κι όμως εκείνος το πέτυχε

[397] "*This is how we entered the powerful Italian market*".

TCo8 case study

Summary
- Legal form: SA
- Year of foundation: 1942, Corporate venturing 2000
- Number of employees: 250 full-time (2014 in Greece)
- Located in: Thessaloniki
- Product families: Underwear sleepwear and lingerie
- Manufacturing: batch production
- Major customers: final consumers
- Major suppliers: yarn producers (Greece, Turkey, India), Lenzing company, technical yarns (Europe)
- Sales' structure: Exports 10 %, national 90%
- Educated staff: 26 with a University degree (today 20)
- Patents: no
- Trademarks: yes
- Awards: yes

Object of investigation

The case was known to the author since 1990, but it was also recommended by a Professor of the Apparel Design and Technology Department, TEI of Central Macedonia, Serres and the SEPEE president. Interview was held with the CEO, shareholder and one of the main contributors of the knowledge-intensive corporate venturing (about 3 hours), with a view of the plant to follow. Moreover additional information has been gathered through press and internet.

TCo8 is an underwear manufacturer with two privately owned production plants: the 1st one at the area of Thessaloniki in Greece and the 2nd one in Romania. The Greek plant was built in 1974 and covers 11500 square meters. The company operates for more than 60 continuous years, always expanding its activities and its production lines and adopting its strategy upon the changes of consumer tastes. The firms focused in Greek market with double digit shares of it; up to 2015 it is has not tried to expand out of the Greek borders. In early 2015 the company made its first efforts to take a share of the underwear markets of Belgium, Germany and Denmark.

The firm possesses a strong (but also historic) brand name with remarkable market recognition at least in the Greek market. After corporate venturing it has developed a strong distribution network comprised of 3000 outlets around Greece and of presence in all of the large department stores. The interviewee commends on the corporate venturing:

"If we had not attempted this total reconstruction, we would not exist today!:(March, 2011)

Basic products: TCo8 is engaged in the production and trading of underwear for men, women and children, as well as pyjamas, home wear, beachwear, T-shirts, female body and

bras. During 2002 new products were added in its product line such as socks for men, Seamless type of underwear and female lingerie.

Competition: There is severe competition in the underwear sub-sector. Greek companies have a five to ten percent of the Greek market, while imports regards both branded products (such as Triumph and Victoria Secret) and cheap products from China, India and Turkey.

The entrepreneurs: At the time of the interview, the champion entrepreneur had retired and the most suitable member to be interview was the CEO, shareholder and one of the main contributors of the knowledge-intensive corporate venturing, Mr S. He studied textiles and clothing engineering in Germany (one of the top relevant Schools worldwide) and joined TCo8 soon after completing his military service as production manager. By that time the firm was a small company. He assisted the entrepreneur in the further development of the company and in 1995 he becomes one of the main shareholders and member of the Board.

The Innovation: TCo8 is a pioneer in fashion underwear design in Greece, *the first* to establish a design department combined with R&D, an ERP system, mass customization (from 30 to more than 8000 codes), new marketing and sales methods and use of "green daisy" label for infantile clothes (eco-image)**.**

Innovation / entrepreneurial process: ***a) History:*** First establishment of the activity draws back in 1942 but it was 1965 that it turned to a General Partnership and started working as a company. In 1970 the company moved to its new plant where it is still located (with several new buildings however). In the following twenty years, TCo8 will grow significantly; it invests in new automated machinery and mass production lines in new buildings industrializing its production. At the same time it develops a well-recognizable strong brand in the market of men's underwear. In 1995 it enters the Stock Market, increasing the equity funds. The end of the old millennium finds the company well-positioned in the Greek market but with too much anxiety for the future: *"We had to restructure the whole product model to resist multinationals. Market messages were very clear. Differentiation was the only solution. Although we had invested heavily on automation and production systems of mass production, we had to change. That started in 1997, since we had received the messages. Our eyes and ears were open. Whatever the knowledge and the experience you have, it is not enough when you enter a completely new area. You have to come out of your shell and start searching… If we did not change, we would not exist today…"*

b) *The corporate venturing*: Market messages turned company to seek differentiation. TCo8's members tried to make these messages more specific: *"We visited fashion shows in Europe, investigated the technology of materials used by big competitors in Europe, we even attended seminars… The trends of the big companies were the main motive. You either follow or shut down!"* According to the interviewee, at that time global trends and strategies of leading companies indicated **fashion** as the only solution combined with innovative raw

material. That meant a total reformation of the company. TCo8 was a highly automized company with a few product codes of white underwear of fine quality. It needed to turn to a fashion producer targeting younger ages (where the meaning of underwear is completely different). The company had to reform its image and production in order to survive the Greek market and the imported products. Some of the decisions made regarded:

- Investing in fashion exploiting creative design, new materials and global trends information for new and fast changing product mix.
- Changing the production lines
- Changing sales and promotion procedures and processes
- Changing image and communication of products
- Capturing new target groups

The **complete restructuring** of TCo8's business model was further an answer to multinationals. Still it required much knowledge and investment on human, social and physical resources. "*It is a very expensive story which still goes on…"* explains the interviewee. In order to realize the above decisions, the executives:

- developed a strong design fashion-centered department with intense NPD[398]: this regarded recruitment of designers, modelists and patronists as well as contracts with famous designers in Europe and consultants to develop the NPD processes
- sought knowledge on innovative material and relevant technology: they participated in relevant exhibitions and made contacts with suppliers of mainly novel raw and supplementary material (ranging from fibers to supplementary material such as elastic waistbands and laces). *"No matter the company's knowledge, if you want to enter some other area where new knowledge and information is necessary you have to come out of your shell and search… Initially we turned to innovative material approaching mainly raw material producers and visiting relevant trade shows. This is how we approached Lenzig and then we formed a joint-venture with T. "*
- sought to find **production technologies** that they could serve their new strategies. This meant flexible production systems (we remind that we refer to 1998), development of logistics and ERP systems which were all just in the beginning of their development. The most important one though was the development of mass customization (indicatively, the company turned from 30 codes every three years to more than 8000 codes per six months)
- invested heavily in new machinery and transport equipment as well as logistics

> *"We invested mainly in innovative knowledge; fibers, spinning, knitting, and their innovative evolution. However, we were quite familiar with these areas. Then we had to invest in areas totally unknown to us; design novel material with specific*

[398] In 2003 the design department occupied 13 employees: designers, technical specifications specialists and specialized cutter-tailors

treatment, novel business models and sales ERP … actually when we started we found no company to support the system. There were some Israeli systems that were promoted by an American company and the Adoniadis' Computerland. We had many problems then because we were actually their guinea pigs!"

