NATIONAL TECHNICAL UNIVERSITY OF ATHENS

SCHOOL OF CHEMICAL ENGINEERING

SECTOR II

LABORATORY OF INDUSTRIAL AND ENERGY ECONOMICS

Product Design and Development: From Idea to Launch

Necessary steps and processes, with application in an innovative product of the food industry

Diploma Thesis

Trougkos Vasileios

Supervisor Professor:

Aggelos Tsakanikas, Associate Professor NTUA

Athens, February 2021

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Prologue

The present master thesis was conducted at Nestlé Research Centre in Lausanne, Switzerland, and in the context of my undergraduate studies at the School of Chemical Engineering of the National Technical University of Athens, as a necessary prerequisite for the acquisition of the respective diploma.

First, I would like to thank my supervisor, Associate Professor Aggelos Tsakanikas, for giving me the opportunity to elaborate on such an interesting subject and for his valuable guidance and suggestions. His help and knowledge will accompany me throughout my career. I would also like to thank Petros Dimas, PhD candidate of the Laboratory of Industrial and Energy Economics (LIEE) at NTUA, for his cooperation and patience to all my questions, that helped to complete this thesis. I would also like to thank Professor Constantina Tzia for her contribution on the food-science related part of the thesis, the Library of Athens University of Economics and Business, the Hellenic Economic Library Network and ICAP for their help to acquire the necessary data for the Greek market.

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Trougkos Vasileios

Abstract

The creation of a new product or the implementation of a new innovation in an already existing product is a complicated process, that encompasses numerous and different steps and processes. Some of them are common among the different sectors of the economy, while others are special and adapted to the specific requirements and requisites of each sector, the consumer target group or the abilities that the product offers. The main objective of this thesis is to illuminate these processes and necessary steps that are needed in order to develop and finally launch a new product in the market. For this objective to be fulfilled, the example of a new instant soup product is used, which was developed in the frame of my internship at the Nestlé Research Centre in Lausanne with the target brand Maggi.

The thesis begins with an introduction to food, its use and constituents, mentioning the different categories into which it can be divided, as well as the reasons of its degradation, and, as a consequence, the need for its preservation and the existing conservation processes. Next, the very important factor of food safety is explained through the Hazard Analysis of Critical Control Points (HACCP). Once the introduction is completed, the thesis describes the different drying processes that are in use or being developed, focusing on freeze-drying, due to the specific requirements of the example of dry soups. A large part of the thesis analyzes the integral and intricate part of food labelling, nutrition declaration and nutrition and health claims that a food product can carry, citing the regulations and guidelines of the World Health Organization (WHO) and Food and Agriculture Organization (FAO) of the United Nations, as well as the respective ones from the European Commission. Additionally, two tools used for the creation of the business plan, aiming to the discovery and improvement of the product's characteristics and prospects, are presented: the Business Model Canvas and the SWOT analysis. Finally, the thesis ends with an overview of the Greek market for ready meals, based on ICAP's analysis for the respective sector under which the dry soups fall, in order to explore the potential of the product's launch in Greece.

All the steps described above were implemented for the development of a new innovative product with Maggi as target brand. A new concept idea that answers the needs of consumers was created – a series of new dry soups with novel recipes and ingredients – with the application of a new technology, in order to improve the total appeal of the product to the consumer (freeze-drying method). The necessary prototypes were developed, and their nutritional values, claims and costs were calculated; their packaging, labels and respective symbols were created; their safety was checked, in accordance to HACCP guidelines. Furthermore, the Business Model Canvas and the SWOT analysis of these products were completed, as well as a market analysis of the three possible markets

for the first launch (Germany, France and United Kingdom), based on data from Mintel, the CIA World Factbook and internal marketing tools of Nestlé. Finally, the Greek market analysis was accompanied by a recognition and penetration consumer survey between Knorr and Maggi.

The results show that Germany is the preferred driver market due to its larger size and consumer habits, in spite of existing competition, while the Greek market cannot stand alone, due to its very small size for dry soups and the high competition. However, the consumer survey leaves enough room for improvement and growth. The products themselves can carry various nutrition and health claims that are important to consumers and the current trends. Finally, the freeze-drying process has important advantages, such as its ability to produce excellent and healthy powders, with instant reconstitution. Nevertheless, it is an energy-intensive process, an element that does not favour its industrial implementation and requires further research and development, which can revolutionize dry food in powder form.

Extended abstract in Greek

Η δημιουργία ενός νέου προϊόντος ή η εφαρμογή μιας νέας καινοτομικής ιδέας σε ένα ήδη υπάρχον προϊόν αποτελεί μια σύνθετη διαδικασία, η οποία περιλαμβάνει πλήθος διαφορετικών βημάτων και διεργασιών. Κάποια από αυτά είναι παρόμοια για τους διάφορους τομείς της οικονομίας, ενώ άλλα είναι ειδικά και προσαρμοσμένα στις ιδιαίτερες απαιτήσεις και προδιαγραφές κάθε τομέα, στον καταναλωτή-στόχο ή στις δυνατότητες που προσφέρει το προϊόν. Ο βασικός στόχος αυτής της διπλωματικής εργασίας είναι να ρίξει φως σε αυτές τις διεργασίες οι οποίες χρειάζονται, ώστε να δημιουργηθεί και να εισαχθεί στην αγορά ένα νέο προϊόν. Για να εκπληρωθεί αυτός ο στόχος, χρησιμοποιείται το παράδειγμα της παραγωγής μιας νέας αφυδατωμένης σούπας, η οποία παρασκευάστηκε στο Ερευνητικό Κέντρο της Nestlé στη Λωζάνη, για την εταιρεία Maggi της Nestlé.

Ειδικότερα, πραγματοποιείται μια εισαγωγή στα τρόφιμα και στα προϊόντα τροφίμων, στα ιδιαίτερα χαρακτηριστικά τους, στην ποιότητά τους και στα μέτρα ασφαλείας που πρέπει να ακολουθούνται κατά την παραγωγή τους. Στη συνέχεια, γίνεται αναφορά στη βιομηχανική μέθοδο της ξήρανσης/αφυδάτωσης και στους διάφορους τρόπους – υπάρχοντες και αναπτυσσόμενους – με τους οποίους μπορεί να πραγματοποιηθεί. Ειδική μνεία γίνεται για τη μέθοδο ξήρανσης υπό κατάψυξη, η οποία χρησιμοποιείται για την παραγωγή των πρωτότυπων των σχεδιαζόμενων προϊόντων αφυδατωμένης σούπας. Επιπλέον, πραγματοποιείται μια ανάλυση των κανόνων και κανονισμών του Οργανισμού Ηνωμένων Εθνών (ΟΗΕ), και συγκεκριμένα του Διεθνούς Οργανισμού Αγροτικών Προϊόντων και Τροφίμων και του Παγκόσμιου Οργανισμού Υγείας (ΠΟΥ), καθώς και των κανόνων της Ευρωπαϊκής Ένωσης που έχει θεσμοθετήσει η Ευρωπαϊκή Επιτροπή κυρίως μέσω του Κανονισμού της Ευρωπαϊκής Ενώσεως 1169/2011. Οι κανονισμοί αυτοί ρυθμίζουν το περιεχόμενο και τον τρόπο με τον οποίο πρέπει να παρουσιάζονται στην ετικέτα των προϊόντων τροφίμων οι διατροφικές πληροφορίες, οι διατροφικοί ισχυρισμοί και οι ισχυρισμοί υγείας.

Με την ολοκλήρωση των παραπάνω, η Διπλωματική μελέτη προχωράει στην περιγραφή δύο εργαλείων που χρησιμοποιούνται για τη δημιουργία του επιχειρηματικού σχεδίου και του σχεδίου για την έξοδο του προϊόντος στην αγορά. Τα εργαλεία αυτά είναι το Business Model Canvas και η ανάλυση SWOT. Ακόμα, πραγματοποιείται μια επόπτευση της ελληνικής αγοράς έτοιμων φαγητών, στην οποία εντάσσονται οι αφυδατωμένες σούπες, με σκοπό τη διερεύνηση της δυνατότητας κυκλοφορίας στην ελληνική αγορά του σχεδιαζόμενου προϊόντος. Στο σημείο αυτό ολοκληρώνεται η θεωρητική ανάλυση των χρησιμοποιηθέντων εργαλείων και πληροφοριών στη μελέτη και ακολουθεί λεπτομερής αναφορά στη μεθοδολογία που ακολουθήθηκε για τη δημιουργία, σχεδιασμό και ανάπτυξη του υπό μελέτη προϊόντος: τις αφυδατωμένες σούπες. Η ανάλυση αυτή περιέχει τόσο τα βήματα για τη σύλληψη και τη δημιουργία της ιδέας του νέου και καινοτόμου προϊόντος, όσο και τις

διεργασίες που χρησιμοποιήθηκαν για την παρασκευή και παραγωγή των προτοτύπων αυτού. Επίσης, αναλύεται και ο τρόπος επιλογής της αγοράς-οδηγού για την πρώτη κυκλοφορία του προϊόντος, με τη βοήθεια ειδικών εργαλείων υπολογισμού της Nestlé. Στη συνέχεια, παρουσιάζονται και σχολιάζονται τα αποτελέσματα των παραπάνω διαδικασιών: δηλαδή τα χαρακτηριστικά του προϊόντος, η διατροφική του αξία, η συσκευασία του και τα χαρακτηριστικά της, οι πρώτες ύλες και οι διεργασίες που αυτά υφίστανται, το επιχειρηματικό σχέδιο και η επιλογή της αγοράς-οδηγού, καθώς και τα αποτελέσματα της ανάλυσης της ελληνικής αγοράς των έτοιμων φαγητών, μαζί με μια έρευνα αναγνωρισιμότητας και αρέσκειας των προϊόντων των ανταγωνιστριών εταιρειών Knorr και Maggi. Τέλος, παρουσιάζονται τα συνολικά και τελικά συμπεράσματα των ανωτέρω, καθώς και τα θέματα τα οποία χρήζουν περαιτέρω μελέτης και έρευνας για την ανάπτυξη και τελειοποίηση του προϊόντος στο μέλλον.

Πιο αναλυτικά, όπως προαναφέρθηκε, πραγματοποιείται μια εισαγωγή στα τρόφιμα και τα συστατικά τους, αναφέροντας τις διάφορες ομάδες στις οποίες μπορούν να κατηγοριοποιηθούν, καθώς και τις αιτίες της αλλοίωσής τους και την, ως αποτέλεσμα, ανάγκη για συντήρησή τους μαζί με τις υπάρχουσες μεθόδους που το επιτυγχάνουν αυτό. Επιπλέον, γίνεται μια σύντομη αναφορά στα οργανοληπτικά χαρακτηριστικά των τροφίμων, στη σημασία και στο ρόλο τους στην ποιότητα των τροφίμων, στα διάφορα είδη οργανοληπτικών ελέγχων που υπάρχουν και στην επιλογή και προετοιμασία των ειδικευμένων εξεταστών και του ειδικευμένου οργανοληπτικού εργαστηρίου. Στη συνέχεια, εξηγείται ο πολύ σημαντικός παράγοντας της ασφάλειας των τροφίμων μέσω της προσέγγισης του HACCP (Ανάλυση Επικινδυνότητας στα Κρίσιμα Σημεία Ελέγχου), όπως και η σημασία της ορθής βιομηχανικής πρακτικής (GMP) και της υγιεινής των τροφίμων.

Η ανάλυση HACCP χωρίζεται στις 7 αρχές της, οι οποίες αναλύονται μία προς μία με σκοπό την εκτίμηση της πιθανότητας εμφάνισης διαφόρων κινδύνων και της επικινδυνότητάς τους. Περιληπτικά, οι 7 αρχές της μεθόδου HACCP περιλαμβάνουν, αντίστοιχα, την ανάλυση επικινδυνότητας, την εύρεση των κρίσιμων σημείων ελέγχου (Critical Control Points, CCPs) μέσω ενός δένδρου αποφάσεων, τον ορισμό συγκεκριμένων ορίων στα κρίσιμα σημεία ελέγχου (για παράδειγμα όρια θερμοκρασίας ή/και χρόνου, μεταξύ άλλων), την εφαρμογή συστήματος παρακολούθησης των ορίων των κρίσιμων σημείων ελέγχου, την εφαρμογή διορθωτικών ενεργειών σε περίπτωση απόκλισης από τα προαναφερθέντα όρια, την επιβεβαίωση και αξιολόγηση της παραπάνω ανάλυσης HACCP και την αρχειοθέτηση και τήρηση όλων των διαδικασιών και αρχείων σχετικών με την ανάλυση HACCP.

Με την ολοκλήρωση της εισαγωγής, η Διπλωματική μελέτη εστιάζει στις διαφορετικές υπάρχουσες διεργασίες αφυδάτωσης που χρησιμοποιούνται ή αναπτύσσονται, και ειδικά στην ξήρανση υπό κατάψυξη, λόγω των ειδικών απαιτήσεων της περίπτωσης της αφυδατωμένης σούπας. Αναφέρονται τα προτερήματα της αφυδάτωσης ορισμένων τροφίμων, ως μέσου συντήρησής τους, με στόχο την αύξηση της διατηρησιμότητάς τους και τη δυνατότητα μεταφοράς τους. Εντοπίζονται οι διαφορές της αφυδάτωσης σε σχέση με άλλες μεθόδους συντήρησης όπου εφαρμόζεται η απομάκρυνση νερού από το τρόφιμο, όπως η αφυδάτωση με υψηλή ωσμωτική πίεση, και γίνεται περιορισμένη αναφορά στα διάφορα είδη ξηραντήρων. Επίσης, γίνεται αναφορά στην ενεργότητα του νερού, η οποία πρέπει να βρίσκεται κάτω του 0.65 σε ένα αφυδατωμένο τρόφιμο, ώστε να αποτρέπεται η ανάπτυξη μικροοργανισμών σε αυτό. Ωστόσο, επισημαίνεται πως μόνο η μέτρηση και εύρεση της ενεργότητας του νερού του τροφίμου κάτω του 0.65 δεν εξασφαλίζει την ασφάλεια του τροφίμου, καθώς δεν καταστρέφονται οι ήδη υπάρχοντες μικροοργανισμοί, απλώς αναστέλλεται η δράση τους. Για πληρέστερο έλεγχο της ασφάλειας του αφυδατωμένου τροφίμου θα πρέπει να μετρείται και το μικροβιολογικό φορτίο του, ενώ ταυτόχρονα να τηρούνται οι κανόνες υγιεινής και ορθής βιομηχανικής πρακτικής, ώστε να ελαχιστοποιείται ο κίνδυνος επιμόλυνσής του.

Στη συνέχεια, αναφέρονται μερικά από τα πολλά είδη και διεργασίες ξήρανσης, όπως η παραδοσιακή και προβιομηχανική διεργασία της ξήρανσης στον ήλιο, η διαδεδομένη ξήρανση με θερμό αέρα, η ξήρανση υπό κενό, η ξήρανση με μικροκύματα, η ξήρανση με ψεκασμό, η ξήρανση με υπερήχους και η ξήρανση υπό κατάψυξη. Ειδικά στην τελευταία, γίνεται ειδική αναφορά και ανάλυση του τρόπου λειτουργίας της, καθώς χρησιμοποιείται ως μέθοδος ξήρανσης για την παρασκευή των πρωτοτύπων των προϊόντων της αφυδατωμένης σούπας. Τέλος, αναφέρονται τομείς που χρήζουν περαιτέρω μελέτης για τη βελτίωση της διεργασίας της ξήρανσης υπό κατάψυξη και την καλύτερη και αποδοτικότερη εφαρμογή της σε βιομηχανική κλίμακα.

Ένα μεγάλο μέρος της Διπλωματικής εργασίας αναλύει τον διαρθρωτικό και περίπλοκο ρόλο της επισήμανσης των τροφίμων, της διατροφικής δήλωσης, των διατροφικών ισχυρισμών και των ισχυρισμών υγείας που μπορεί να φέρει ένα τρόφιμο. Ανά τον κόσμο υπάρχουν διάφοροι κρατικοί και διεθνείς οργανισμοί που με τις αποφάσεις τους ρυθμίζουν τα ανωτέρω, ωστόσο η Διπλωματική εστιάζει στους κανονισμούς και στις ρυθμίσεις (Codex Alimentarius) του Οργανισμού Αγροτικών Προϊόντων και Τροφίμων του ΟΗΕ και του Παγκόσμιου Οργανισμού Υγείας, οι οποίοι αποτελούν τη ραχοκοκαλιά όλων των άλλων κανονισμών των αρχών παγκοσμίως.