- invested heavily in logistics*: "The new strategy created a complex system; there are many codes of products to sort, to store and decide upon since they change every six months. Then there is the productivity issue; the new system demanded machinery that do not work all the periods; so we have to organize productions in novel ways in order to stay competitive in prices; ERP helped a lot. Now all shops are on-line. However we had the experience; we scanned production in 1986!"*
- made plans in order to change market positioning and enter new sub-markets as well (e.g. lingerie and youth underwear)
- created new sales and marketing policies using external collaborators : development of the Design Collection Marketing Software; segmentation of clientele to fashion-oriented and traditional; the company turned from B2B to the opening of own chain stores and shop-in-shop stores intensifying promotion mainly through advertisements in press and TV (**market entrance**). Later with less TV and more with leaflets and catalogues as well as participation in exhibitions.
- became a licensee in a number of famous trademarks, and
- invested heavily on training both on technology issues as well as to embed the new culture
- Made a series of acquisitions: a subsidiary in Rumania entering the Balkans' market as well (2001), a collaboration on a subcontracting basis for lingerie with a local company (2003), a joint venture (2004), a number of selling points in Greek cities

"We tried to enter lingerie in an innovative way. That meant knowledge, training, close co-operation with consultants and specialists and companies with the necessary know-how. We had to combine novelty in material-design – production and promotion! … That meant a significant combination of knowledge that even international companies did not owe by then…"

In 2005 the company enjoys the fruits of its efforts ranking third with a slight difference from the first two. The same year it invests in the creation of a new series targeting the ages 17-25; the products enter the Greek market in 2006 (Spring) with very good perspectives. Until 2010 the company maintains its position in Greece following the international Triumph.

However, in 2012 it falls to the 15th position and the 17th in 2013. According to the author's opinion a significant mistake was that they hesitated to enter European markets during the decade. They turn to this direction now (in 2015). It is worth mentioning that during the 2000-2010 decade many relevant firms lost the race of competition and shut down.

The imperative need for survival drove to the idea of a complete reconstruction of the company's strategy and business model: from a top-quality white underwear producer based on automatization and technology provided by manufacturers to a modern fashion (under)wear solutions for younger target groups. **Shifting** from "white and healthy" underwear to "colorful", trendy and fashion and from "underwear" to "outwear" ***led*** to the development of unique design capabilities and a series of changes in production and the business model. *"Although we had heavily invested in automatization, the shift to design proved to be a highly demanding and resource intensive strategic movement that demanded constant changes in structures and knowledge. Thank God we are a flexible team!"*

Appropriability Strategies: registered well recognized trademarks worldwide and license of known brands

Knowledge bases: Design, textile and fabric technology (fiber, spinning, treatment etc), chemistry, ERP systems, logistics, marketing, sales, new administrative models, Mechanical /electronic engineering, fabric and yarn quality control

Financial resources: bank loan and private capital were mentioned. The company was considered a large one (> 250 employees) and could not apply for subsidy (in the area of Thessaloniki).

University and Research Institutes: ETAKEI for quality controls or analyses.

Institutional: The mediocre work of the State General Laboratory; Chinese imports enter Greece through Italy and on-one cares. *"And we refer to baby underwear..."* The small size of the Greek market is a significant hampering factor for such strategies. The unpredictable Greek crisis leads to death most of the Greek companies.

Corporate strategy: to provide contemporary value-added products, aiming both at the satisfaction of the consumer clothing needs in the global market and the best possible capital return. Development of a modern sales network and a wide range of products, novel use of innovative materials, exploitation of the well-recognized brand name in Greece and market share in European markets.

Innovativeness: It regarded mainly use of new materials and design while time was needed to excel new methods and strategies. We can mention:

The collaboration with Lenzig in order to use the innovative fibers. Problems in dyeing processes led to many try-and-error efforts and a collaboration with two dyeing plants.

The effort to use new production systems (the cells) in order to become more flexible with faster changing operations.

Processes: ***a) Before corporate venturing (CV)*****:** TCo8 was actually concentrated on ***technology sensing*** before corporate venturing: *"We would search for pioneering raw material mainly though international fashion shows and suppliers. We searched only technology to reach innovation. Till the beginning of the new millennium we had focused on*

production with heavy investments, use of consultants and acquisition of relevant knowledge. Imagine we scanned productions in 1986. Actually we could not find a relevant ICT firm to support such activities. We had even tried to develop cell production which was very fashionable in the 90s[399] *but it didn't work out."*

The company was among the first in Greece (at least) to use CAD-CAM systems

b) **After CV:** ***NPD*** with around 0.8% devoted in R&D. According to the interviewees' sayings the members of the NPD department were tripled comparing the time of establishment and at the time of the interview.

Training: in regard of technologies, new market trends, ICT, sales management and strategy, inventory control, logistics, production and quality management, industrial management

Market sensing: Panhellenic research (initially), TGI reports which outline the company's image according to consumers' estimations. TCo8 uses questionnaires in order to locate tendencies. The company benchmarks the leading lingerie group in Europe.

Quality controls: In-house quality control department and in collaboration with the suppliers' laboratories and ETAKEI. The company is certified with ISO 9001:2000, Oeko-Tex Standard 100, Eco Textile label and the "green daisy" label for infantile clothes

Quoting the interviewee:

> *"This decision led to a total, in-depth restructure of a traditional company. By then the classical search for raw material and for new technology ready by suppliers was enough. Then we invested in new knowledge regarding unknown sectors: design, technical material well beyond the familiar cotton and synthetic ones which required knowledge on chemistry and a shift to mass customization which was in its infant stage for the sector; this was painful. It required significant changes in production technologies, modernization of the administrative and the commercial parts a change of the company's image in the market; thus completely new skills and capabilities"*

"Beyond statistics and research, you must have the ability to see far away, beyond the reality of the moment which –of course – affect thoughts and judgments"

> Κι εδώ είναι το κρίμα βέβαια. Να έχεις τεχνολογία, τεχνογνωσία και υποδομή και… Αν ήμασταν στη Γερμανία θα ήμασταν 8 φορές μεγαλύτεροι… Θα είχαμε οικονομικούς πόρους… Τεχνογνωσία που δεν την είχαν στο εξωτερικό τότε. Και τώρα… Κάναμε επένδυση γραμμή παραγωγής 6 εκατομμύρια ευρώ που δεν δούλεψε ποτέ. Πού να το φανταστεί κανείς αυτό το πράγμα πριν από 2 χρόνια!!! Κάτι δεν πάει καλά. Δεν είναι απόλυτα λογική η πορεία μας. Μιλάω με πάρα πολύ κόσμο. Δεν υπάρχει κλάδος ή και άνθρωπος που να το είχε προβλέψει αυτό!!! Δεν υπήρχε κανείς που να έλεγε ότι θα αλλάξουν έτσι τα πράγματα. 40% πτώση και δεν πήρε κανείς κάποια μέτρα…

[399] Cell production (in Japan) or Cellular manufacturing (in USA and Europe) were quite popular since 90s together with the concepts of lean production and keizen.