Σύμφωνα με τον Codex Alimentarius, η επισήμανση των τροφίμων, δηλαδή το τι και πώς περιλαμβάνεται στην ετικέτα του κάθε τροφίμου, είναι συγκεκριμένη και πρέπει να ακολουθεί αυστηρούς κανόνες, ώστε να προστατεύεται ο καταναλωτής. Η λίστα των κανονισμών περιλαμβάνει

οδηγίες σχετικά με το όνομα του προϊόντος, τα συστατικά του (περιεκτικότητα, ονοματολογία και κατηγοριοποίηση, παρουσία αλλεργιογόνων, προσθετικών κλπ.), το καθαρό και αποστραγγισμένο βάρος, τα στοιχεία του παραγωγού, τη χώρα προέλευσης, την ιχνηλάτηση, την αναγραφή των απαραίτητων ημερομηνιών και των συνθηκών αποθήκευσης και τυχούσες οδηγίες για τη σωστή χρήση του προϊόντος. Επιπλέον, ο Codex Alimentarius ορίζει πως όποια πληροφορία αναγράφεται, θα πρέπει να είναι αληθινή, κατανοητή και καθόλου παραπλανητική, ενώ η ετικέτα θα πρέπει να βρίσκεται σε εμφανές σημείο και να είναι ευανάγνωστη και σε γλώσσα απλή και κατανοητή από τον καταναλωτή.

Σχετικά με τη διατροφική δήλωση, ο Codex Alimentarius δηλώνει πως σκοπός της είναι να εξασφαλίσει και να προστατέψει την υγεία των καταναλωτών, βοηθώντας τους να διαλέξουν το προϊόν που επιθυμούν ελεύθερα και με σαφή και αληθή ενημέρωση και πληροφορία. Υπάρχουν συστατικά τα οποία πρέπει υποχρεωτικώς να αναφέρονται στη διατροφική δήλωση του προϊόντος, όπως η ενέργεια, οι πρωτεΐνες, οι υδατάνθρακες (φυτικές ίνες και μη), τα λίπη, καθώς και οποιοδήποτε διατροφικό συστατικό πάνω στο οποίο στηρίζεται οποιοσδήποτε διατροφικός ισχυρισμός ή ισχυρισμός υγείας. Επιπροσθέτως, ο Codex Alimentarius ορίζει με ενιαίο τρόπο διεθνώς την παρουσίαση των παραπάνω πληροφοριών και τον τρόπο με τον οποίο θα πρέπει να εκφράζονται τα αντίστοιχα μεγέθη, όπως μονάδες και αναλογία, ενώ αναφέρει και τις διάφορες τιμές ημερήσιας προσλαμβανόμενης ποσότητας, ώστε να μπορεί ένα τρόφιμο να φέρει τον αντίστοιχο διατροφικό ισχυρισμό.

Σχετικά με τους ισχυρισμούς που μπορεί ένα τρόφιμο να φέρει, ο Codex Alimentarius αναγνωρίζει τρεις κατηγορίες ισχυρισμών: τους «απαγορευμένους ισχυρισμούς», τους «πιθανώς παραπλανητικούς ισχυρισμούς» και τους «ισχυρισμούς υπό προϋποθέσεις». Οι δύο πρώτοι πρέπει να αποφεύγονται, καθώς είτε δεν μπορούν να αποδειχθούν, είτε είναι ασαφείς και παραπλανητικοί για τον καταναλωτή. Αντίθετα, η τρίτη κατηγορία ισχυρισμών, περιλαμβάνει 7 υποκατηγορίες που επιτρέπονται, υπό προϋποθέσεις. Επιπλέον, ο Codex Alimentarius ρυθμίζει τη χρήση των διατροφικών ισχυρισμών και των ισχυρισμών υγείας, αναγνωρίζοντας και υποδεικνύοντας το πώς πρέπει να χρησιμοποιούνται και να αναφέρονται οι ισχυρισμοί διατροφικής περιεκτικότητας, οι συγκριτικοί διατροφικοί ισχυρισμοί και οι ισχυρισμοί υγείας, θέτοντας και τα αντίστοιχα όρια για κάθε διατροφικό συστατικό.

Ωστόσο, καθώς το υπό σχεδιασμό προϊόν πρόκειται να κυκλοφορήσει στην ευρωπαϊκή αγορά, η Διπλωματική εστιάζει και στους ευρωπαϊκούς κανονισμούς που έχουν θεσμοθετηθεί σχετικά με την επισήμανση των τροφίμων, τη διατροφική δήλωση που τα συνοδεύει και τους ισχυρισμούς που φέρουν. Οι ρυθμίσεις της Ευρωπαϊκής Επιτροπής επικεντρώνονται περισσότερο στη διαφύλαξη της

υγείας του καταναλωτή, παρ'όλο που στο μεγαλύτερο μέρος τους ακολουθούν τους κανονισμούς του ΟΗΕ και του ΠΟΥ. Ο κεντρικός κανονισμός της ΕΕ που ασχολείται με την επισήμανση των τροφίμων είναι ο Κανονισμός 1169/2011, ο οποίος αντικατέστησε προηγούμενους κανονισμούς και οδηγίες και μέσω λίγων τροπολογιών έχει λάβει πλέον την τελική του μορφή. Όπως και ο Codex Alimentarius, έτσι και ο Κανονισμός 1169/2011 ορίζει πως οποιαδήποτε πληροφορία πάνω στην ετικέτα πρέπει να είναι αληθινή, κατανοητή, μη παραπλανητική, να μπορεί να αποδειχθεί και να μην υπονοεί πρόληψη ή θεραπεία ασθενειών.

Επίσης, ο Κανονισμός 1169/2011 αναφέρει τις κατηγορίες των τροφίμων που πρέπει να αναφέρονται στην ετικέτα του τροφίμου, ενώ μέσω των παραρτημάτων του ρυθμίζει πολλές πτυχές της επισήμανσης, της διατροφικής δήλωσης και των ισχυρισμών των τροφίμων. Ειδικότερα, ορίζει τα δικά του όρια για τις ημερήσιες προσλαμβανόμενες ποσότητες διατροφικών συστατικών και για τη δυνατότητα να φέρει ένα τρόφιμο ορισμένους ισχυρισμούς, ορισμένα από τα οποία διαφέρουν από τα αντίστοιχα του ΟΗΕ. Τέλος, σε συνδυασμό με τον Κανονισμό 1924/2006, ρυθμίζονται οι ισχυρισμοί που μπορεί να φέρει ένα τρόφιμο και οι τρόποι παρουσίασής τους, ενώ απαγορεύει ρητά τη χρήση ισχυρισμών που υπονοούν πως η μη κατανάλωση ενός τροφίμου μπορεί να έχει επιβλαβείς συνέπειες στην υγεία του καταναλωτή, ισχυρισμών που αναφέρονται σε ρυθμό ή ποσό απώλειας βάρους και ισχυρισμών που αναφέρονται σε συστάσεις μεμονωμένων ιατρών η επαγγελματιών υγείας, εκτός και αν προβλέπουν διαφορετικά οι εθνικοί νόμοι και κανονισμοί.

Με την ολοκλήρωση της ανάλυσης των κανόνων και κανονισμών του ΟΗΕ και της ΕΕ, η Διπλωματική ασχολείται με το επιχειρηματικό σχέδιο για την κυκλοφορία του προϊόντος στην αγορά. Πιο συγκεκριμένα, παρουσιάζονται δύο εργαλεία που χρησιμοποιούνται στη δημιουργία του επιχειρηματικού σχεδίου, τα οποία στοχεύουν στην ανακάλυψη και βελτίωση των χαρακτηριστικών και προοπτικών του προϊόντος: το Business Model Canvas (BMC) ή Καμβά Επιχειρηματικού Σχεδίου και την ανάλυση SWOT.

Το BMC αποτελεί ένα γραφιστικό εργαλείο, το οποίο βοηθά στην οπτικοποίηση των διαφορετικών τομέων της επιχείρησης με σκοπό την ανάλυση του επιχειρηματικού σχεδίου και την καλύτερη κατηγοριοποίηση των πόρων και των δυνατοτήτων αυτής. Έτσι, η επιχείρηση επιμερίζεται σε 9 κατηγορίες, οι οποίες περιλαμβάνουν από τους βασικούς συνεργάτες και τις δραστηριότητες της εταιρίας, μέχρι την οικονομική δομή και τις σχέσεις με τους πελάτες της. Επιπλέον, πέρα από το κλασικό BMC, έχουν δημιουργηθεί και άλλες μορφές του, οι οποίες συνυπολογίζουν και άλλους παράγοντες στη λειτουργία της εταιρίας, όπως το περιβαλλοντικός BMC, το κοινωνικός BMC και τα ειδικότερα BMC απαίτησης-απόκρισης και ηθικός BMC.

Η ανάλυση SWOT αποτελεί ένα εργαλείο με το οποίο καθίσταται δυνατή η οπτικοποίηση των προοπτικών μιας εταιρίας ή ενός προϊόντος και συνήθως συνοδεύει την ανάλυση του BMC. Ειδικότερα, το όνομα της ανάλυσης προκύπτει από τα αρχικά στα αγγλικά των τεσσάρων κατηγοριών στις οποίες χωρίζεται η ανάλυση SWOT (Strengths, Weaknesses, Opportunities and Threats). Δηλαδή η ανάλυση SWOT καταγράφει τις δυνάμεις, τις αδυναμίες, τις ευκαιρίες και τις απειλές της εταιρίας, τόσο εσωτερικά, όσο και εξωτερικά. Με αυτόν τον τρόπο, η εταιρία μπορεί να εντοπίσει στρατηγικά πλεονεκτήματα και μειονεκτήματα, να λάβει ευκολότερα ορθότερες αποφάσεις, να βελτιωθεί όπου υστερεί, να προστατέψει τα πλεονεκτήματά της, να ενισχυθεί όπου μπορεί και να προσαρμοστεί στις διαρκώς μεταβαλλόμενες συνθήκες, υιοθετώντας αποτελεσματικότερες στρατηγικές. Τέλος, η ανάλυση SWOT μπορεί να εφαρμοστεί παντού και όχι μόνο στη βιομηχανία τροφίμων.

Επιπλέον της παραπάνω ανάλυσης του επιχειρηματικού σχεδίου, στη Διπλωματική εργασία πραγματοποιείται μια επισκόπηση της ελληνικής αγοράς έτοιμων (ή στιγμιαίων) προϊόντων τροφίμων, βασισμένη στην αντίστοιχη ανάλυση τομέα της ICAP, στον οποίον ανήκουν οι αφυδατωμένες σούπες. Σύμφωνα με αυτήν, ο σύγχρονος τρόπος ζωής με τους έντονους ρυθμούς του και η μεταβαλλόμενη οικογενειακή διάρθρωση στην Ελλάδα αποτελούν σημαντικούς παράγοντες για την ανάπτυξη της αγοράς των στιγμιαίων τροφίμων. Ακόμα, η μελέτη της ICAP αναλύει μερικές από τις επιχειρήσεις του κλάδου που κυριαρχούν σε σχέση με την πιστωτική τους ικανότητα, τον κύκλο εργασιών τους και τις προοπτικές τους, μεταξύ άλλων, με τη βοήθεια ορισμένων χρηματοοικονομικών δεικτών, όπως δείκτες κερδοφορίας, ρευστότητας, αποδοτικότητας, χρηματοοικονομικής διάρθρωσης και δραστηριότητας. Τέλος, η μελέτη επισημαίνει πως το μερίδιο των αφυδατωμένων στιγμιαίων τροφίμων, όπως οι αφυδατωμένες σούπες, αποτελεί ένα πολύ μικρό τμήμα του συγκεκριμένου κλάδου, με υψηλό ανταγωνισμό και μικρό περιθώριο κερδοφορίας, ενώ προτείνει και τρόπους ώστε μια εταιρία να εισέλθει ή να εδραιώσει την παρουσία της στον κλάδο. Η παραπάνω μελέτη της ICAP συμβάλει στην προσπάθεια εκτίμησης της ελληνικής αγοράς για τη δυνατότητα κυκλοφορίας σε αυτήν του σχεδιαζόμενου προϊόντος αφυδατωμένων σουπών.

Όλη η παραπάνω εισαγωγική ανάλυση της Διπλωματικής εργασίας θέτει τα θεμέλια για το σχεδιασμό και την ανάπτυξη ενός καινοτόμου προϊόντος με τελικό στόχο την κυκλοφορία του στην αγορά. Το νέο προϊόν, το οποίο σχεδιάστηκε σε συνεργασία με τη Nestlé στο ερευνητικό της κέντρο στη Λωζάνη της Ελβετίας από τον Οκτώβριο του 2018 μέχρι τον Απρίλιο του 2019 για λογαριασμό της Maggi, θυγατρικής της Nestlé, είναι μια σειρά από πέντε αφυδατωμένες σούπες. Η καινοτομία των σουπών έγκειται στη μέθοδο που προτείνεται να χρησιμοποιηθεί για την παραγωγή τους, στις συνταγές και στις γεύσεις τους και, σε βάθος χρόνου, στη συσκευασία τους.

Η νέα ιδέα του προϊόντος που δημιουργήθηκε, ανταποκρίνεται στις ανάγκες των καταναλωτών – υγιεινά και ποιοτικά τρόφιμα, μικρός χρόνος προετοιμασίας, νέες εμπειρίες, αίσθηση σπιτικού φαγητού. Για την παραγωγή του προϊόντος εφαρμόστηκε μια νέα τεχνολογία που βελτιώνει την ελκυστικότητα του προϊόντος στον καταναλωτή (ξήρανση υπό κατάψυξη), καθώς διατηρεί τα περισσότερα οργανοληπτικά χαρακτηριστικά του τροφίμου μετά τη διεργασία της ξήρανσης. Αυτό αποτελεί ένα συγκριτικό πλεονέκτημα της συγκεκριμένης μεθόδου σε σχέση με άλλες διεργασίες ξήρανσης και αφυδάτωσης.

Τα βήματα που ακολουθήθηκαν ξεκινούν με τη σύλληψη και τη δημιουργία της ιδέας του προϊόντος, συνεχίζουν με το σχεδιασμό και την ανάπτυξη του προϊόντος μέσα από εργαστηριακούς ελέγχους, μετρήσεις, δοκιμές και παραγωγή πρωτοτύπων σε μικρή κλίμακα μέσω ενός εργοστασίου πιλότου (pilot plant) και καταλήγουν με τη μαζική παραγωγή του προϊόντος και την κυκλοφορία του στην αγορά. Με τη βοήθεια ειδικών εργαλείων ανάλυσης της αγοράς και των τάσεων των καταναλωτών, όπως της Mintel και της Nestlé, σχεδιάστηκε ένα προϊόν το οποίο ακολουθεί τις τάσεις και απαντά στις ανάγκες των υποψήφιων καταναλωτών. Μετά τη δημιουργία της ιδέας και το σχεδιασμό της διεργασίας που επρόκειτο να ακολουθηθεί, πραγματοποιήθηκε έλεγχος αυτής μέσω της ανάλυσης HACCP με τη βοήθεια του αντίστοιχου τμήματος της Nestlé και λήφθηκαν τα απαραίτητα μέτρα, ώστε να διασφαλιστεί η ασφάλεια των πρωτοτύπων που θα αναπτύσσονταν. Στο σημείο αυτό, λόγω της μικρής ποσότητας παραγωγής και της απλής διεργασίας, χρειάστηκε να μετρηθεί μόνο η ενεργότητα του νερού των αφυδατωμένων με ξήρανση υπό κατάψυξη σουπών. Όταν το προϊόν θα έφτανε στη μαζική παραγωγή, θα εφαρμοζόταν εκ νέου η ανάλυση HACCP στην τελική διεργασία.

Οι συνταγές των πέντε σουπών σχεδιάστηκαν και δοκιμάστηκαν στο εργαστήριο δημιουργικής μαγειρικής (Creative Food Lab) του ερευνητικού κέντρου της Nestlé. Κάθε φορά που ολοκληρωνόταν μια παρτίδα, ελεγχόταν η ενεργότητα νερού καθώς και η επανενυδάτωση και τα οργανοληπτικά χαρακτηριστικά των σουπών. Με βάσει τα αποτελέσματα αυτά, πραγματοποιήθηκε μια σειρά αλλαγών στις αρχικές σούπες.

Μετά την τελειοποίηση των συνταγών των πρωτοτύπων, εκτιμήθηκε η διατροφική τους αξία, η οποία ωστόσο θα πρέπει να ελεγχθεί και να υπολογιστεί και εργαστηριακά, πριν τη μαζική παραγωγή του προϊόντος. Σύμφωνα με την παραπάνω διατροφική αξία, συμπληρώθηκε η διατροφική δήλωση των προϊόντων και βρέθηκαν οι διατροφικοί ισχυρισμοί και οι ισχυρισμοί υγείας που μπορούσε να φέρει η κάθε σούπα. Στη συνέχεια, εκτιμήθηκε το κόστος της κάθε σούπας, βάσει των συστατικών της, και πραγματοποιήθηκε μια ανάλυση σύγκρισης των κόστεων αυτών σε σχέση με τη διεργασία που έχουν υποστεί τα συστατικά των σουπών (φρέσκα ή αφυδατωμένα με θερμό αέρα ή αφυδατωμένα με ξήρανση υπό κατάψυξη). Ταυτόχρονα με τα ανωτέρω, δημιουργήθηκαν οι συσκευασίες των

προϊόντων και σχεδιάστηκαν, με τη βοήθεια των σχεδιαστών της Nestlé, οι διατροφικές ετικέτες, τα σύμβολά και οι περιγραφές των σουπών που θα εμφανίζονταν πάνω στη συσκευασία της καθεμιάς.

Επίσης, συμπληρώθηκε το Business Model Canvas και η ανάλυση SWOT των προϊόντων, ενώ πραγματοποιήθηκε και η ανάλυση των τριών πιθανών αγορών για την πρώτη κυκλοφορία του προϊόντος, σε Γερμανία, Γαλλία και Ηνωμένο Βασίλειο. Αυτή η ανάλυση έγινε με βάση τα δεδομένα της Mintel, του CIA World Factbook και των εσωτερικών εργαλείων ανάλυσης αγοράς της Nestlé, από τα οποία εκτιμήθηκαν οι πιθανοί καταναλωτές των σουπών και τα πιθανά κέρδη με βάση τα εκτιμώμενα περιθώρια κέρδους και τη διείσδυση στην αγορά. Τέλος, η ανάλυση της ελληνικής αγοράς, η οποία πραγματοποιήθηκε με τα ίδια εργαλεία όπως και αυτές σε Γερμανία, Γαλλία και Ηνωμένο Βασίλειο, συνοδεύεται από μια «έρευνα καταναλωτή» σε 98 υποψήφιους καταναλωτές με στόχο τη μέτρηση της αναγνωρισιμότητας και της διεισδυτικότητας των αντίστοιχων προϊόντων των ανταγωνιστριών εταιρειών Knorr και Maggi.

Το αποτέλεσμα των παραπάνω βημάτων και συνιστωσών διαδικασιών ήταν η δημιουργία ενός νέου και καινοτόμου προϊόντος: μιας σειράς πέντε αφυδατωμένων σουπών. Οι σούπες αυτές σχεδιάστηκαν, ώστε να ανταποκρίνονται στις ανάγκες και τις απαιτήσεις των καταναλωτών για υγιεινό φαγητό με μικρό χρόνο προετοιμασίας, το οποίο σέβεται το περιβάλλον και προσφέρει νέες γευστικές εμπειρίες. Η σειρά αυτή των προϊόντων αποτελείται από σούπες παρασκευασμένες με πέντε διαφορετικές συνταγές, η καθεμία εκ των οποίων εμπνέεται από παραδοσιακές συνταγές από καθεμία από τις πέντε ηπείρους και προσφέρει νέους γευστικούς συνδυασμούς. Αυτή η ιδιότητα δίνει και το όνομα στη σειρά των προϊόντων: “Around the World in 5 Soups” («Ο γύρος του κόσμου σε 5 σούπες»). Καθώς οι συνταγές των αφυδατωμένων σουπών στηρίζονται σε παραδοσιακές συνταγές από όλον τον κόσμο, για την παραγωγή τους χρησιμοποιήθηκαν και πολλά συστατικά από όλον τον κόσμο.

Σε συνεργασία με το τμήμα των σχεδιαστών της Nestlé δημιουργήθηκαν τα ονόματα των σουπών (“Africana”, “Amerinca”, “Celtae”, “Dragonlong” και “Oceander”), τα σλόγκαν και οι περιγραφές τους, ενώ οριστικοποιήθηκαν και τα χρώματα και τα σύμβολα που θα συνοδεύουν την κάθε σούπα στη συσκευασία της. Σχετικά με τη συσκευασία των αφυδατωμένων προϊόντων, προτάθηκαν διάφορες ιδέες συσκευασίας. Τελικά, επιλέχθηκε η πιο απλή, συγκεκριμένα η δημιουργία και ο σχεδιασμός ενός χάρτινου πακέτου-φακέλου (sachet), το οποίο θα φέρει όλες τις απαραίτητες πληροφορίες σύμφωνα με τους ισχύοντες κανονισμούς, και το οποίο θα είναι επικαλυμμένο εσωτερικά με ειδική επιφάνεια, ώστε να περιορίζεται η διαπερατότητα του χαρτονιού σε υγρασία και αέρα. Σε πιο μακροπρόθεσμο πλάνο, ωστόσο, προτάθηκε η δημιουργία ειδικής συσκευασίας, την οποία θα μπορεί να έχει μαζί του ο καταναλωτής και να τη χρησιμοποιεί για την παρασκευή της σούπας με την

απευθείας προσθήκη ζεστού νερού. Επιπλέον, προτάθηκε αυτή η συσκευασία να μην είναι μόνο μίας χρήσεως, αλλά επαναλαμβανόμενης, συμβάλλοντας έτσι στην επίτευξη του στόχου της Nestlé για περιορισμό των πλαστικών και άλλων αποβλήτων. Τέλος, προτάθηκαν και δύο μοντέλα πώλησης του προϊόντος. Το πρώτο μοντέλο προτείνει την πώληση ξεχωριστά της κάθε σούπας, ενώ το δεύτερο συμπεριλαμβάνει και τη δυνατότητα πώλησης και των πέντε σε ένα πακέτο.

Σχετικά με την επισήμανση των προϊόντων, τις διατροφικές τους δηλώσεις, τους διατροφικούς τους ισχυρισμούς και τους ισχυρισμούς υγείας που μπορούν να φέρουν, εκτιμήθηκαν τα διατροφικά συστατικά και με βάση αυτά οι διατροφικές αξίες της κάθε σούπας (ενέργεια, πρωτεΐνες, υδατάνθρακες, φυτικές ίνες, λίπη, σάκχαρα, βιταμίνες και ιχνοστοιχεία), ανά 100g προϊόντος και ανά μερίδα (30g). Ακολουθώντας τους κανονισμούς της Ευρωπαϊκής Επιτροπής και τα όρια τα οποία έχει θέσει, βρέθηκαν οι διάφοροι διατροφικοί ισχυρισμοί και οι προτεινόμενοι ισχυρισμοί υγείας. Η κάθε αφυδατωμένη σούπα φέρει τους δικούς της ισχυρισμούς, αφού η καθεμία περιέχει διαφορετικά συστατικά και σε διαφορετικές ποσότητες. Ορισμένοι από αυτούς είναι οι ισχυρισμοί: χωρίς γλουτένη, βιολογικό/οργανικό προϊόν, κατάλληλο για χορτοφάγους και πηγή χαμηλής ή υψηλής περιεκτικότητας βιταμινών και ιχνοστοιχείων (ανάλογα με την ποσότητα και τα όρια κάθε βιταμίνης ή ιχνοστοιχείου για κάθε σούπα).

Όσον αφορά τα συστατικά και τη φύση τους, καθώς η προτεινόμενη διεργασία παραγωγής των αφυδατωμένων σουπών (ξήρανση υπό κατάψυξη) είναι ιδιαιτέρως ενεργοβόρα και ακριβή σε βιομηχανική κλίμακα, προτάθηκαν δύο διαφορετικοί τρόποι παραγωγής τους σε σχέση με το κόστος. Ο πρώτος προτείνει τη χρήση ήδη αφυδατωμένων συστατικών με τη μέθοδο της ξήρανσης υπό κατάψυξη και τη συνεπακόλουθη ανάμειξή τους σε μορφή σκόνης για την παραγωγή της τελικής συνταγής του προϊόντος. Ο δεύτερος τρόπος, από την άλλη, προτείνει τη χρήση φρέσκων ή/και αφυδατωμένων με ρεύματα θερμού αέρα συστατικά, το μαγείρεμα των σουπών σύμφωνα με τις συνταγές τους και την τελική ξήρανσή τους υπό κατάψυξη. Οι δύο αυτοί τρόποι παρουσιάζουν πλεονεκτήματα και μειονεκτήματα, καθώς η πρώτη διεργασία είναι μεν οικονομικότερη, αλλά πιο δύσκολη στο να αναπαράγει τις συνταγές πιστά και με τα επιθυμητά οργανοληπτικά χαρακτηριστικά, ενώ η δεύτερη είναι ακριβότερη, αλλά οι σούπες διατηρούν πολύ καλά τα οργανοληπτικά τους συστατικά και ακολουθούν πιστά τις συνταγές. Ωστόσο καθώς η διαφορά κόστους σε βιομηχανική κλίμακα είναι σημαντική, προτείνεται η χρήση της πρώτης μεθόδου με τις απαραίτητες παρεμβάσεις, ώστε τα τελικά προϊόντα να ακολουθούν πιστά τις συνταγές και να διατηρούν τα απαραίτητα οργανοληπτικά χαρακτηριστικά.

Τα αποτελέσματα της έρευνας αγοράς δείχνουν πως η Γερμανία αποτελεί την προτιμητέα αγορά-οδηγό, λόγω του μεγαλύτερου μεγέθους της και των συνηθειών των καταναλωτών της, παρά τον

υπάρχοντα ανταγωνισμό. Η ανάλυση SWOT αποκαλύπτει σημαντικούς παράγοντες, οι οποίοι μπορούν να χρησιμοποιηθούν για τη βελτίωση της ανταγωνιστικότητας της εταιρίας, ενώ το Business Model Canvas παρουσιάζει τη διάρθρωση της εταιρίας για την παραγωγή του συγκεκριμένου προϊόντος. Ο συνδυασμός των δύο αυτών αναλύσεων συμβάλει στο να αναδειχθούν οι ευκαιρίες που παρουσιάζονται και οι δράσεις που πρέπει να ληφθούν για την επιτυχή κυκλοφορία του προϊόντος στην αγορά. Από την άλλη μεριά, η ανάλυση της ελληνικής αγοράς δείχνει πως αυτή δεν μπορεί να σταθεί μόνη της, λόγω του μικρού μεγέθους της για την αγορά αφυδατωμένων σουπών και τον υψηλό ανταγωνισμό. Ωστόσο, η έρευνα καταναλωτών δείχνει πως υπάρχει αρκετός χώρος για βελτίωση και ανάπτυξη της συγκεκριμένης αγοράς με την ανάληψη των σωστών επιχειρηματικών αποφάσεων και δράσεων.

Εν κατακλείδι, η παρούσα Διπλωματική εργασία ασχολείται με τη δημιουργία, το σχεδιασμό και την ανάπτυξη ενός καινοτόμου προϊόντος τροφίμων και την είσοδό του στην αγορά. Για τη δημιουργία της ιδέας μιας νέας σειράς αφυδατωμένων σουπών και των συνταγών τους, χρησιμοποιήθηκαν στοιχεία σχετικά με τα χαρακτηριστικά των σύγχρονων καταναλωτών και των συνηθειών τους. Επιπλέον, όσον αφορά το σχεδιασμό και την ανάπτυξη των προϊόντων, πραγματοποιήθηκε μια επόπτευση των διεργασιών ξήρανσης και αφυδάτωσης, με ιδιαίτερο ενδιαφέρον στην ξήρανση υπό κατάψυξη, καθώς και στους κανονισμούς και στις οδηγίες του Οργανισμού Αγροτικών προϊόντων και Τροφίμων του ΟΗΕ και του Παγκόσμιου Οργανισμού Υγείας και της Ευρωπαϊκής Επιτροπής. Επίσης, σχεδιάστηκαν ο Καμβάς Επιχειρηματικού Σχεδίου και η ανάλυση SWOT, αναλύοντας το επιχειρηματικό πλάνο για τα συγκεκριμένα προϊόντα.

Αποτέλεσμα των παραπάνω ήταν, όπως αναφέρθηκε, η ανάπτυξη πέντε πρωτοτύπων αφυδατωμένων σουπών, ένα με την κάθε διαφορετική συνταγή. Τα πρωτότυπα παρήχθησαν με τη χρήση της ξήρανσης υπό κατάψυξη, καθώς φάνηκε πως με τη συγκεκριμένη μέθοδο τα προϊόντα διατηρούσαν ικανοποιητικά οργανοληπτικά χαρακτηριστικά και απαιτούσαν από ελάχιστο έως καθόλου χρόνο για την επανενυδάτωσή τους. Αντίθετα, τα αντίστοιχα προϊόντα που παρασκευάστηκαν με τη χρήση συστατικών αφυδατωμένων με θερμά ρεύματα αέρα απαιτούσαν σημαντικά περισσότερο χρόνο μαγειρέματος για την επανενυδάτωσή τους. Ωστόσο, σε βιομηχανική κλίμακα προτείνεται ένας διαφορετικός τρόπος παρασκευής των προϊόντων: η χρήση προ-μαγειρεμένων και αφυδατωμένων συστατικών με τη μέθοδο της ξήρανσης υπό κατάψυξη, με την εφαρμογή κατάλληλων διορθωτικών κινήσεων, ώστε τα τελικά προϊόντα να διατηρούν τη πιστότητά τους σε σχέση με τα πρωτότυπα και να έχουν απωλέσει όσο το δυνατόν λιγότερα από τα οργανοληπτικά τους χαρακτηριστικά. Σχετικά με τη συσκευασία τους προτείνεται η χρήση ειδικών χάρτινων φακέλων με κατάλληλη εσωτερική επικάλυψη, ώστε η συσκευασία να καθίσταται μη διαπερατή σε υγρασία και αέρα. Τέλος, ως αγορά-οδηγός προτείνεται η Γερμανία, λόγω του

μεγέθους της αντίστοιχης αγοράς αφυδατωμένων σουπών, των συνηθειών και χαρακτηριστικών των καταναλωτών της και του υπάρχοντας δικτύου πώλησης των προϊόντων της εταιρίας, ενώ η ελληνική αγορά φαίνεται πως δεν μπορεί να υποστηρίξει αυτούσια την κυκλοφορία του προϊόντος γιατί δεν πληροί τις παραπάνω προϋποθέσεις.

Κλείνοντας, υπάρχουν ακόμα πεδία έρευνας τα οποία θα μπορούσαν να βελτιώσουν τα συγκεκριμένα προϊόντα. Βασικότερο πεδίο είναι η διεργασία της ξήρανσης, η οποία διαδραματίζει σημαντικό ρόλο στην τελική ποιότητα του προϊόντος και στα οργανοληπτικά του χαρακτηριστικά. Συνεπώς, θα μπορούσε να διερευνηθεί το αποτέλεσμα και η συνεισφορά που θα είχε στην αφυδάτωση των συστατικών η προηγούμενη προκατεργασία τους ή/και η αλλαγή ορισμένων παραμέτρων της αφυδάτωσης υπό κατάψυξη. Ακόμα, η πρόοδος που συντελείται σχετικά με το σχεδιασμό βιώσιμων και φιλικών προς το περιβάλλον συσκευασιών θα μπορούσε να αλλάξει στο μέλλον και τη συσκευασία του συγκεκριμένου προϊόντος. Τέλος, πριν την είσοδο του προϊόντος στην αγορά θα πρέπει να πραγματοποιηθεί επανέλεγχος των ισχυρισμών και της διατροφικής δήλωσης των προϊόντων, ενώ μετά την κυκλοφορία του, η πραγματοποίηση ερευνών καταναλωτή θα βοηθήσει στην καλύτερη προσαρμογή του προϊόντος στις ανάγκες των καταναλωτών.