TCo9 case study

Summary
- Legal form: SA
- Year of foundation: 1974, Corporate venturing 2000
- Number of employees: 580 full-time (2013) (1200 in 2000)
- Located in: Giannitsa Pellas
- Product families: indigo denim
- Manufacturing: batch production
- Major customers: apparel (mainly jeans) industry
- Major suppliers: Greek cotton, chemical industry (mainly indigo provision) –Greek suppliers preferred.
- Sales' structure: Exports 55 %, national 45%
- Educated staff: 12 with a University degree (2000), 25 in 2013
- Patents: yes
- Trademarks: yes
- Awards: yes

Object of investigation

The case was recommended by the president Hellenic Fashion Industry Association (SEPEE), the main representative of the apparel and textile industry in Greece and by a Professor of the relevant TEI Department in Serres. Furthermore, it was known to the author since the years of the occupation in a textiles company; actually the author had met once the interviewee (by then his father was in charge). Interview was held with the CEO, President of the Group and entrepreneur (about 2.5 hours) in the central offices in Thessaloniki. The facilities were known to the author. Moreover additional information has been gathered mainly by internet sites, the press as well as from company's reports.

TCo9 specializes in premium quality denim fabrics that have unique and individual characteristics.

Denim is used to manufacture jeans. Despite the various trends in fashion, it is a timeless product that always manages to be in style. The plant is located in Pella and has an annual production capacity of around 20 million meters of denim fabrics. It is the only totally verticalized organization of denim production in Europe, with cutting edge technology, equipment and quality assurance systems. Its departments comprise of a weaving department, a dyeing department, a finishing department accompanied by an R&D Department and a quality control laboratory. The firm uses an on-line production monitoring system linked to sales order processing and production scheduling.

The company is certified with ISO 9000, ISO 14001, Oeko-Tex and SCal-Control Union for organic products. It has been many times awarded with the "export Award" by the Athens Chamber of Industry and Commerce.

The company insists in its Greek identity. Its plant is in Greece and all raw and supplementary material that are produced in Greece are preferred.

The company is famous for its products worldwide; however not to final consumers since its products address the jeans industry which comprises of legendary names in the fashion domain (upper segment of the market).

Basic products: production of indigo denim fabrics for jeans: a wide variety of denim fabrics that differ in terms of weight, color, weave, composition, type of yarns and finishing allowing its customers the potential to create any desirable result after stonewashing.

Competition comes mainly from Italy (3 companies) and Turkey (5 companies) regarding the same level of quality and differentiation. There are about 100 denim producers worldwide (India, China, Indonesia, Japan, Pakistan, South America, 4 in USA and Spain)[400].

The entrepreneur: TCo9'**s** KI entrepreneur is the second generation, has studied economics in Greece and holds a master from George Washington USA where he combined the master course with several courses on textiles technology. He was raised in an entrepreneurial milieu and more precisely he grew up together with TCo9. He worked mainly in exports until the decision of corporate venturing. Then he took over the general management. His father has a law degree from the Aristotelian University. His father owned a ginning mill in Thessaloniki. He was an Honorary General Consul in Sweden and Denmark (for Northern Greece), Vice-president of the Greek-British Chamber for Northern Greece, Member of the Boards of the Greek Industries Association, the Greek Industries Association of Norther Greece and the Panhellenic Export Association, of the Cotton Association and other unions.

Innovation / entrepreneurial process: ***a) History:*** TCo9 was established in 1974 by the A. family and the multinational Dutch company Royal Ten Cate. While the management belonged to family, there were professional managers besides the family members. The plant soon became the only vertically organized production unit in Europe (at least up to 2010) with spinning, rope-dyeing, weaving, finishing, quality control and packaging departments The production of denim fabrics started in 1976 with an annual production capacity at that time of 5 million meters. In the same year, the company signed its first contract with Levi's and started its intense export activity. The Dutch company introduced new concepts like the internal reporting, internal audits etc which were unfamiliar to the majority of the Greek SMEs of the 80s and the 90s.

[400] The main problems that TCo9 faces today are mainly due to excessive borrowing in order to face competition from Turkey, the increase of cotton price and the 7 million Euros on tax returns. In the end of 2012 TCo9 became the first Greek company to take distress funds (**http://www.tovima.gr/finance/article/?aid=443140**)

In 1994, TCo9 was listed in the Athens Stock Exchange and uses the amount of the capital increase to modernize the production facilities

b) *The corporate venturing*: In 1999, the *A* family bought out the share of the Dutch and Marfin acquired a company share. Being in charge of the company the entrepreneurs re-considered their strategy. The messages of the industry worldwide indicated the threat of Asia, while Turkey started becoming a countable competitor. Denim producers started appearing in developing country posing lower prices for conventional denim. These threats and partly the insecurity of the withdrawal of the Dutch partner posed a need for change. *"Our new ideas started around 1998. It was evident that the company had to change."* The family focused on denim branded fashion for many reasons:

- Denim started to become female fashion with the new millennium
- Fashion required a huge number of product codes and fast changes
- Levis was a core customer and they started requiring a significant number of different samples and impose specifications for their own denim
- They had the basic knowhow and a totally verticalized production unit

The entrepreneur decide to build unique competitive advantages. They want to move from mass market up to fashion market (Figure 1) which demands a series of changes: R&D for new products, fast fashion, unique yarn properties and flexible butches together with a well-developed marketing department. This reconstruction requires the development of a strong R&D department, innovation processes and relevant production technologies to support variety and fast fashion. Thus, this decision called for **a total restructuring of the company** to become a customer-focused organization; by then the company was highly automated for *mass production***.**

Figure 1: New business plan of TCo9 (by the company's records)

The R&D department was developed by two external fabric specialists. They were contacted by a customer of ours and worked for foreign companies. So we had the knowhow of the yarns and the fabric and we combined it with the knowhow of the Greek and foreign

apparel manufacturing and specifications. This kept for a while until we got the experience needed. Then the department was staffed by textiles and fabric engineers – its manager is a specialist on dyeing and finishing. We created a pilot production laboratory with miniature machinery where we are simulating the novel or developing techniques; in this way we eliminate losses and can repeat try-and-error efforts as many times as we wish. The first R&D high value added products were presented to customers in 2003.