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1. Introduction

1.1 Structure of the thesis

The structure of the thesis is the following:

- Chapter 1: Introduction to the object and the objectives of the thesis, as well as to food, its sensorial characteristics and to the safety control measures of the food industry.
- Chapter 2: Various drying processes and methods that exist and can be used in the food industry in order to dry and, thus, extend the life of the food products, with focus on the freeze-drying method.
- Chapter 3: Detailed overview of the established regulations and guidelines by organizations such as WHO, FAO, EU and FDA regarding the labelling of the food products, their nutrition declaration and the nutrition and health claims they carry.
- Chapter 4: Necessary tools for a business plan (the Business Model Canvas and the SWOT analysis) and how to use them in order to evaluate and improve a product and a business.
- Chapter 5: Analysis of the Greek market of ready meals, based on ICAP's review for 2020, in an attempt to explore the possibilities and prospects of launching a new dry soup product in the Greek market.
- Chapter 6: Methodology and processes followed in order to develop a new safe food product – a series of new dry soups for Nestlé's Maggi – and the tools used to evaluate and choose the markets for its launch.
- Chapter 7: Results of the thesis and a step-by-step presentation of the characteristics of the new product, the business plan and market analysis for the targeted markets (Germany), as well as the results of the Greek market analysis for a possible future launch.
- Chapter 8: Final conclusions, questions and challenges for further discussion and research.

1.2 Scope and objectives of the thesis

The scope and objectives of this thesis was to explore the necessary processes and procedures in order to design and develop a product and launch it in the market. To achieve that, knowledge from different and diverse fields of expertise was combined, such as consumer insight, product design, business and marketing analysis, food engineering etc. All the above were applied in the development of a new product under the umbrella of Nestlé, in Nestlé's Research Centre in Lausanne, Switzerland, from

October 2018 to April 2019, with the goal to re-invent and re-innovate the Maggi dry soups. Of importance was the choice of a launch market through research based on analysis using special, internal Nestlé tools to calculate costs and revenues and market reports from Mintel and ICAP. The chosen launch market for the product was Germany, however, a special analysis was also made for the Greek market to evaluate the readiness and possible acceptance of that product by consumers in Greece.

1.3 Food and its preservation

Food plays a pivotal role in human society since prehistorical times. More than a necessity for survival and source of energy and nutrients, humans attributed extra, special properties to food, based on established social regulations and/or spiritual and religious commands, creating customs, which are still regarded as important and followed by millions, or even billions, of humans worldwide, e.g., fasting. These customs and traditions, among other factors, help in creating different identities, through which groups of humans identify themselves. The complexity of these food customs has evolved and progressed alongside with human social evolution – from hunter gatherers to the modern world – adding new elements and keeping some of the old, by cultural interchange and interaction. [1]

Food can be defined as any organic or inorganic substance that living creatures eat in order to be provided with the necessary energy and components to survive and grow. [2] [3] The value of foods can differ in regard with their nutritional value, their scarcity and availability etc. [2] Food products usually go through industrial processes in order to preserve their nutritional value and nutrients, be stored, transported etc. before their consumption. [4] Food products can be categorised into many different groups, depending on the process they have undergone or their origin. For example, food products can be divided in foods of plant origin and in foods of animal origin, with further sub-groups, based on their characteristics; food products can also be divided on whether they have undergone any industrial process, i.e., fresh (foods without having sustained any process other than sorting, standardization and packaging), preserved (foods that have been processed in order to extend their shelf life, such as canned, smoked, dried, salted, pasteurized etc.) and processed (produced from raw materials for immediate consumption, such as sugar from sugar beets). [4] Furthermore, food can generally be grouped into nine categories: [4]

1. Cereals and their products
2. Starchy roots

3. Legumes
4. Fruits and vegetables
5. Sugars, syrups, canned fruits, compotes and jams
6. Meat, fish and eggs
7. Milk and dairy products
8. Fats and oils
9. Beverages

Food, before being consumed, goes through a variety of processes in order to be safe and suitable for consumption. Prime target of processing food is the ability of its preservation and, thus, the prolongment of the shelf life and radius of transportation. [4] The preservation of food is possible via many methods, that deal with the main factors of their degradation: [4]

1. Microorganisms (mainly bacteria and fungi)
2. Enzyme activity
3. Chemical reactions (such as oxidation, reduction etc.)

Hence, there are many methods of preservation, such as low temperature preservation, drying, high temperature preservation, chemical treatment, radiation and concentration. [4]

Low temperature preservation extends the expiration date of foods by impeding biological and physicochemical processes (i.e., microorganisms' growth, enzymatic reactions etc.) and can be divided into two different sub-methods: refrigeration or cooling and freezing: [4]

1. Refrigeration occurs in temperature higher than the melting point, it delays food decomposition and is used for small-term preservation, but due to evaporation it causes dehydration, surface drying, shrinkage, loss of weight and deteriorating sensorial characteristics
2. Freezing occurs in very low temperatures, where the product freezes, and inhibits efficiently the growth of microorganisms

Drying methods remove the water contained in the food, creating thus unbearable conditions for the growth of microorganisms and the enzymatic activity, either naturally, such as with sun dried products, or artificially in temperatures between 50^{o}C and 100^{o}C via hot air streams, water vapours, inert gases or direct heating. [4]

High temperature preservation or canning has three goals: preserve the food for a long period, remove or impede any activity of microorganisms and enzymes and improve some foods sensorially. It consists of two main processes: pasteurization and sterilization: [4]

1. Pasteurization targets fungi and bacteria with relevant heat resistance and does not destroy spores
2. Sterilization targets bacterial spores and especially high heat-resistance bacterial spores of the Bacillus and Clostridium strains that produce lethal toxins. C. botulinum and C. sporogenes are used as bacteria reference.

Chemical methods of preservation, such as fermentation, salting and marination, are achieved by the addition of several – alien to the food – substances that are, finally, consumed alongside with the food: [4]

1. Fermentation, such as oxidative and alcoholic, occurs due to enzymatic systems from specific bacteria strains (i.e., in yoghurt, cheese and cold cuts);
2. Salting is not applied as widely as it used to for conservation, but for taste, with the use only of dry or solutioned salt (brine);
3. Marination resembles salting, however it uses a mix of salt with other substances and nowadays it is not used as a preservation method, but as a method that improves the sensorial characteristics of foods, such as meat.
4. Chemical preservatives, which are specific substances that delay the growth of microorganisms without destroying them or protect the deterioration of food during its process, transportation and distribution, are also used sometimes.

Radiation can sterilise foods in low temperatures, without significantly altering their physical properties, but it alters their chemical composition and is widely prohibited for a large variety of foods.

Lastly, concentration removes an amount of water, thus impeding the growth and activity of microorganisms, and is used in products such as jams, compotes and condensed juices. [4]

In addition, package, storage and the process of quality control play a crucial role in food quality. Packaging is a very important factor of food preservation, affecting the final cost of the product and its appearance and appeal to the consumer's eye. [4] The selection of the right package for a food product should be based on the properties of the food (e.g., gain or loss of humidity, particle size, light sensibility, oxygen and/or microorganisms, content of fats and oils etc.), its storage conditions and the costs of the available packaging materials. [4] Damaged packaging can result in loss of value and reduced storage time up to total food spoilage, rendering it not acceptable and/or dangerous for consumption. [4] Storage, also, has strong impact on food conservation, as storage conditions play a key role on the endurance of the food and its suitability for consumption, while it balances between costs of storage and food degradation. [4] Finally, quality control is a process that tries to estimate the

total quality of the food product, based on predefined criteria, and suggests corrections of the processes to achieve at least the targeted acceptable quality, with the goal to create the optimum conditions for the production of stable quality foods and minimize the production of faulty and unsafe products. [4] Indispensable part of the quality control procedure is the Hazard Analysis of Critical Control Points method (HACCP).

1.4 Sensorial Characteristics

Sensorial characteristics are an important element of the quality of the food, since the consumers evaluate the food by their senses. Therefore, the sensory laboratory is an indispensable part of the food industry, along with the chemistry and microbiology laboratories. [5] The combination of these three laboratories measures, controls and safeguards the quality (sensorial, nutritive and sanitary) of the foods produced by the industry and sold to the consumers. [5] The sensorial characteristics can be categorised in the following groups: [5]

1. Appearance
    a. Colour
    b. Gloss
    c. Geometric features
    d. Viscosity
    e. Size – Shape
    f. Defects
2. Texture
    a. Feel in the hand or in the fingers
    b. Mouthfeel
3. Taste – Smell
    a. Taste
    b. Odour
    c. Flavour
4. Hearing
    a. Cutting
    b. Chewing

The sensorial evaluation of foods is a scientific process that aims to “challenge, measure, analyze and interpret the reactions in those characteristics of food and its components that are perceived by the

senses of sight, smell, taste, touch and hearing". [5] The sensorial quality of a food is evaluated by trained examinators using a variation of specific sensorial testing methods, such as the Triangle test, the Duo-Trio test, the Paired Comparison test, the Same/Different test and Descriptive tests, among others. [5] Regarding the sensorial laboratory in which the tests are performed, there are strict rules and protocols (ISO 8588: 1988) that regulate the area, the lighting and the environmental conditions, as well as the procedure, the selection of evaluators and their training. [5]

1.5 Hazard Analysis of Critical Control Points

In recent decades the importance of food safety has increased. Specific methods have been created and implemented internationally as standard security and safety control processes in order to safeguard the consumers. The most common method is the Hazard Analysis of Critical Control Points, known as HACCP. HACCP was firstly developed in USA in order to provide astronauts with food of insured quality. Since then, it has been improved and used worldwide, not only in food industries, but also in other industries that require specific safety standards, and has been codified in multiple legal documents. [6]

HACCP covers all processes, from harvest and procurement of the first materials of the product to the moment of consumption from the consumer, and tries to identify risks and hazards (chemical, physical and biological) and their possibility of appearance in all these different processes. [6] [7] In spite of its numerous possibilities due to its complexity, HACCP has a sturdy spine of 7 principles that can be adjusted and applied in every case. [6] These principles are shown in the Table 1.

Table 1: The seven principles for HACCP implementation. [8]

The 7 principles of HACCP	
1st	Hazard Analysis
2nd	Determination of the Critical Control Points (CCPs)
3rd	Implementation of specific critical limits
4th	Implementation of monitoring control system of the CCPs
5th	Corrective action systems for CCP out of control
6th	Verification and validation process of HACCP system
7th	Documentation of all procedures and records

A further brief explanation of each principle is necessary in order to fully understand how the HACCP method works and prevents risks in food industry. According to the first principle (hazard analysis), a specification of the multiple risks is performed, containing all the production steps, from the collection of the first materials to the consumption of the product. Then these risks are classified according to their severity and possibility of appearance (risk) and preventive measures are defined in order to maintain control of the process and the safety of the product. [9] According to the second principle and based on the hazard analysis, all the possible steps of the processes, that need to be controlled in order to diminish the appearance of a certain hazard, are found with the help of a decision tree. These few steps are the Critical Control Points (CCPs) of the process, whose control enables the control of the whole process. [9] According to the third principle, the critical limits of the determined CCPs are established, while the fourth principle demands the implementation of monitoring systems for these CCPs, in order to safeguard the formerly established limits and, as a consequence, the whole process. [9] The fifth principle contains all the correction measures that must be implemented in case that a variation, that overcomes the critical limits of the process, occurs. [9] Finally, the sixth and seventh principles require an effective verification, validation and archiving system for all the HACCP analysis. [8] A more detailed view of these seven principles of HACCP is discussed further below**.**

As mentioned above, the HACCP team has to analyse all the hazards in every step, find the critical points, put specific limits, evaluate the likelihood of occurrence and suggest corrective measures to diminish the possibilities of safety failures. In this process the team checks, not only the food or the first materials, but also the equipment, the cleaning systems, (methods, schedules and materials), the building's adequacy (storage units design, preventing and safety measures etc.) and the good hygiene and practices of the human resources. [6] The necessary steps required for a complete HACCP plan are shown in Figure 1. [8]

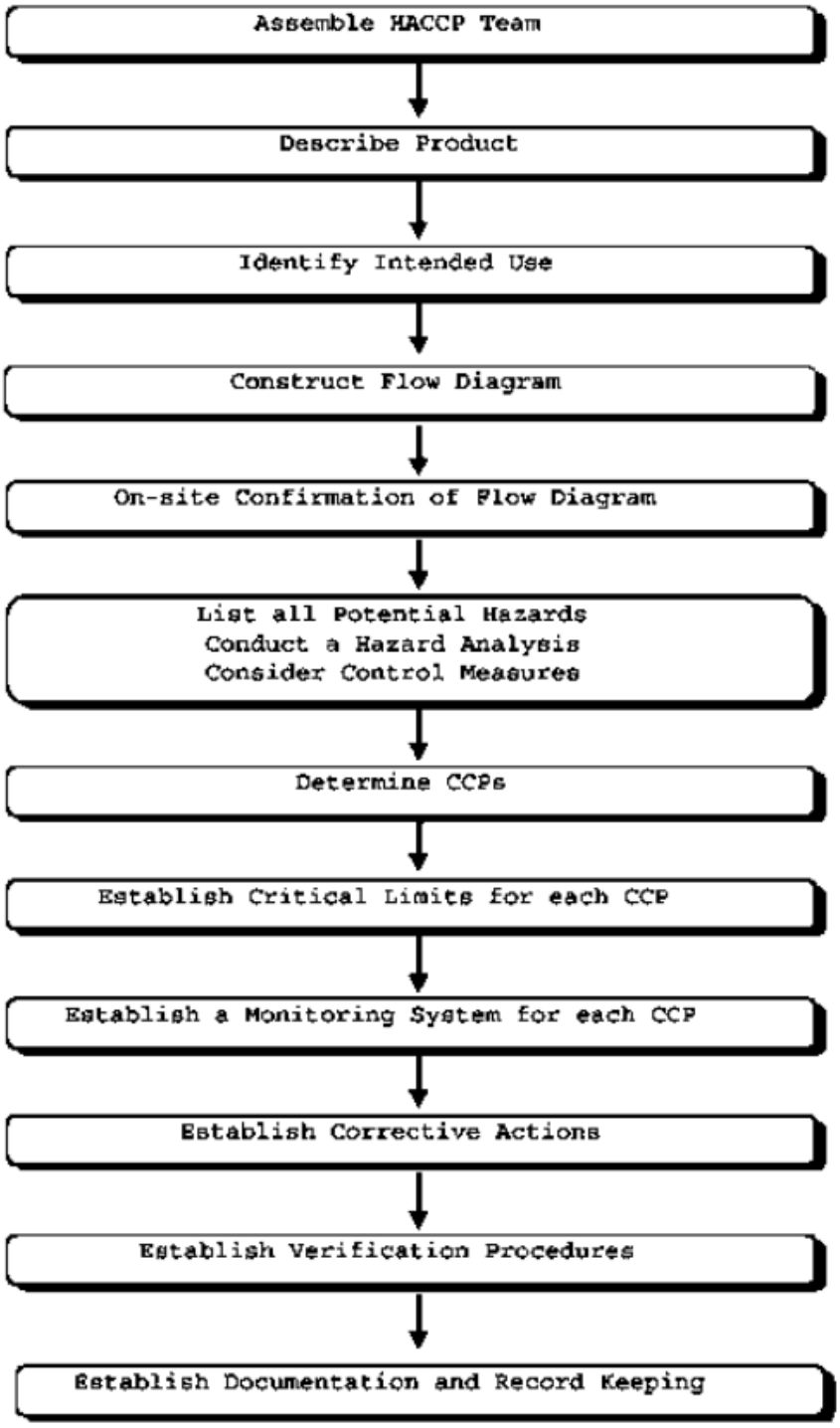


Figure 1: Step sequence for HACCP plan application based on the Codex Alimentarius by FAO/WHO [8]

After a detailed description of the product and its intended use from the consumer, the HACCP team in collaboration with all the necessary personnel has to create and verify in-situ a flow chart of all the processes, from harvest to consumption, in order to find and analyze all the different steps and possible hazards. When all these steps are completed, the team can start working on the first principle,

the hazard analysis. [6] All the different hazard categories are examined: biological (microorganisms), chemical (pesticides, chemicals etc.) and physical (glass, wood, stones, metals, dirt, insects etc.) on every step of the process of every product. [10] During this procedure, the HACCP team identifies dangerous materials (raw or processed and pathogens), assesses their potential maleficent impact, finds possible contamination points, examines the likelihood of survival and thriving of microorganisms and categorizes these hazards and their possible occurrence. [6] [8] [10] [11] In addition, the source of each danger must be identified, in order to take the correct and necessary measures to diminish it. Also, the team consults with field experts and examines the literature for similar cases, suggestions and solutions for all existing and possible hazards. [11] After all the above, the information generated needs to be classified according to the possibility of occurrence and the possible impact, creating thus the risk assessment, which indicates the most important hazards that need to be controlled (prevented, eliminated or reduced). [10] For that to happen, the team has to identify the CCPs of the process. [6] [11] An example is shown in Table 2. [11]

Table 2: Example of the first step in a hazard analysis [11]

Step	Potential Hazard(s)	Justification	Hazard to be addressed in plan? Y/N	Control Measure(s)
5. Cooking	Enteric pathogens: e.g., *Salmonella*, verotoxigenic-*E. coli*	enteric pathogens have been associated with outbreaks of foodborne illness from undercooked ground beef	Y	Cooking

As mentioned before, the second principal of a HACCP analysis is based on a system of Critical Control Points (CCPs) which indicate the few critical steps that must be controlled in order to assure the whole process. Loss of control in these steps could have disastrous effects on the product's safety and, as a consequence, on the consumer's health and safety. [6] [12] The CCPs can be identified in processes that need to be controlled in order to prevent the occurrence of a hazard, that is processes that contain a controllable hazard, e.g., thermal or cooling processes and the presence of chemical or physical contaminants. [11] [12] At this point, it is crucial to mention the difference between a Critical Control Point (CCP) and a Control Point (CP): the CCP plays a fundamental role in the safety of the

product, since with its control the whole process is controlled, while the CP is any point that "measures biological, chemical or physical factors, whose loss of control does not lead to unacceptable risk for the consumer's health". [12] The evaluation of a step as a CCP, can be performed with the help of a decision tree, as shown in Figure 2.

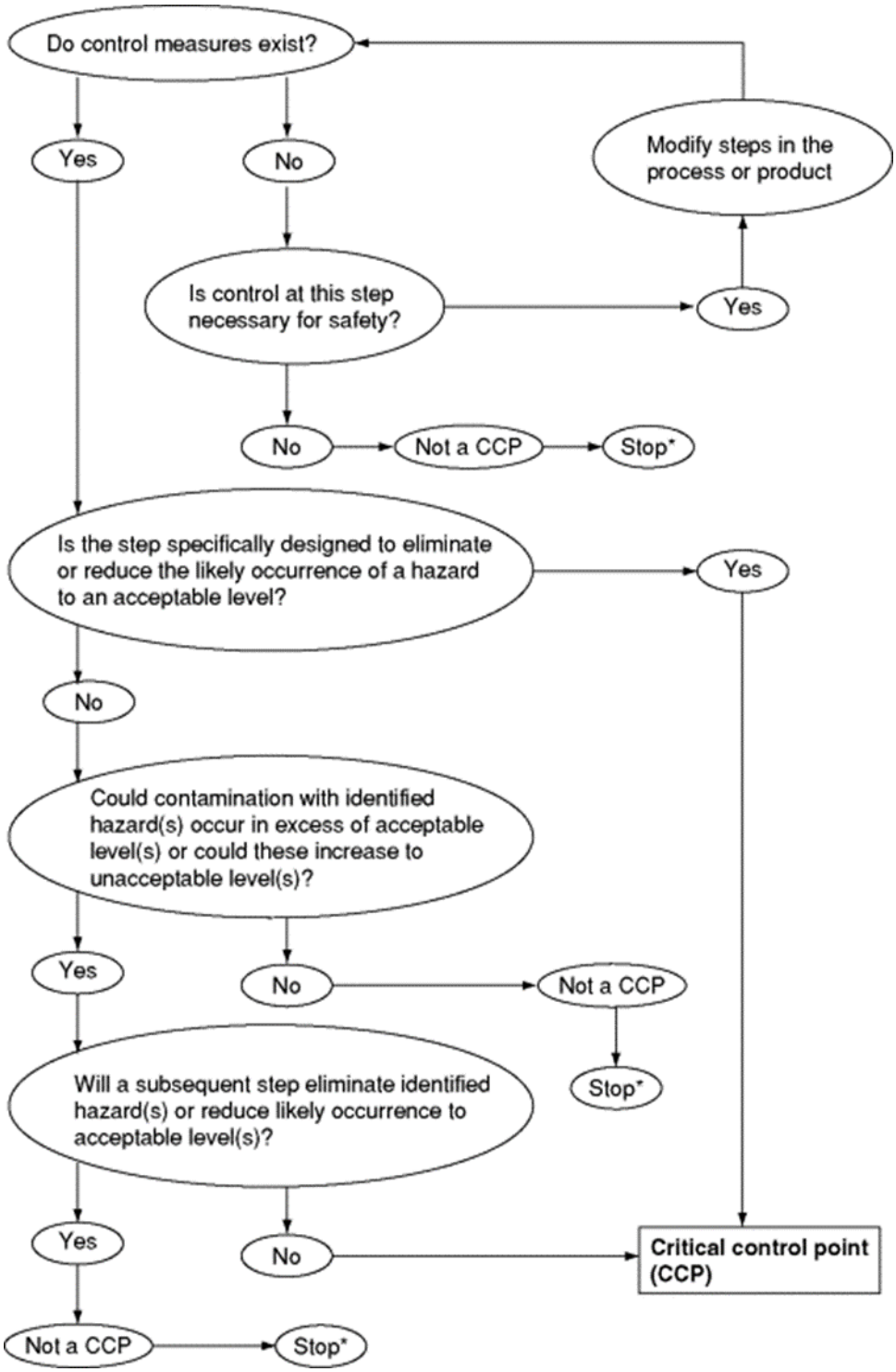


Figure 2: Decision tree of Critical Control Point (CCP) evaluation [6]

Once the CCPs have been established, the necessary thresholds and limits must be placed, in respect with the type, category and severity of the possible hazards and for every CCP. Usually, these limits are based upon the environment conditions that promote the multiplication of specific microorganisms (biological hazards) and the existence or non-existence of dangerous chemical compounds (chemical hazards) and of alien bodies (physical hazards). [13] One of the most important properties of a critical limit is its easy, continuous and automatic measurability. Some examples of parameters suitable for critical limits are temperature, time, water activity, pH and moisture. [11] [13] These limits should not, however, be confused with other operational limits [11] and, in case of a contradiction between them, the critical limits must prevail in order to safeguard the consumer's wellbeing. [11] Also, other limits that create a buffer zone can be applied, in order to inform and alert for a possible disruption and give enough time to react and solve the problem before it occurs. [6] Table 3 shows an example of critical limits over a CCP characterized step. [11]

Table 3: Example of critical limits of a CCP hazard in cooking [11]

Process Step	CCP	Critical Limits
5. Cooking	YES	Oven temperature:___° F Time; rate of heating and cooling (belt speed in ft/min): ____ft/min Patty thickness: ____in. Patty composition: e.g. all beef Oven humidity: ____% RH

For these limits to work, a monitoring system is required, adapted to each specific CCP and its conditions, that will indicate whether necessary action is needed to keep the CCP in control. In case that the CCP is out of control, corrective actions must be in place in order to preserve the safety of the product and of the consumer's health. [6] Once the HACCP plan is completed, a verification and validation process must be implemented to check that the plan really works and stands up to the high expectations, while detailed documentation must be kept for every hazard, step, limit, control, corrective measure, audit and decision. [6]

Table 4: Example of a complete HACCP plan table [11]

CCP	Hazards	Critical limit(s)	Monitoring	Corrective Actions	Verification	Records

Finally, for a HACCP analysis to be effective, the personnel must follow the necessary good hygiene and manufacturing practices (GHPs and GMPs, respectively), as well as be trained on the importance of HACCP and on how to implement it and react according to it to any abnormality that might occur. [6] In respect with the GHPs, some of the most important parameters are: [14]

- Hygiene of the location (environment) of the industry
- Hygiene of the supplies and first materials
- Hygiene during production, storage and transportation of the product
- Personal hygiene of the workforce

Regarding the GMPs, they are rules that aim to protect the health of the consumers, produce products of good quality and protect the working workforce, thus stretching over the following parameters: [14]

- Industry personnel
- Location and layout of the industry
- Industrial equipment
- General hygiene and decontamination
- First materials selection
- Processes
- Packaging materials and labelling
- Quality control
- Internal inspections and archiving

2. Drying processes

The recent and projected increase of human population highlights the importance of food production. The great necessity to cover the demand for food worldwide has put in the spotlight the methods of food preservation. Since the raw food materials have a high percentage of water, one of the most common, but also most energy-consuming, method of preservation is the drying process, in order to reduce the available water in the food, prevent the growth of microorganisms, reduce the total weight and volume of the product and the packaging/transportation cost of the product. [2] [15] [16] [17] The drying processes remove the available water by evaporation or sublimation, while processes that remove water with solutions, salts, sugar or high osmotic pressure are not regarded as drying processes. [17] In general, the drying processes use heat and mass transfer phenomena to remove the water that is contained inside the food cells. [15] [17] Usually, the resulting dried products are in the form of powder, granules, flakes or other shapes according to the requirements of the manufacturer and/or the process's capability. [18] [19] Low moisture foods (LMFs) are food products with water activity (a_w) equal or below 0.65, such as powdered products (e.g., milk powder, flours, spices and dehydrated soups) [20]. Yet, water activity lower than 0.65 does not guarantee alone that the food product is safe for consumption. On the contrary, although the reduction of the water activity prevents the growth of the already existing microorganisms, they are not destroyed, and special care should be given on the good hygiene and manufacturing practices to avoid the existence of and contamination with pathogens of the food product. [21]

There are numerous different methods of drying, depending on the conveyor of energy, the conditions applied, the sensibility and specific treatment requirements of the food products and the form and final specifications of the product (powder, intact pieces etc.). [15] [17] Examples of such techniques are hot air drying, vacuum drying, freeze drying, ultrasound drying, spray drying and microwave drying, among others. [15] [18] In the drying process a significant amount of energy is needed, which depends on and varies among the above-mentioned methods. [15] The efficiency of the drying methods can be expressed by the energy efficiency (η), which is the ratio between the required energy for drying (E_r) and the supplied energy (E_s) as shown in the following equation: [18]

$$\eta = \frac{E_r}{E_s} \qquad (1)$$

There are many different types of dryers, but they can generally be divided into three main categories: [19]

1. Adiabatic or Direct Dryers that expose the products to hot air
2. Non-adiabatic or Indirect Dryers that transfer the heat from an external medium (i.e., vapour through a metallic surface in direct contact with the product)
3. Dryers that convey heat through dielectric energy, radiation or microwaves

In addition, some dryers can combine and use more than one medium to transfer heat. [19] Finally, the desired properties and characteristics of the final product can determine the drying method and the dryer that needs to be used. Examples of drying methods are presented in the following paragraphs.

2.1 Sun drying

Sun drying is the oldest drying method known. Although it is still in use, it is not preferred from other newer developed methods, due to its dependency on environmental factors (sun, surroundings etc.), slow drying process and high labour necessities. [16]

2.2 Air drying

The air-drying method is perhaps the most common drying method used worldwide. There are many different processes of air drying, the most common of them being oven drying and tray drying. [22] The principle behind it is the use of a continuous stream of hot air to remove water from the food product. [2] [23] Important factors for the efficiency of air drying are, among others, temperature, time, air velocity and relative moisture. [22] However, the high temperatures needed can cause severe deterioration to the shape, colour, taste and nutritional value of the food, while at the same time problems occur during rehydration. [23] Figure 3 shows an example of a batch air-dryer with trays.

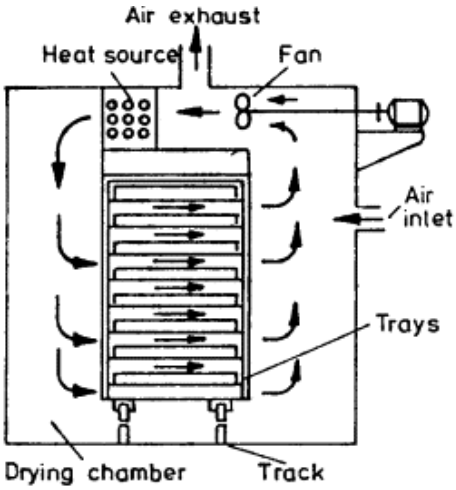


Figure 3: Example of an air-dryer with trays. [24]

2.3 Vacuum drying

Vacuum drying due to the low pressure and temperature applied, is usually used to dry food sensitive to heat, to appearance changes (e.g., colour) and to loss of nutrients. [18] It is very popular in drying foods with important bioactive compounds, that otherwise could be destroyed by the oxidation caused by conventional methods. Moreover, vacuum drying can be combined with other drying methods to provide even better results. [18]

2.4 Microwave drying

Microwave drying uses a spectrum of microwaves to heat and dry the food. Although the progress has improved in the recent years, still this type of drying is more often used in combination with other processes, such as the aforementioned vacuum drying, in order to reduce the drying time and, as a result, the food degradation and improve the energy efficiency of the drying process. [18]

2.5 Spray drying

Spray drying is commonly used for industrial scale drying processes to produce powders, mainly in food and pharmaceutical industry. [25] It is a relatively cheap, simple, fast and continuous process that can produce high-quality powders, with particle sizes varying between 20μm and 180μm, able to encapsulate and preserve valuable and sensitive compounds against external deteriorating elements.

[26] [27] However, spray dryers have small efficiency, since they lose large amounts of heat via the disposed gases and they are large, tall and difficult to run. [26] Figure 4 shows an example of a spray dryer.

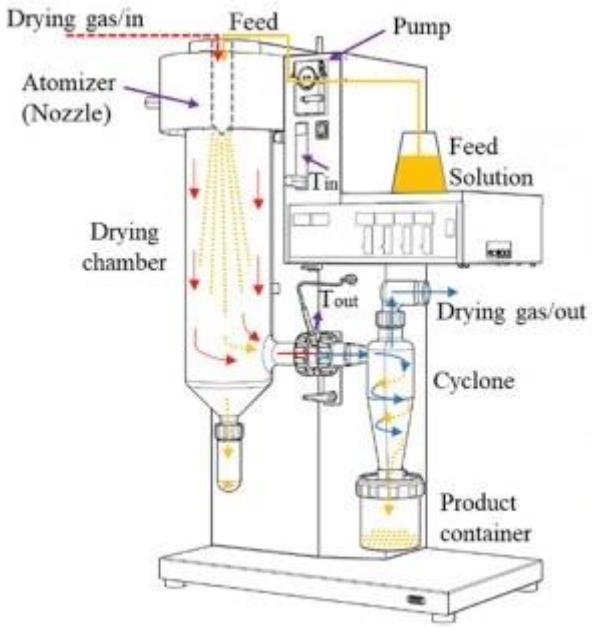


Figure 4: Example of a spray dryer with its compartments and flows. [27]

2.6 Ultrasound drying

Ultrasound drying is a novel, non-thermal method used in drying food products side by side with other methods, such as microwave and vacuum drying. This method can reduce the water activity and the loss of nutrients of the product and improve its colour. [16] Its appliance can increase the effect of the other methods by enabling the drying of sensitive materials due to the decrease of temperature and drying time. [16] There are three different approaches of ultrasound drying: ultrasound pre-treatment, airborne ultrasound assisted drying and contacting ultrasound assisted drying. [16] Regarding the assisted drying, although the contacting ultrasound is better than the airborne ultrasound, its implementation in industrial scale is troublesome. [16] An example of an ultrasound assisted hot-air dryer can be seen in the following Figure 5.