R&D resulted in a significant number of new products which had to be produced. However, the existing automated production lines could not satisfy orders in a feasible way. *"This was the "consequence"; i.e. the new needs and requirements in production. In the following years (2000-2005) we invested almost 60 million Euros in new machinery and different forms of automation. We bought all new machinery, we replaced some others and there were also custom-made machinery to serve the flexibility we were seeking in order to produce many new products simultaneously".* The company was among the pioneers worldwide of the sub-sector to introduce mass customization, a method first defined theoretically by Stan Davis in Future Perfect (1987).

Table 1: Transferability of technology and business models

	Easy						Difficult
Technology	CAD/CAM	Digital printing	E-commerce		Mass customization	Technical textiles	Biopolymers
Business Models	Two string strategy	Delocalisation	Co-contracting	Specialisation	Export	Consolidation	Verticalisation Value chain control

Figure 2: Technology and business models and level of difficulty in applyng them.

Source: Sheffer (2012)

The same period, TCo9 buys a ginning mill to produce its own quality certified cotton. TCo9's vision soon produced exciting results as well as a plethora of novel products some of which were patented at first at national level and now at European level. In order to finally apply the solution of mass customization[401], TCo9 applies new Knowledge and tangible investments for new equipment, logistics, marketing and organization. The company develops new processes of R&D and marketing, new production planning and a new philosophy of customer treatment through synergies such as specialized HR employment, co-development of innovative products, and co-operation with machine and automatization manufacturers.

[401] Appearing in literature in 1987, in 1998 mass customization was almost an "oxymoron" between theory and practice and was partly applied in Japanese industries

In his report to the European Commission, Sheffer (2012) mentions the company and highlights restructuring as "the successful strategy of [TCo9]" and comments that the company "is somehow less vulnerable to the crisis because of a combination of vertical integration and international leadership in the niche of high-end denim".

Considering the above figure, TCo9 managed to adapt total verticalization and value chain control while it reached mass customization at technology level. The company was the major supplier for Levis till 2005 while other customers were Diesel, Armani and TCo7. TCo9 occupied the 3rd position in Europe's textile industry in 2001. In 2004 the company achieves record sales of 21 million meters and a consolidated turnover of over 100 million Euros.

Appropriability is considered important. Secrecy contracts are undersigned by R&D members. The company has two patents for denim specific types. Trademarks and lead-time advantage on competitors are also used.

Knowledge bases: Textile Processing, chemistry and manufacture of fibers, chemical processing such as bleaching, dyeing, printing and finishing, application of various kinds of chemicals, dyes, thickeners, and finishing auxiliaries' knowledge of green chemistry, biotechnology and nanotechnology with special reference to chemical processing of textiles. Mechanical /electronic engineering, design, fabric and yarn quality control (physical properties () and color-fastness),,

NPD, production (mass customization), logistics, marketing and customer satisfaction, management, denim technology (denim innovative treatment and finishing methods, washing-prewashing processes, enzyme technology, design), knowledge on apparel industry

Financial resources: subsidies and private capital were mentioned

University and Research Institutes: while there was no involvement of academia during corporate venturing, TCo9 has developed a number of research projects with academia. Indicatively with the University of Ghent (department of textiles) for the development of a specific type of machinery; two research projects with the Aristotle University of Thessaloniki, Physics Department Lab of "Thin Films - Nanosystems & Nanometrology (LTFN); a research project with the Agricultural University of Athens.

Processes: ***before venturing***: TCo9 had developed an informal type of *NPD* in collaboration with major customers and significant *sensing* through *collaborations* with suppliers and customers as well as new contacts made at international trade shows. The company was among the few ones in Greece to develop routines in the 80s due to the joint venture with a relevant Dutch company: *"The experience gained from this cooperation was significant: we had learnt some concepts pioneering for Greece such as the internal reporting, the internal control – we refer to the 80's; this entire staff was totally strange for Greece… "*

*b) **After CV**:* TCo9 developed a well-organized ***R&D Department*** presenting new products twice a year. Although there is an R&D budget, which counts of the1.5-2% of the total costs, expenses are usually higher since a part of it "is lost" in the production costs according to the entrepreneur's sayings. A wide range of experimentations regards fabrics and treatment as well as novel fibre uses. The company ***co-operates in research projects***; the latest regards applications of nanotechnology while sometimes there are also exclusivity agreements with six-month or annual duration. TCo9 develops ***knowledge and innovation linkages*** with suppliers of innovative material (machinery, material) and customers. Novel proposals derived by research are also presented at international trade shows.

NPD: TCo9 invests in continuous development of specialized types of fabrics regarding new uses for denim in response to the changing demands of customers and jeans consumers. The company ***monitors closely the denim developments at global basis*** while it has a certain ***process of organized visits*** to customers to detect new and latent demands and hopes (with observation, discussions, suggestions) and ***processes of reverse engineering***.

Knowledge management is evident through knowledge seeking and diffusion at meetings, try and error processes, supplier and customer requirements and research.

Emphasis is given to developing the knowledge and skills of the company's manpower. Part of the yearly budget goes towards ***training and education*** at all levels of the workforce, such as participation of executives in post-graduate programs, educational programs on technical issues, information systems, finance, accounting, management, health and safety and even foreign language courses for managers.

Collaborations –acquisitions: TCo9 owns two subsidiaries (100%) in Greece, a subsidiary in the area of renewable energy sources (95%) and a special subsidiary (95%) in a Northern Africa country to serve a famous global branded customer

TCo9 participates in ***exhibitions*** (Paris and Munich) and visits ***trade shows*** of machinery and materials (ITMA is the most important one). They also participate in relevant conferences (one mentioned is the fabric finishing Conference in Germany) or other relevant scientific events.

There is a management committee for Decision making: the President and CEO, the directors of all department for general strategic decisions. Managers are encouraged to take initiatives.

There are processes to monitor competitors; informal links such as common suppliers and customers are very important sources of information.

TCo10 case study

Summary
- Legal form: Ltd
- Year of foundation: 2002
- Number of employees: 22 full-time (2011) /started with 15
- Located in: Athens
- Product families: High-fashion clothes and shoes
- Manufacturing: batch production
- Major customers: final consumer
- Major suppliers: fabric and accessories providers
- Sales' structure: Exports 2-5 %, national 98-95%
- Educated staff: 7 (not specific subject-related)
- Patents: no
- Trademarks: yes
- Awards: no

Object of investigation

This case was the **last interview** in November 2011. The author wanted to include a case of KIE related to fashion design; however it was quite difficult to find a fashion designer who would be also an entrepreneur. Mr Z was a designer known to the author due to its style; however research in internet could not prove any entrepreneurial action. The author contacted the general manager of CLOTEFI S.A. (the Greek Technological Center for the textile and clothing industry) in Athens who gave some valuable information on the entrepreneurial effort of Mr Z. The author contacted the designer in his atelier; he was very polite and accepted to be interviewed. The interview lasted about 2.5 hours. The facilities were not visited but this was not of great importance because the focus of the case was not at the operational level of the case. Additional information has been gathered mainly by internet sites and the press.

TCo10 is a quite different case of new venture which however deserves being included as a representative case of alternative KIE in the T&C sector. ***Fashion Entrepreneurship*** is organized around a designer, evolving a complex net of knowledge assets (such as design, raw materials, manufacturing and business) and focusing on the production of high design clothing and accessories. The entrepreneur managed to enter the high-fashion and demi-couture world, create and build his own empire developing his new symbolic language –a distinctive and consistent style characterized as "Old Athens" (elegance, nostalgia and womanly looking). Today he is considered among the emerging global designers, while his company counts ten years of life.

Gaining some market share means taking customers of other competitors, since the fashion sector is a saturated and volatile market (Jones, 2005). Furthermore, **only a few fashion designers become entrepreneurs** while a very small percentage of them are capable of

making it through the first years and many do not succeed in reaching a stage of retention (Kurz, 2010). As Renzo Rosso, creator of Diesel, stated: "Fashion is inspiration, creativity and intuition. But it is also organisation, strategy and management. These two apparently contrasting sets of elements have to come together to ensure the success of a business idea." (In Saviolo and Testa, 2002). Leadbeater et al (2005) further pointed out that many want to stay small, because they want to maintain their independence and the focus on creativity. KIE in fashion industry is quite different since it is more connected with creativity and a complex communication network. Innovation comes through creativity and constant change.
On the other hand, TCo10's KI ***innovation*** refers to fashion design. "Indeed, it could be argued that much of the clothing industry, and certainly the designer clothing sector, are based entirely on innovative design. (Hirsch-Kreinsen et al., 2003).

TCo10's central "offices" are the designer's atelier in Athens. The plant where he produces his shoes is in the Attica area and it was a strategic alliance of his.

Basic products: Haute couture (high-end fashion) shoes and dresses (including wedding dresses)
Competition: The Haute couture industry is highly competitive and fragmented. It is subject to rapidly evolving fashion trends, and it continuously presents innovative and upgraded design.
Design and brand image are tightly connected with public relations, marketing and promotion.
The entrepreneur: Mr Z has a career of more than 25 years in some of the most important fashion journals in Greece (Vogue, Votre Beaute, Status, Woman etc). He started working for the first fashion journal in Greece back in the 1984 and he has worked as a fashion photographer and personal stylist of TV and theater people. The entrepreneur states that he is a citizen of Europe and believes strongly (At least in the end of 2011) that Greece can act as a springboards for young designers to conquer the international market.
The innovation: Design - creative innovation (fashion industry- Fashion innovation); among the few cases where the designer becomes a producer and an entreprenur as well
Innovation / entrepreneurial process*: "My dream was to bring back the glamour of the grand shoe salons. The lady would had her own shoe last; the order was unique; this was wonderful! Then in the beginning of the new millennium the Greek market was full of the shoes of all designers but for Manolo Blank (he entered the market later). So I saw that gap that niche market and I wanted to be the one to fill it!"* The entrepreneur confesses that the business idea came accidentally: "I was working at M; a show maker of more than 100 years. I was designing the shop decoration and concept – I had even prepared the logo for the shoe

boxes - when he bankrupted and he suggested that I could use the merchandise with my name: *"He told me: Since you are famous in these magazines and since you want it, why don't you try?"*

This was the trigger for the start. The entrepreneur found an old friend, persuaded him to become his business angel and used the bankrupted plant and its workers to switch to pumps and bags that brought memories of the 60s. *"I had design and marketing knowledge but I had to learn a lot about the production and management!"* says the entrepreneur-designer. *"More or less, it is a one-man show. You have to make bows and to pay wages at the same time…"*

Market entrance: Avoiding the high costs of advertisement and debut in the fashion world, he used his network in the fashion magazines: *"Instead of paying for promotion, I was presenting my plans in interviews. It is really very important that before even the opening and with zero advertising expenditure I was in all fashion magazines. This was a big success by its own!"*

Then he prepared his first collection at a friend's atelier. His first shop was different in all aspects: *"I tried to avoid the super market aspect of most shoe shops. I tried to give the air of Old Athens – girls (i.e. the salesgirls) with purls and red lipstick and nicely combed hair. Each customer was unique for me (and still is)!"*

TCo10's shoes pass with success the strict control of the American Bergdorf Goodman but there was no contract since the entrepreneur could not provide the order volumes required.

Appropriability Strategies: the luxury brand

Knowledge bases: Mostly design, fabric properties, shoe manufacturing, marketing, management

Financial resources: Initial capital needed was around 300000 by a business (a friend from childhood).

University and Research Institutes: not mentioned

Institutional: TCo10 was established in 2002; it was still the time of prosperity with high fashion to pay back all costs in the domestic market and a time of opportunities for openings to the fashion capitals (i.e. most prominently New York, Milan, Paris and London).

However, the entrepreneur claims that the State does not support the new fashion designers *"We are the only country that we do not back up our creators; Greek newspapers and fashion magazines devote pages and pages to Milan fashion shows and ignore the Greek Fashion Week of the work of Greek fashion designers! What a xenomania!"*

The state does not support Greek production either according to the interviewee.