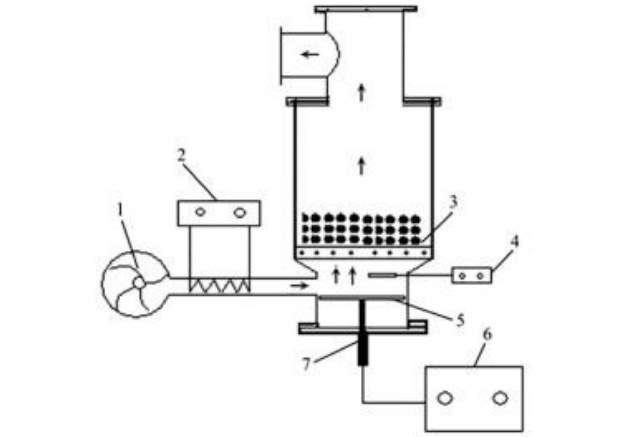


Figure 5: Diagram of a hot-air ultrasound assisted dryer. [16]

2.7 Freeze drying

The freeze-drying technique, also known as lyophilization, is a method that is used mostly in food and (bio-)pharmaceutical industries. During freeze-drying the water is removed by sublimation in low temperatures, which prevents further deterioration of the product's quality. There are two processes, the more common batch vacuum freeze-drying (VFD) and the continuous atmospheric freeze-drying (AFD). [2] [28] [29] [30] As shown in Figure 6, sublimation is the process of transition directly from the solid phase to the vapor phase.

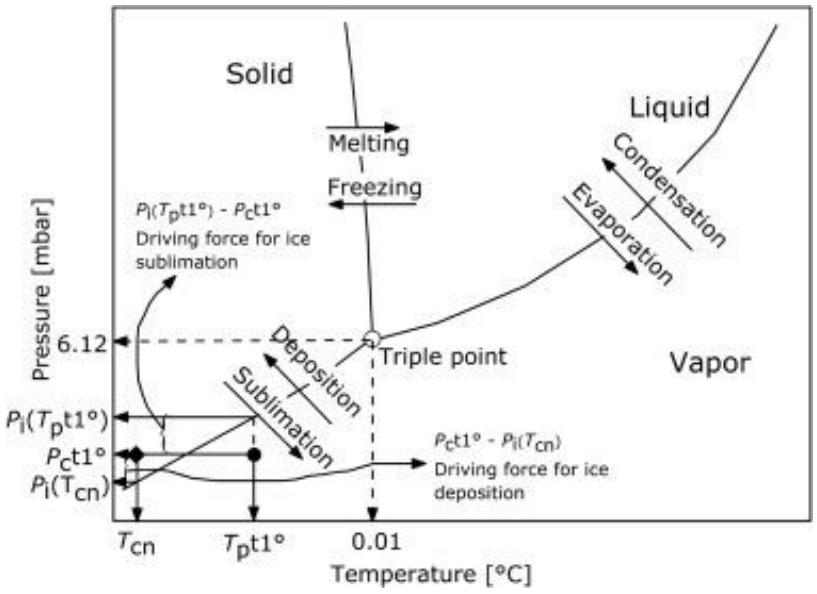


Figure 6: Water phase diagram, with all the possible phase transitions and the triple point. [30]

During freeze-drying, the water in the food product is frozen and in solid form, enabling, through the sublimation procedure, the product to keep its structure without severe volume decrease and shape destruction. [2] [17] In addition, the time required for this process is several hours due to the fact that "the heat required for the sublimation is much larger than the change of the enthalpy of the dry solid and the temperature differences are smaller than in other drying methods". [31] However, the freeze-drying method is regarded as the most expensive and energy consuming drying method, with a ratio of 4-8 times higher than the air-drying. [2] One great advantage of freeze-dried materials is the excellent rehydration/reconstitution ability, 4-6 times higher in comparison with air-dried ones, due to the very high specific surface the products acquire. [2] [32] [33] For this reason, the method is preferred for ready-to-eat food products, such as soups. [2] [30] Moreover, due to the low temperatures, the colour deterioration and the loss of nutrients of freeze-dried products is much less than in air-dried and spray-dried products, which appeals to the consumers and increases the products' acceptance from the market. [2] [30] [34] Furthermore, freeze-drying can maintain the sensorial characteristics of the food product after rehydration and it is regarded as one of the most suitable methods to dry high-temperature sensitive materials and active compounds. [2] [30] [34] [35] Although freeze-drying produces products with good structural integrity, in the case of incorrect application of the method, serious structural problems might occur, such as the collapse of the structure of the freeze-dried product. [2] [35]

The freeze-drying cycle can be divided into two main processes, freezing and drying. [30] During the first step, the majority of the water is converted into the solid phase. On the second one the solid water is removed by endothermic sublimation in low pressure, lower than the vapor pressure of ice at the desired product temperature – at least an absolute pressure below 620 Pa – (primary drying). [17] [30] The heat transfer occurs mainly by conduction and radiation through the shelfs and by convention through the air. [17] The remaining unfrozen water is removed by desorption (secondary drying). [30] Due to the excellent moisture removal through these processes, freeze-drying produces generally safe products, since the ability of microorganism growth is almost eliminated. [30] Finally, there is active research aiming at finding ways to lower the method's energy consumption and, hence, the production cost. Some suggestions have emerged, such as an ultrasound assisted freeze-drying process. [29] *Getachew et al. (2020)* provide detailed information on the specific steps of freeze-drying. [30] A schematic diagram of an industrial freeze dryer is shown in Figure 7.

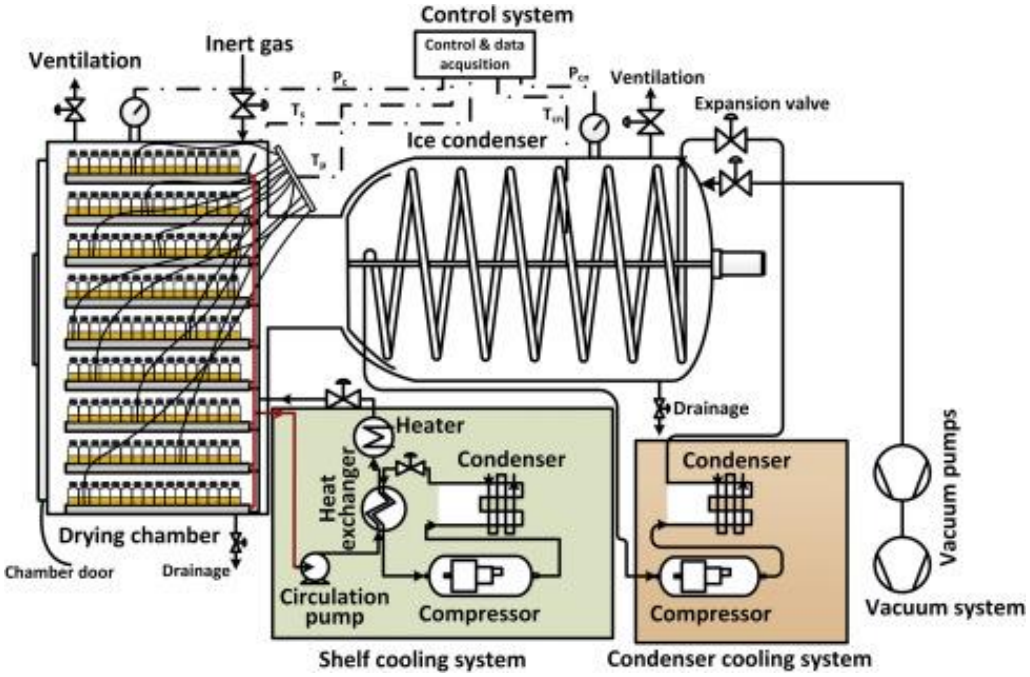


Figure 7: Diagram of an industrial scale freeze dryer and its compartments. [30]

The durability and the good structural integrity are important factors of the freeze-dried products' quality. Regarding the structure of the freeze-dried product, the freeze-drying rate plays a role on the size and location of the created water crystals, which impacts the damage that the product sustains and, as a consequence, its structure and durability. [36] It is worth mentioning that *Nowak et al. (2016)* showed that pre-treatment of the food or ingredient can have an important influence on structure decay. [36] Finally, the freeze-drying time can differ in respect to the form and condition of the food or ingredient before the process i.e., intact materials require less freeze-drying time than pulp-like ones. [36]

3. Labelling and Claims Regulations

3.1 Labelling

According to the Codex Alimentarius, the term “labelling” describes “any written, printed or graphic matter that is present on the label, accompanies the food, or is displayed near the food, including that for the purpose of promoting its sale or disposal”. [37] In contrast, the term “label” includes “any tag, brand, mark, pictorial or other descriptive matter, written, printed, stencilled, marked, embossed or impressed on, or attached to, a container of food”. [37] There are some differentiations in the labelling guidelines in Codex Alimentarius regarding the properties of the food product and its ingredients, i.e., the existence of food additives, the claims for specific dietary uses etc., however, in the context of this analysis, the focus will be on the labelling of pre-packaged foods (food that is “packaged or made up in advance in a container, ready for offer to the consumer”). [37] According to the Codex (paragraph 3), there are two general principles on the labelling of pre-packaged foods: [37]

1. The food should not be described in any erroneous or misleading manner
2. The food description must not refer to any other, already in existence, product, with which it might be confused or linked with.

In addition to the aforementioned general principles, the Codex requires a list of obligatory and detailed information to appear on the label of the food product, which is the following: [37]

1. Name
    a. The name must be specific and to the true state of the food.
        i. If it exists, the name must follow the established Codex standard name of that food.
        ii. If it does not exist, the name must follow the established by national legislation name.
        iii. In case of the total absence of the above, the name must describe the product and avoid confusion with other, already existing products.
        iv. In addition to all the above, a trademark or a coined brand name can be used.
    b. Phrases that further explain, among other, the true nature of the food and its type of treatment, such as “*dried”, “concentrated”* etc., must also appear on the label in close proximity to the name.
2. Ingredients
    a. A full list of ingredients must be presented on the product’s label.

i. Before the list, the term *"ingredients"* must appear.
ii. The ingredients' list must be in declining order of weight (m/m).
iii. Complex ingredients (ingredients that are products of other ingredients must be declared with their compounds in brackets in declining order of weight (m/m)). Ingredients already existing by name in Codex's standard or national legislation that constitute less than 5% of the product and are not food additives, may not be presented.
iv. Ingredients that can cause hypersensitivity must always be declared, including, but not limited to:
    - Gluten inclusive ingredients, such as wheat, barley and oats
    - Crustacea
    - Milk and milk products
    - Peanuts and soybeans
    - Nuts
v. Water, in case that it does not constitute part of the ingredients, must be also declared. Volatile ingredients or evaporated water during the food's production may not be declared.
vi. In the case of dehydrated or condensed products, that need only the addition of water to be reconstituted, the list of ingredients can be in declining order of weight (m/m) of the reconstituted product, with an explicit statement that declares it.

b. The existence of any biotechnologically manufactured ingredient or the transfer of an allergen from any other ingredient must also be declared specifically. In case of insufficient information that can prove the above, the food should not be launched in the market.
c. There are some exceptions concerning the ingredients' name in the ingredients list:
    i. With the exception of the ingredients that can cause hypersensitivity, the following respective general class name can also be used, as shown in Table 5.

Table 5: Alternative class names that can be used. [37]

Name of Classes	Class Names
Refined oils other than olive	"Oil" together with either the term "vegetable" or "animal", qualified by the term "hydrogenated" or "partially-hydrogenated" as appropriate
Refined fats	"Fat" together with either, the term "vegetable" or "animal", as appropriate
Starches, other than chemically modified starches	"Starch"
All species of fish where the fish constitutes an ingredient of another food and provided that the labelling and presentation of such food does not refer to a specific species of fish	"Fish"
All types of poultrymeat where such meat constitutes an ingredient of another food and provided that the labelling and presentation of such food does not refer to a specifi type of poultrymeat	"Poultrymeat"
All types of cheese where the cheese or mixture of cheeses constitutes an ingredient of another food and provided that the labelling and presentation of such food does not refer to a specifi type of cheese	"Cheese"
All spices and spice extracts not exceeding 2% by weight either singly or in combination in the food	"Spice", "spices", or "mixed spices", as appropriate
All herbs or parts of herbs not exceeding 2% by weight either singly or in combination in the food	"Herbs" or "mixed herbs", as appropriate
All types of gum preparations used in the manufacture of gum base for chewing gum	"Gum base"
All types of sucrose	"Sugar"
Anhydrous dextrose and dextrose monohydrate	"Dextrose" or "glucose"
All types of caseinates	"Caseinates"
Milk protein	Milk products containing a minimum of 50% of milk protein (m/m) in dry matter (calculation of milk protein content: Kjedahl nitrogen x 6.38)
Press, expeller or refined cocoa butter	"Cocoa butter"
All crystallized fruit not exceeding 10% of the weight of the food	"Crystallized fruit"

ii. Pork fat, lard and beef fat must always be declared specifically

iii. Food additives that can be classified in their respective class shown in Table 6, can be presented with their class name, in addition to their specific name or numerical identification

Table 6: List of food additives' name classes that can be used alongside with the numerical identification of said additive. [37]

Name classes of food additives	
Acidity Regulator	Flavour Enhancer
Acids	Foaming Agent
Anticaking Agent	Gelling Agent
Antifoaming Agent	Glazing Agent
Antioxidant	Humectant
Bulking Agent	Preservative
Colour	Propellant
Colour Retention Agent	Raising Agent
Emulsifier	Stabilizer
Emulsifying Salt	Sweetener
Firming Agent	Thickener
Flour Treatment Agent	

iv. The following class names can also be used for the respective ingredients:
- Flavour(s) and Flavouring(s)
- Modified Starch(es)

d. Processing aids and carry-over of food additives
   i. In case that a food additive is carried over into the final food and in a quantity that can have a specific effect, this additive must also be mentioned in the ingredients list.
   ii. In case that a food additive is carried over into the final food, but in a lower quantity and does not have a specific effect and is not included in the list of the ingredients that can cause hypersensitivity, then that additive may not be mentioned in the ingredients list.

3. Net content and drained weight
   a. The net contents must be declared in the metric system.
   b. The net contents are declared differently, depending on the state of the food product:
      i. Net content of liquid foods is declared by volume.
      ii. Net content of solid foods is declared by weight.
      iii. Net content of semi-solid foods is declared by either weight or volume.
   c. The drained weight of the foods in liquid medium (i.e., water, vinegar, salt or sugar solutions etc.) must also be mentioned in the metric system.
4. Name and address

a. The name and address of the manufacturer, the packer, the distributor, the importer, the exporter or the vendor must be declared.

5. Country of origin
    a. The country of origin of the product must be declared, if needed, to avoid the confusion of the consumer.
    b. If the product is processed in a different country and that process alters its nature, then the latter is considered as country of origin and must be mentioned as such.
6. Identification
    a. Every food container must be permanently marked in order to be able to identify the producing factory and the lot number.
7. Date marking and storage
    a. If not otherwise specified in the Codex standard, the following rules regarding the date marking must be followed:
        i. The “date of minimum durability” must be declared.
        ii. That date consists at least of:
            - The day and month for products with minimum durability of less than three months.
            - The month and year for products with minimum durability of more than three months.
            - If the month is December, the indication of the year is sufficient.
        iii. The date must be declared as:
            - “Best before…”, if the day is indicated.
            - “Best before end…” in other cases.
        iv. These declarations must be accompanied by one of the following means:
            - The date itself.
            - A reference to where the date is presented.
        v. The date must be presented in uncoded numerical sequence. The month can also be written in letters, only if this will not confuse the consumer.
        vi. The display of the “day of minimum durability” may not be required for:
            - Fresh fruit and vegetables
            - Wines
            - Beverages with more than 10% of alcohol by volume
            - Bakers’ or pastry-cooks’ that are usually consumed within 24 hours of their production

- Vinegar
- Food grade salt
- Solid sugars
- Confectionary consisted of flavoured and/or coloured sugars
- Chewing gum

b. In addition to all the above, if the product requires specific storage conditions to ensure the mentioned “date of minimum durability”, these must be declared on the label.