Corporate strategy: to sustain the strong luxurious identity the entrepreneur has built around the dream of the 60s. *"It is equally important to have a strong identity and to differentiate"*.

His products target women between 15 and 75 of middle and upper class (however he makes it clear that most customers are between 35 and 60). The motto of the designer is that each woman wants to be unique.

Innovativeness / Processes: The company can be considered innovative since most product innovation refers to fashion design (Faust, 2005). However, the entrepreneur is also responsible to manage the entrepreneurial processes and bring his NPD to marketplace.

Market sensing which regards mainly market and the world of the fine fashion creative industry. The entrepreneur visits and participates in international trade and fashion shows, he reads a lot of fashion magazines and he is actively involved in the world of fashion. On the other hand, he updates knowledge on fabrics and leather technology and collaborated with manufacturers. He also gets new knowledge on specific markets like the ones of Russia and USA. *"I travel a lot, I visit fairs and trade shoes abroad, I have my eyes open. When I watch a film I observe everything, I listen to music – everything is actually inspiration."*

Normally it is said that designers find inspiration in everything everywhere, but to be in touch with contemporary and future tendencies, ideas for the entrepreneur and fashion designer of TCo10 are complemented with all the above mentioned as well as inputs from online fashion predictors and test samples. His collection of 2012 reflected the crisis framework without lagging behind in creativity and luxury: "*Now, more than ever, is a time to be resourceful and creative"*.

NPD: He prepares two collections a year. Besides design, he uses novel luxury fabrics and accessories.

Networking: The entrepreneur seems to go on relying on his initial network pool as his primary means of access to the welter of resources needed during and after founding; however the company extents to new contacts as well (e.g. the fashion show in USA).

Promotion: the entrepreneur believes that customers need to be reminded of his existence. *"People must see you and hear of you!"*

TIP: Ο Μανόλο Μπλάνικ έδωσε την πρώτη του παραγγελία στις αρχές της δεκαετίας του '70 σε ελληνικό εργοστάσιο

APPENDIX D

International peer-reviewed journals

Karagouni G, A.Protogerou, Y. Caloghirou (2013), "The impact of Autotelic and Dynamic Capabilities on the performance of knowledge-intensive, low-tech ventures", International Journal of Innovation & Regional Development

Karagouni G, A.Protogerou, Y. Caloghirou (2013),"Autotelic capabilities and their impact on technological capabilities", Euromed Journal of Business

Karagouni, G. and Caloghirou, Y. (2013) 'The nature and dimensions of autotelic capabilities in knowledge-intensive low-tech ventures: an introduction', *World Review of Entrepreneurship, Management and Sustainable Development*, Vol. 9, No. 2, pp.230–245.

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Karagouni, G. and Caloghirou, Y. (2013) 'Unfolding autotelic capabilities in low-tech knowledge-intensive entrepreneurship', *J. International Business and Entrepreneurship Development*, Vol. 7, No. 1, pp.21–36.

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Karagouni, G. (2015). Knowledge–intensive entrepreneurship and performance during the crisis: cases of the Greek wood industry. *World Review of Entrepreneurship, Management and Sustainable Development*, *11*(2-3), 232-246.

Peer Reviewed Conference Publications

Karagouni G., (2011), "Autotelic Capabilities and Knowledge Intensive Entrepreneurship in Low Tech Sectors", *4th Annual EuroMed Conference of the EuroMed Academy of Business,* ISBN: 978-9963-711-01-7, pp 946-949, October 20th-21st, 2011, Elounda, Crete, Greece

Karagouni G., A. Protogerou, Y. Caloghirou, (2012) "Autotelic Capabilities and their impact on technological capabilities: a focus on production technologies" Book Proceedings of the 5th Annual International EuroMed Conference of Building New Business Models For Success Through Competitiveness and Responsibility, ISBN: 978-9963-711-07-9, pp889-905 October 4th-5th, Glion-Montreux, Switzerland

"Best PhD student paper award"

http://emrbi.org/wp-content/uploads/2014/09/euromed-newsletter-006.pdf.

Karagouni G., A. Protogerou, Y. Caloghirou, (2012) "Dynamic and autotelic capabilities in knowledge-intensive, low-tech ventures", Book Proceedings of the 7th European Conference on Entrepreneurship and Innovation, ISBN 978-1-908272-66-9, 20-21 September 2012, Santarem, Portugal, pp. 810-818

Karagouni, G., & Caloghirou, Y. (2013) "Production technologies and innovation in knowledge-intensive low-tech ventures: evidence from the Greek wood and furniture industry", 6th Annual EuroMed Conference of the EuroMed Academy of Business. 1148. Confronting Contemporary Business. ISBN: 978-9963-711-16-1. Estoril, 23-24 September 2013

Karagouni, Glykeria (2014), "Knowledge-Intensive Entrepreneurship and Innovation in Low-tech Industries: a Capabilities Perspective", Paper presented at the DRUID Academy conference, Rebild, Aalborg, Denmark, January 15-17

Karagouni Glykeria, Caloghirou Yannis, (2014) "Knowledge-intensive entrepreneurship and low-tech sectors: questioning the successful creation of low-tech but knowledge-intensive ventures", 7th Annual Conference of the Euromed Academy of Business, 18-19 September Kristiansand, Norway, ISBN: 978-9963-711-27-7

Other publications

Protogerou A. and G. Karagouni, (2012) "Identifying dynamic capabilities in knowledge-intensive new entrepreneurial ventures actors sectoral groups and countries " D 1.8.2., WP 1.1 "Knowledge-intensive entrepreneurship: Theory and Conceptual Framework", Aegis Project, *7th Framework Programme for Research and Technological Development.*

Book units

Protogerou A., Y. Caloghirou, G. **Karagouni,** (2014),"The relevance of the dynamic capabilities perspective in low-tech sectors", in 'Knowledge-Intensive Entrepreneurship in Low-Tech Sectors: The Prospects of Traditional Economic Industries' H. Hirsch-Kreinsen and I. Schwinge (eds.), Edward Elgar Publishing, UK

APPENDIX E

F1) The Critique of Pure Reason

The ***Critique of Pure Reason*** (*Kritik der reinen Vernunft)* was first published in 1781, (second edition 1787), followed in 1788 by the *Critique of Practical Reason* and in 1790 by the *Critique of Judgment*. In this work he attempted to explain the relationship between reason and human experience and to move beyond the failures of traditional philosophy and metaphysics. Before Kant, it was generally held that truths of reason must be *analytic*, meaning that what is stated in the predicate must already be present in the subject. Actually, Kant's work was stimulated by Hume's arguments about basic principles as cause and effect, which had implications for Kant's grounding in rationalism. In Kant's view, Hume claimed that all ideas are presentations of sensory experience. Kant's goal was to find some way to derive cause and effect without relying on empirical knowledge. Kant established the need for synthetic reasoning. However, this posed a new problem — how is it possible to have synthetic knowledge that is not based on empirical observation — that is, how are synthetic *a priori* truths possible?