8. Instructions
    a. Special instructions that guarantee the correct use of the product, such as reconstitution, must be mentioned on the product’s label.

In addition to all the above, there is also additional and obligatory information that needs to be presented on the label. [37] In case that the label of a food product mentions a specific quality attributed to one of its ingredients (i.e., the low content of an ingredient), the ingoing percentage of the ingredient (m/m) must be declared, while a connection between the name of the food and one of its ingredients or a reference in the label to a low-quantity ingredient should not take place. [37] Moreover, foods or ingredients that have been treated with ionizing radiation, must be accompanied with a written statement close to the name or in the list of ingredients, respectively, or with the international food irradiation symbol (optional). [37] However, the Codex allows for some exceptions for spices, herbs and small units (“largest surface area less than 10cm^2”). These ingredients may not be referred in the ingredients list, and can be exempted from mentioning their lot identification, date marking, storage and use instructions. [37]

Furthermore, the label can include “any information or pictorial device written, printed, or graphic matter […] not in conflict with the mandatory requirements” of the Codex standard, provided that it is true, understandable and not misleading in any way. [37] Finally, the labels must not get detached from the product, all the necessary statements must be “clear, prominent, indelible and readily legible by the consumer under normal conditions of purchase and use”, the wrapper of the product, if it exists, must contain the same information or that information must be “readily legible” through the wrapper. The name and net contents must be presented in prominent position and next or close to each other, the information must be written in the language of the targeted consumer, otherwise a supplementary label is required written in the appropriate language and in case of “re-labelling or of a supplementary label”, the information of the original label must be “fully and accurately” presented. [37]

3.2 Nutrition Labelling

The main goal of nutrition labelling is to ensure and safeguard the health of the consumers and help them to make a sound choice based on valid and not in any way misleading or deceptive information and claims. [38] To achieve that, the Codex Alimentarius recognizes three principles for nutrition labelling: nutrient declaration, supplementary nutrition information and nutrition labelling. The first principle indicates that any information should have the purpose to enlighten consumers about the important nutrients of the food, without suggesting that "there is exact quantitative knowledge of what individuals should eat in order to maintain health. The second principle states that any supplementary nutrition information may vary from country to country and from target group to target group, according to the needs of the target group and the laws and policies of each country. The third principle warns against implied advantages among foods that carry certain nutrition labelling and foods that do not. [38]

According to the Codex, nutrition labelling consists of two different components: nutrient declaration and supplementary nutrition information. Nutrient itself is defined as "any substance normally consumed as a constituent of food: (a) which provides energy; or (b) which is needed for growth, development and maintenance of life; or (c) a deficit of which will cause characteristic bio-chemical or physiological changes to occur". [38] Nutrition claim is any statement, suggestion or implication that "a food has particular nutritional properties including but not limited to the energy value and the content of protein, fat and carbohydrates, as well as the content of vitamins and minerals". The mentioning of substances or nutrients in the ingredients' list or as a part of the obligatory nutrition labelling, respectively, and any, by law, required quantitative or qualitative nutrient declaration cannot be categorized as nutrition claims. [38] Moreover, the Codex states that for any nutrition claim a nutrient declaration is mandatory and the following must be contained in it: [38]

1. Energy value
2. Protein amount
3. Carbohydrate amount (non-dietary fibre and dietary fibre separately)
4. Fat amount
5. Any nutrient used in any health or nutrition claim
6. Any nutrient relevant for maintaining a good nutritional status (accordingly to national laws and guidelines)

In addition to the above, all relevant nutrients to a voluntary declaration of specific nutrients or to a specific nutrition or health claim, that help to maintain a good nutritional status, should be mentioned

according to national law and guidelines. [38] Regarding the carbohydrates' declaration, if a claim is based on a specific type or amount of carbohydrates or on dietary fibres, then the total sugars or the specific amount of dietary fibres should also be listed, respectively, while the declaration of starch and/or other carbohydrates is voluntary. [38] In respect to the fat (fatty acids), if a claim is based on their type or amount or the amount of cholesterol, then the amount of saturated, monounsaturated and polyunsaturated fatty acids and the amount of cholesterol should be also listed, while the declaration of the amount of trans fatty acids is eligible to national laws. [38] Vitamins and minerals of nutritional importance, for which specific intake recommendations exist and their presence exceeds the 5% of the Nutrient Reference Value or the national established threshold per 100g or per 100mL or per serving, can also be listed in the nutrient declaration. [38] For special provisions and diets, the respective Codex guidelines apply, in accordance with the general Codex guidelines. [38] Furthermore, the Codex states that specific conversion factors or formulae must be used for the calculation of energy and protein content, respectively: [38]

Table 7: Conversion factors for the calculation of energy amount in foods and formula for the calculation of the protein content in foods. [38]

Energy conversion factors	
Carbohydrates	4 kcal/g - 17 kJ
Protein	4 kcal/g - 17 kJ
Fat	9 kcal/g - 37 kJ
Alcohol (Ethanol)	7 kcal/g - 29 kJ
Organic acid	3 kcal/g - 13 kJ

$$Protein = Total\ Kjeldahl\ Nitrogen * 6.25 \qquad (2)$$

The Codex also regulates the mean of the presentation of all nutrient information, in order for consumers all over the world to receive the information easily and avoid confusion and mischief. [38] Hence, the nutrient declaration should be numerical, without excluding the use of additional formats of presentation, the energy content must be expressed in kJ and kcal per 100g, per 100mL, per package for single portion packages or per serving or portion, provided that the number of servings or portions is explicitly written on the package. [38] Accordingly, the information for protein, carbohydrate and fat content should be given in g per 100g, per 100mL, per package for single portion packages or per

serving or portion, provided that the number of servings or portions is explicitly written on the package (especially the protein content can also be expressed as percentage of the Nutrient Reference Value). [38] Vitamin and mineral content must be presented in metric units and/or as percentage of the Nutrient Reference Value per 100g, per 100mL, per package for single portion packages or per serving or portion, provided that the number of servings or portions is explicitly written on the package. [38] The following Table 8 presents the Nutrient Reference Values, as incorporated in the Codex Alimentarius. Especially for Vitamin A, a clarification was made that "for the declaration of β-carotene (provitamin A) the following conversion factor should be used": [38]

$$1\ \mu g\ retinol = 6\ \mu g\ \beta\text{-}carotene \qquad (3)$$

Table 8: Nutrient Reference Values, as presented in the Codex Alimentarius. [38]

Nutrient	NRV	Unit	Nutrient	NRV	Unit
Protein	50	g	Vitamin B12	1	µg
Vitamin A	800	µg	Calcium	800	mg
Vitamin D	5	µg	Magnesium	300	mg
Vitamin C	60	mg	Iron	14	mg
Thiamin	1.4	mg	Zinc	15	mg
Riboflavin	1.6	mg	Iodine	150	µg
Niacin	18	mg	Copper	Value to be established	
Vitamin B6	2	mg	Selenium	Value to be established	
Folic acid	200	µg			

In the case of carbohydrates, when a specific type of carbohydrates is mentioned, then it should always follow the declaration of total carbohydrates (i.e., "Carbohydrate …g, of which sugars …g"), while for fats, the following format should be used for the declaration of their type, according to the Codex: [38]

Total Fat		...	g
of which	saturated fatty acids	...	g
	trans fatty acids	...	g
	monounsaturated fatty acids	...	g
	polyunsaturated fatty acids	...	g
Cholesterol		...	mg

Figure 8: Format of specific fat declaration in foods. [38]

Regarding tolerance limits, these "should be set in relation to public health concerns, shelf-life, accuracy of analysis, processing variability and inherent lability and variability of the nutrient in the product, and, according to whether the nutrient has been added or is naturally occurring in the product". [38] Furthermore, all the values should be weighted averages from specific analysis and, in case of a nutrient that follows a specific Codex standard, then the tolerance limits must follow the standard's requirements. [38] The supplementary nutrition information helps the consumer better understand the nutritional value of the food, is optional and can exist only in addition to the nutrient declaration and not replacing it. Pictorial and/or colour presentations can be used and it should be accompanied by consumer education programmes in order to improve consumer understanding and use. [38] Finally, the Codex suggests that a periodic review of the nutrient declaration should take place, in order to update information and comply with novel policies and scientific breakthroughs related to public health and nutrition. [38]

3.3 Claims

The claim of a certain benefits of a food product, that its consumption will provide to the consumer, must be made following strict rules and guidelines, which assure that the in-question claim is true, not misleading, does not "create an erroneous impression regarding its character in any respect" and it can be proven and justified. [39] According to the Codex Alimentarius, "a claim is any representation which states, suggests or implies that a food has particular characteristics relating to its origin, nutritional properties, nature, production, processing, composition or any other quality". [39] The Codex categorises the claims into three different groups: "prohibited claims", "potentially misleading claims" and "conditional claims", which are also divided into several sub-groups. [39] The first category contains claims that cannot be proven, claims that imply that a balanced diet does not "supply adequate amounts of all nutrients", claims that a food can supply the consumer with "an adequate

source of all essential nutrients" with the exception of well-defined products into the Codex standard, claims that can cause safety related doubt and fear about similar products and claims that suggest that the consumption of a food will prevent or treat a disease or physical condition, with two exceptions: the appliance of the Codex's standards on Foods for Special Dietary Uses and the lack of a Codex standard combined with the national laws of the country in which the food is sold. [39] The second category encompasses misleading claims, such as claims that use "incomplete comparatives and superlatives" and claims that relate to good hygiene practice (i.e., "wholesome, healthful, sound"). [39] The third and last category permits seven cases of conditional claims: [39]

1. The enrichment of the food with nutrients, such as vitamins, minerals and amino acids, according to the Codex's General Principles for the Addition of Essential Nutrients to Foods.
2. The reduction of nutrients, according to laws by the appropriate authorities.
3. The use of terms such as "natural, pure, fresh, home-made, organically/biologically grown" only when the laws of the country where the food is sold allow it.
4. The use of terms such as "Halal, Kosher", only when "the food conforms to the requirements of the appropriate religious or ritual authorities".
5. The use of generally accepted claims for all similar products.
6. The use of claims that declare the "absence or non-addition of particular substances" only when:
    a. It is not misleading
    b. The substance is not subject to specific requirements in any Codex Standard or Guideline
    c. The substance is expected to exist into the food
    d. The substance has not been replaced with another, thus not altering the food's characteristics, unless this replacement is emphasized
    e. The substance's presence or addition is permitted in the food
7. The use of claims that emphasize on the absence or non-addition of nutrients should comply with the mandatory nutrient declaration of the Codex's Guidelines on Nutrition Labelling.

3.4 Use of Nutrition and Health Claims

As far as the use of nutrition and health claims is concerned, the Codex Alimentarius has some strict guidelines in order to safeguard the health of the consumers worldwide: the nutrition claims should abide to national laws and policies, while the health claims should, in addition to compliance with

national laws and policies, be supported by concrete scientific evidence, be true and straightforward and be monitored for their effect on consumers' eating behaviours and diets. [40] According to the Codex, nutrition and health claims are prohibited for foods targeting infants and young children, unless otherwise regulated by specific Codex standards or national legislation. [40] For better understanding the nutrition and health claims, the Codex has divided them into different categories, in respect to their intended message: [40]

1. Nutrient content claim: a claim based on the level of a nutrient contained in a food (i.e., "source of …", "high in …", "low in …" etc.)
2. Nutrient comparative claim: a claim based on the comparison of the nutrient and/or energy levels between at least two different foods (i.e., "reduced", "less than", "fewer", "increased" etc.)
3. Health claim: a claim based on any suggestion or insinuation of a relation between a food or any of its constituents and health. The following can be regarded as health claims:
    a. Nutrient function claims: claims based on the physiological role of a nutrient in the growth, development and normal functions of the body (i.e., "Nutrient X [role of nutrient X]. Food Y is [nutrient content claim] in nutrient X.")
    b. Other function claims: claims based on specific favourable and positive effects due to the consumption of a food, in the context of a total, normal diet and normal functions of the body (i.e., "Substance X (positive effect of X associated with health). Food Y contains …g of substance X.")
    c. Reduction or disease risk claims: claims based on the reduced risk (significantly altering a major risk factor) of developing a disease, due to the consumption of a food. Since diseases have numerous risk factors and altering only one of them might not have a beneficial effect or prevent the said diseases, the interpretation of the claim must ensure that consumers will not confuse it with prevention claims. (i.e., "A healthful diet low in/high in X may reduce the risk of disease Z. Food Y is low in/high in X.")

In relation to nutrition claims and nutrition labelling, any claim must be accompanied by a nutrient declaration and only claims concerning energy value, protein, carbohydrate, fat, dietary fibre, vitamins and minerals are permitted. [40] All conditions of the Codex's guidelines must apply for a nutrient content claim to be made. In the specific case that "a food is by its nature low in or free of the nutrient that is the subject of the claim, the term […] should be in the form "a low (name of the nutrient) food" or "a (name of the nutrient)-free food"". [40] Table 9 shows the conditions for nutrient content claims to be made.

Table 9: Conditions that should apply for a nutrient content claim to be made, according to Codex Alimentarius. [40]

Component	Claim	Conditions (not more than)
Energy	Low	40kcal (170kJ) per 100g (solids) or 20kcal (80kJ) per 100mL (liquids)
	Free	4kcal per 100mL (liquids)
Fat	Low	3g per 100g (solids) 1.5g per 100mL (liquids)
	Free	0.5g per 100g (solids) or per 100mL (liquids)
Saturated Fat	Low*	1.5g per 100g (solids) 0.75g per 100mL (liquids) and 10% of energy
	Free	0.1g per 100g (solids) 0.1g per 100mL (liquids)
Cholesterol	Low	0.02g per 100g (solids) 0.01g per 100mL (liquids)
	Free	0.005g per 100g (solids) 0.005g per 100mL (liquids)
	Low / Free	1.5g saturated fat per 100g 0.75g saturated fat per 100mL and 10% of energy of saturated fat
Sugars	Free	0.5g per 100g (solids) 0.5g per 100mL (liquids)
Sodium	Low	0.12g per 100g
	Very Low	0.04g per 100g
	Free	0.005g per 100g
Component	**Claim**	**Conditions (not less than)**
Protein	Source	10% of NRV per 100g (solids) 5% of NRV per 100mL (liquids) or 5% of NRV per 100kcal (12% of NRV per 1MJ) or 10% of NRV per serving
	High	2 times the values for "source"
Vitamins and Minerals	Source	15% of NRV per 100g (solids) 7.5% of NRV per 100mL (liquids) or 5% of NRV per 100kcal (12% of NRV per 1MJ) or 15% of NRV per serving
	High	2 times the values for "source"
*In the case of the claim "low in saturated fat", trans fatty acids should be taken into account where applicable. This provision consequentially applies to foods claimed to be "low in cholesterol" and "cholesterol free"		

Regarding the comparative claims, the following rules must be abided by: [40]

1. All claims should be based on the food as sold, taking in account any preparation steps described in the label
2. The foods which the in-question food is compared to must be different versions of or similar to that food
3. The amount of energy or nutrient content difference must be mentioned near the comparative claim, as well as:
    a. The content difference presented as a percentage, fraction or absolute number with full comparison details and to the same quantity
    b. The identity of the compared foods, so that the consumer can easily identify them
4. There must be an energy or nutrient content difference of at least 25%, with the exceptions of micronutrients (at least 10% difference in NRV and compliance of the absolute numbers with the guidelines' levels for characterizations such as "low in", "source of" etc.)
5. The term "light" must be used like the term "reduced", with explicit mention on the reason why the food can be characterized as "light"

For any health claim to be made, all the following conditions must be met: [40]

1. The claims must be based on relevant and valid scientific results, able to support the connection between the claim and health and consisting of the following information on:
    a. The physiological role of the in-question nutrient or an accepted diet-health relationship
    b. The composition of the product relevant to the said role that verifies (a), except if the connection is based on a category of foods with the same results and not on a specific nutrient
2. The claims must be accepted by the appropriate national authorities
3. The benefits of the claim must be produced by the consumption of a reasonable quantity of the food
4. In case that the claim is based on a nutrient with an established NRV, then the food should be characterized by:
    a. "source of" or "high in" label, where the increased consumption is suggested
    b. "low in", "reduced in" or "free of" label, where reduced consumption is suggested
5. Only nutrients for which an established NRV in the Codex or in national authorities' guidelines should be used for nutrient function claims

6. A “clear regulatory framework for qualifying and/or disqualifying conditions for eligibility to use a specific claim” should exist, able to prohibit claims based in quantities of nutrients that can cause a variation of diseases or health irregularities, as well as claims that “encourage or condone excessive consumption of any food or disparage good dietary practice”
7. A valid method to quantify the nutrient on which a health claim is based must exist
8. The following information must appear on the label of the food with a health claim:
    a. The quantity of any health claim related nutrient
    b. The target group, if appropriate
    c. How to use and consume the food, in order to get the benefits of the claim
    d. Advice on how to use the food for vulnerable people and those who should not use it or avoid it
    e. The maximum safe intake
    f. The relation of the nutrient and/or the food to the total diet
    g. A statement on the importance of maintaining a healthy diet

The Codex also allows for claims related to dietary guidelines or “healthy diets” only if: [40]

1. These guidelines or diets are recognized by the respective national authorities
2. The claims “remain faithful to the pattern of eating” of the in-question guidelines or diets
3. The foods are not “based on selective consideration of one or more aspects of the food” and satisfy specific major nutrient criteria of dietary guidelines
4. The foods in-question are not represented with the innuendo that they can “impart health”
5. Their label mentions the relation between the food and the pattern of eating, accordingly to the dietary guidelines

3.5 European Union Guidelines and Regulations

Based on the guidelines of Codex Alimentarius, other national and international institutions, such as the Food and Drug Administration of the United States (FDA) and the European Commission, along with the European Food Safety Authority of the European Union (EFSA), have furtherly specified and adapted these guidelines to their needs. Although the majority of the guidelines are in the same spirit and with the same aim, there are minor differentiations, mainly on limits and thresholds, in order to safeguard the health and interests of the consumer. [41] [42] In order to avoid repetition with the extended aforementioned Codex’s guidelines presentation and since the focus of the present study is

the European markets and not the market of the USA, this section of Chapter 3 will examine the guidelines and regulations of the EU.