Kant writes, "Since, then, the receptivity of the subject, its capacity to be affected by objects, must necessarily precede all intuitions of these objects, it can readily be understood how the form of all appearances can be given prior to all actual perceptions, and so exist in the mind ***a priori***" (A26/B42). Appearance is then, via the faculty of transcendental imagination, grounded systematically in accordance with the categories of the understanding. Kant's metaphysical system, which focuses on the operations of cognitive faculties, places substantial limits on knowledge not founded in the forms of sensibility. According to Heidegger (1997) transcendental imagination is what Kant also refers to as the unknown common root uniting sense and understanding, the two component parts of experience.

Transcendental imagination is described in the first edition of the *Critique of Pure Reason*. In the second preface to the *Critique of Pure Reason* Kant takes into account the role of people's cognitive faculties in structuring the known and knowable world. Kant makes his famous comparison of his critical philosophy to Copernicus' revolution in astronomy. Kant writes: "Hitherto it has been assumed that all our knowledge must conform to objects. But all attempts to extend our knowledge of objects by establishing something in regard to them *a priori*, by means of concepts, have, on this assumption, ended in failure. We must therefore make trial whether we may not have more success in the tasks of metaphysics, if we suppose that objects must conform to our knowledge" (Bxvi). Just as Copernicus revolutionized astronomy by taking the position of the observer into account, Kant's critical philosophy takes into account the position of the knower of the world in general and reveals its impact on the structure of the known world. Kant's view is that in explaining the movement of celestial

bodies Copernicus rejected the idea that the movement is in the stars and accepted it as a part of the spectator. Knowledge does not depend so much on the object of knowledge as on the capacity of the knower.

In Kant's view, *a priori intuitions*[402] and concepts provide some *a priori* knowledge, which also provides the framework for *a posteriori* knowledge. Things as they are "in themselves" — the thing in itself or *das Ding an sich* — are unknowable. For something to become an object of knowledge, it must be experienced, and experience is structured by the mind—both space and time being the forms of intuition.

Short CV of Immanuel Kant

Immanuel Kant (22 April 1724 – 12 February 1804) was a German philosopher, and, according to the Stanford Encyclopedia of Philosophy is "the central figure of modern philosophy." Young Kant was a solid, albeit unspectacular, student. His education was strict, punitive and disciplinary, and focused on Latin and religious instruction over mathematics and science. Maintaining a belief in God, Kant was skeptical of religion in later life; various commentators have labelled him agnostic. A common myth is that Kant never traveled more than 16 km from Königsberg his whole life.

Kant argued that fundamental concepts of the human mind structure human experience, that reason is the source of morality, that aesthetics arises from a faculty of disinterested judgment, and that the world as it is "in-itself" is unknowable. His beliefs continue to have a major influence on contemporary philosophy, especially the fields of metaphysics, epistemology, ethics, political theory, and aesthetics.

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F2) MASS CUSTOMIZATION

Mass Customization is attributed to Stan Davis; in his book "Future Perfect" the author writes about "mass customization, the production and distribution of customized goods and services on a mass basis." The system combines the low unit costs of mass production processes with the flexibility of individual customization.

The term is mentioned mainly in connection with manufacturing and change management. The concept brought a revolution; quite soon Prof. Pine published his book "Mass Customization: The New Frontier in Business Competition" and big companies began considering customized versions of their existing products. The conversation turned to making mass production lines flexible, and creating a system that allows interaction between

[402] For Kant, intuition is the process of sensing or the act of having a sensation

producer and customer. This resulted in tremendous increase in variety and customization without a corresponding increase in costs. At its best, the system provides strategic advantage and economic value.

Keep in mind that this was in the 90s! The internet had just hatched, social media still 20 years or so away. Manufacturing had just discovered Kanban and Just-In-Time production 10 years ago- mass customization required on demand production!

So people thought of mass customization as a big promise - a “nice idea”, but still an “oxymoron”**.** However, theory and practice moved on. Mass customization became also known as “build to order” or “made to order”. Kaplan & Haenlein (2006) called it "a strategy that creates value by some form of company-customer interaction at the fabrication and assembly stage of the operations level to create customized products with production cost and monetary price similar to those of mass-produced products". Similarly, McCarthy (2004, p. 348) defined it as "the capability to manufacture a relatively high volume of product options for a relatively large market (or collection of niche markets) that demands customization, without tradeoffs in cost, delivery and quality".

Chen, Wang and Tseng (2009) viewed mass customization as collaborative efforts between customers and manufacturers, with different sets of priorities; solutions must best match customers’ individual specific needs with manufacturers’ customization capabilities.

Today, the concept of mass customization is being used in businesses like high-end boutiques where exclusive outfits are created for customers according to their taste. However, different sectors are also benefiting from it through the usage of technology that is making it easier to create customized products for masses. Automated-manufacturing-machinery incorporated with an order-taking structure enables the order-taking structures which are combined with internet-based client interfaces. On the other hand, consumers, today, seem to like being the center of attention and they pay higher price for it. For instance, in Levi Strauss, 80% of the custom ordered jeans fall under the categories of the available sizes – the clients still choose to custom order through the ‘Personal Pair’ method of the company. The Custom Foot’s Keegan confirms the same client behavior.

In February 25, 2015, it is still stated that mass customization needs a few years before it becomes a household name. Even then, it will more likely be a rough adaptation of conventional mass production, according to some theorists. On the contrary, products that cannot exist without customization will be customized no matter what happens to this concept (adapted by www.entrepreneurial-insights.com).

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APPENDIX F

a) Questionnaire: adapted from the research design for low-tech industries of the AEGIS PROJECT

A) Guideline for the case – interviews

Formal case data	
Case Code[403]	
Number of interviews	
Date and duration of interview	
Interviewees (Acronym +position)[404]	
Company viewing	
Product(s)	
Sector	
Legal form	
Turnover[405]	
Year of foundation	
Form of entrepreneurship[406]	
Number of employees	
Academic	
Skilled workers	
Semi-skilled workers	
Attachments	

[403] Acronym: nation/sector/case no., e.g. G/T/I = Germany, Textile, 1st case
[404] Also interviewees of related expert interviews.
[405] Annual turnover since founding year if available.
[406] Academic spin-off, industrial start-up, corporate entrepreneurship, or other form.

1. Entrepreneur(s)

- *Identification of entrepreneurs*
- *Education, work history (including previous workings)*
- *Field of work, activities (intern, extern)*
- *Motivation*
- *Inspiration*

➢ *How did the entrepreneur(s) get to the idea of this kind of knowledge combination?*
➢ *How did they manage to have access to the scientific knowledge base or to the relevant low-tech or product field-specific knowledge-base?*

2. Innovation process

- ➢ *How was the innovation generated?*
- ➢ *Which relevant knowledge bases[407] have been connected within the innovation process?*
- ➢ *In which way have the different knowledge bases been linked?*
- ➢ *What was/were the catalyst(s) (technological, market, institutional opportunities)?*
- ➢ *What is new about the innovation with regard to the market and the low-tech sector?*

3. Entrepreneurial process

- ➢ *Why has this form of transfer (start-up, spin-off, corporate entrepreneurship) been selected for the realization of the innovation?*
- ➢ *How did the process of founding take place?*
- ➢ *Who was involved in the entrepreneurial process (function/skills)*

3.1 Determining factors

- ➢ *What are the relevant institutional constraints and opportunities?*
- ➢ *What are the relevant market constraints and opportunities?*
- ➢ *Which constellation of actors is relevant?*

3.2 Implementation

- ➢ *How have the determining opportunities (market, institutional) been used?*
- ➢ *How have constraints (market, institutional) been overcome?*
- ➢ *Wherefrom and how have resources been organized?*
- ➢ *How have mechanisms of selection and decision been applied?*

Additional Explanatory Notes Per Section

1. Identification of the object

- identification of the sector/subsector (of main business)
- General company information: year of foundation, actual number of empl., actual turnover and ratio of profit to sales, position in the supply chain, and market position
- Nature and scope of products or components that are manufactured by the company
- Key sales markets, key purchasing markets (industry, region)
- Main business strategy (low cost, differentiation, market niche, market leadership)
    - ➢ How are the products positioned in the supply chain?
    - ➢ How is the firm doing compared to its competitors (national, international)?
    - ➢ What is the market power vis-à-vis its clients and suppliers?

2. Entrepreneur(s)

- Identify the person(s) responsible for introducing the innovation investigated in this case/founding the company
- Position and main activities in the company
- Educational background, degree, and work experience and expertise, and motivation

[407] Firm-specific, sectoral, product field specific, scientific or general applicable knowledge-bases?

- Activities contributed to the innovation or innovation process
  - Who else contributed to the innovation investigated in this case (activities, position in the company, department, education, work experience, expertise, and motivation)?
  - What did they learn from the innovation or innovation process?

3. Innovation

- Please describe the innovation (product, process, new market)
  - Why did the innovation occur?
  - What is new to the market or in case of a process innovation: what is new to the common processing of competitors (sectoral knowledge base)?
  - Why can it be characterized as new to the market or as a new market?
- Describe the relevance of the innovation for and its impact on the company (share of turnover, development of growth in sales, employment, etc.), for/on the market and customers, and/or suppliers (changes in purchasing, cost savings, etc.)
  - Can there be changes in the value chain identified regarding the innovation?

4. Innovation process

- How did the innovation emerge?
- Which internal and external sources of innovation can be identified (knowledge base, technologies, and actors)?
- Did relationships to high-tech suppliers or high-tech customers play a decisive role?
- Was there an idea, or an opportunity, or catalysts? And how were they recognized?
- How did the innovation process evolved? (Process of exploration and exploitation)
- Were there implementation and appropriability strategies applied?

6. Determining factors

- Determining factors are defined as significant factors which affect the process of KIE in terms of enabling or constraining entrepreneurial opportunities to implement an innovation.

6.1 Environmental factors

6.1.1 Technological (technological system, technological regimes)
6.1.2 Market (market structure, customers, and competitors)
6.1.3 Institutional (regulations, policy measures, supporting programs)

6.2 Internal/organizational factors

6.2.1 Firm-specific knowledge base (technological, customer knowledge, etc.)
6.2.2 Capabilities (dynamic organizational or innovation enabling capabilities, entrepreneurial capabilities)
6.2.3 Resources (financial, human)
6.2.4 Social practices and organizational routines
6.2.5 Internal linkages (promoters)

6.3 Linkages and cooperation

6.3. 1 Relations within the value chain
6.3.2 Linkages with high-tech companies
6.3.3 Co-operation with research institutes, Universities

- Sectoral and national specific background information:
  What national specifics concerning the industry structure (number and size of competitors, export orientated, etc.), recent developments, trends in innovation, supporting programs (based on secondary sources and or expert interviews) can be identified as relevant in the context of the case?

  - Which enabling and constraining environmental factors can be identified?

- How were entrepreneurial opportunities conditioned by environmental factors?
- Which enabling and constraining internal or organizational factors can be identified?
- How were entrepreneurial opportunities conditioned by internal organizational factors?
- How were barriers and constraining factors overcome?
- What strategies were applied for this?

VII. Policy measures

- Have there been any supporting institutions for the innovation and/or founding activities?
- What is their specific role?
- Did the company call upon any supporting program? Why did it decide on this one?
- Is there a need to improve the relations to these institutions or generally to install such relations?

- Describe the role of political institutions on regional and national levels with the help of expert interviews and secondary sources
- Estimation of the general local conditions by the company

B. Guideline interviews with experts

Person/function

- Education, work history
- Field of work

Institution/function

- Targets of organization
- formation background
- Field of activities (main focus)

Industry structure

- Competitive environment
- Average age and size of the companies
- Supplier-markets, purchaser-markets

Innovation trends

- Development dynamic in recent years
- Fields of innovation
- Technological, market and institutional determinants
- Relevant actors and constellations of actors

Foundation trends

- Development dynamic in recent years
- Pioneers
- Market and institutional determinants