In summary, the EU Regulation No 1169/2011 declares that "Food information shall not be misleading" – regarding the characteristics of the food, their attributed properties, ingredients, claims and their presentation to the consumers – and should be accurate, straightforward, without innuendos of prevention, treatment or cure of disease. The Regulation also mentions the responsibilities of each party on food information. [41] In continuation, it regulates the mandatory information that must appear on the food package, such as the list of ingredients, the allergens declaration, the net weight, expiration dates, special conditions and use instructions and the origins of the food, among others. [41] Further instructions are given for the nutrition declaration – contents, their calculation and expression per 100g, 100ml**,** portion and their presentation – as well as the voluntary information. [41] Moreover, the EU Regulation No 1169/2011 prohibits EU Member States to adopt or maintain national measures, unless authorised by the EU, with the exception of measures not impeding the free movement of goods and of issues not regulated by said Regulation, such as those concerning the safeguarding of public health, consumer and industrial or commercial rights protection and fraud prevention. [41] According to the detailed description of "substances or products causing allergies or intolerances" depicted in Annex II of EU Regulation No 1169/2011, similar to the one in Codex Alimentarius, the food categories that must be mentioned on the food label are: [41]

1. Cereals containing gluten and their product
2. Crustaceans and their products
3. Eggs and their products
4. Fish and their products
5. Peanuts and their products
6. Soybeans and their products
7. Milk and its products
8. Nuts and their products
9. Celery and its products
10. Mustard and its products
11. Sesame seeds and their products
12. Sulphur dioxide and sulphites of more than 10 mg/kg or 10mg/L
13. Lupin and its products
14. Molluscs and their products

In addition to that, Annexes I and III-XII of EU Regulation No 1169/2011 further specify important definitions, foods whose labelling needs one or more additional particulars, definitions on the label's x-height, exemptions from the mandatory nutrition declaration, matchings of foods and respective particulars, indication and designation of ingredients, further quantitative ingredient indications, net quantity declarations, dates of minimum durability, "use by" and freezing, meat types whose country of origin or provenance's mentioning is obligatory and alcoholic strength, respectively. [41] Annexes XIII, XIV and XV of EU Regulation No 1169/2011 regulate reference intakes (NRVs) for adults and their amount to sustain a possible nutrition claim (Tables 10, 11 and 12), conversion factors for energy calculation (Table 31 in Annex I) and examples of a nutrition declaration presentation (Table 32 in Annex I), respectively. [41] The respective table containing the NRVs values according to FDA can be found for comparison in Table 33 Annex I.

Table 10: NRVs of vitamins and minerals for adults, according to EU Regulation No 1169/2011. [41]

Nutrient	NRV	Unit	Nutrient	NRV	Unit
Vitamin A	800	µg	Potassium	2000	mg
Vitamin D	5	µg	Chloride	800	mg
Vitamin E	12	mg	Calcium	800	mg
Vitamin K	75	µg	Phosphorus	700	mg
Vitamin C	80	mg	Magnesium	375	mg
Thiamin	1.1	mg	Iron	14	mg
Riboflavin	1.4	mg	Zinc	10	mg
Niacin	16	mg	Copper	1	mg
Vitamin B6	1.4	mg	Manganese	2	mg
Folic acid	200	µg	Fluoride	3.5	mg
Vitamin B12	2.5	µg	Selenium	55	µg
Biotin	50	µg	Chromium	40	µg
Pantothenic acid	6	mg	Molybdenum	50	µg
			Iodine	150	µg

Table 11: NRVs for energy and nutrients other than vitamins and minerals for adults, according to EU Regulation No 1169/2011. [41]

Energy or Nutrient	Reference intake
Energy	2000kcal / 8400kJ
Total Fat	70g
Saturates	20g
Carbohydrate	260g
Sugars	90g
Protein	50g
Salt	6g

Table 12: Percentage thresholds of nutrients for "significant amount" designation, according to EU Regulation No 1169/2011. [41]

"Significant amount" thresholds
-15% of the nutrient's NRV per 100g or per 100ml (except beverages)
-7.5% of the nutrient's NRV per 100ml for beverages
-15% of the nutrient's NRV per portion (for single portion packages)

Concerning nutrition claims, the European Union has regulated the use of nutrition claims in the EU via Regulation (EC) No 1924/2006 and Regulation (EU) No 1047/2012 (amended part of Regulation (EC) No 1924/2006 Annex). [43] Since these regulations are similar to the ones from Codex Alimentarius, a synopsis of them is presented in the present study, focusing on the claims' thresholds and their conditions. According to EU Regulation No 1924/2006, the Regulation applies to all "nutrition and health claims made in commercial communications, whether in labelling, presentation or advertising of foods to be delivered as such to the final consumer, including foods which are placed on the market or supplied in bulk", as well as to "foods intended for supply to restaurants, hospitals, schools, canteens and similar mass caterers". [44] The Regulation declares that any nutrition or health claim must be true and straightforward, based on scientific evidence and justifiable. Also, that they must avoid any confusion and suggestion that other foods' safety or a balanced diet are inadequate, any encouragement or condoning of excess consumption of a food and any generation and exploitation of fear to the consumer, regarding bodily function changes. [44] Moreover, according to

Regulation (EC) No 1924/2006, referring to the ready-for-consumption food, nutrition and health claims should be made if "the average consumer can be expected to understand the beneficial effects, as expressed in the claim", and only if, according to Article 5: [44]

1. "The presence, absence or reduced content in a food or category of food of a nutrient or other substance in respect of which the claim is made has been shown to have a beneficial nutritional or physiological effect, as established by generally accepted scientific data"
2. The nutrient upon which the claim is based:
    a. Exists in the final product in adequate quantity, according to established Community or national laws, to produce the claimed nutritional and/or health benefit
    b. Does not exist or exists in reduced quantity, thus producing the claimed nutritional and/or health benefit
3. The used nutrient exists in a usable by the body form
4. The claimed benefit is produced by a reasonable product consumption, according to Community or national laws
5. The claim is in accordance with further Regulation specifications

Like Codex Alimentarius, Regulation (EC) No 1924/2006 categorizes claims into three groups: nutrition, comparative nutrition and health claims. [44] Regarding comparative claims, the Regulation states that any such claim must be made only among a range of foods of the same category and must refer to the same food quantity, by comparing the foods' compositions of said nutrient(s) which generate the in-question claim. [44] For a food to carry a health claim on its label (or advertisement if the label does not exist), there must be "a statement indicating the importance of a varied and balanced diet and a healthy lifestyle", the necessary quantity and pattern of food consumption, a statement for specific groups of consumers that should not consume the in-question product and a warning if overconsumption of the food might cause health problems and implications. [44] In addition, Regulation (EC) No 1924/2006 strongly forbids the use of the following health claims: [44]

1. Claims that "suggest that health could be affected by not consuming the food"
2. Claims that refer "to the rate or amount of weight loss"
3. Claims that refer "to recommendations of individual doctors or health professionals and associations", unless otherwise provided by national laws and policies

Regarding nutrition claims and their conditions, the provisions of Regulation (EC) No 1924/2006, Regulation (EU) No 1169/2011 and Commission Regulation (EU) No 1047/2012 are summarised in Table 30 in Annex I. [44]

4. Business Plan

4.1 Business Model Canvas

The business model canvas (BMC), proposed by *Osterwalder et al. (2009)*, is a cognitive map that helps and facilitates entrepreneurs to better organize the structure of their business, by illustrating the different aspects of the said business. [45] [46] The BMC consists of nine different elements, as listed below, that define the business, specifically the question "what", by trying to facilitate the procedure of "connecting the dots" from conception to creation. [45]

1. Key partners
2. Key activities
3. Key resources
4. Value propositions
5. Customer relationships
6. Channels
7. Customer segments
8. Cost structure
9. Revenue streams

Definitions for these nine categories might have small variations, however, it is generally accepted that the key partners refer to the possible firm's network of partners; the key activities refer to the definitive activities of the firm in order to develop its product; the key resources contain all the resources needed to develop the product, i.e. human resources, supplies etc.; the value propositions are the services that generate value for each customer segment; customer relationships refer to the relationships that the company maintains with its customer segments; the channels are the firm's mean of communication between value propositions and customer segments; the customer segments are the different target populations of the firm's product; the cost structure contains all of the different business model categories' costs; and, finally, the revenue streams are the value revenues generated from the customer segments. [45] An example of a business model canvas of Nestlé's Nespresso is shown in Figure 9. [47]

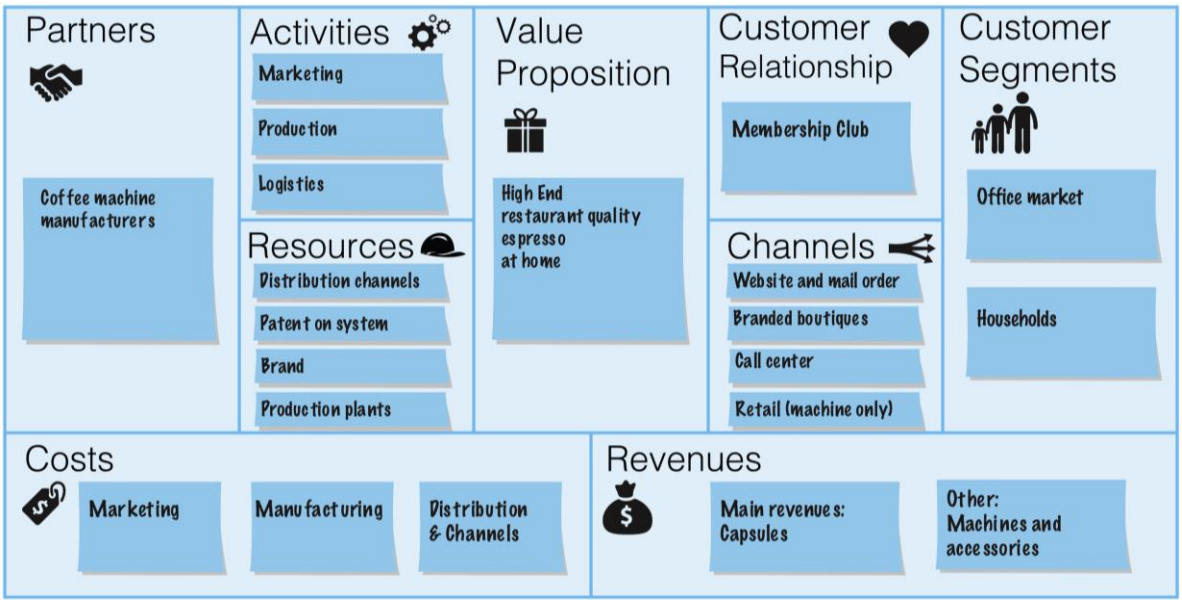


Figure 9: Example of a Business Model Canvas for Nestlé's Nespresso. [47]

These nine categories can be furthermore organized into four larger groups: the product, the customer interface, the infrastructure management and the financial aspects. [45] [48] The first group contains the value propositions of the company, the second one consists of the customer segments, relationship and channels, the third one of the key partners, activities and resources, while the last one contains the cost structure and revenue streams, as is shown in Figure 10. [45]

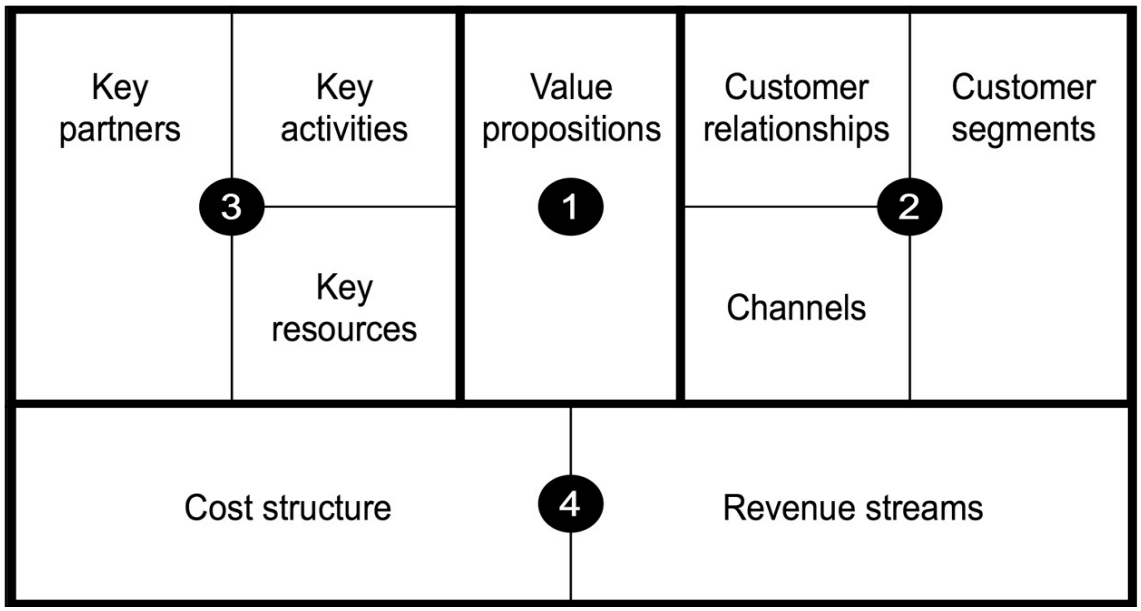


Figure 10: Wider categorization groups of the nine Business Model Canvas elements: 1 = products, 2 = customer interface, 3 = infrastructure management, 4 = financial aspects. [45] [48]

In addition to the already presented model, novel and more specialized models have been created adding new aspects that better adapt to the modern era trends and businesses, i.e., environmental and ethical factors, such as the Triple Layered BMC, the Demand Response BMC or the Ethical BMC. [47] [49] [50] These models organize the company's different aspects of value gains, such as environmental and social, in addition to the economic ones. In this way they enable the improvement of the company's sustainability and adaptability to markets that are characterized by rapid changes, i.e., electricity markets, while still adhering to customers' trends and wishes and to the great scientific and technological advances that are taking place worldwide. [47] [49] [50] The Triple Layered model combines life-cycle analysis and stakeholders' views with environmental and social needs, trying to bridge their distance, while generating value through innovation. [47] In the following Figures 11 and 12 examples of an environmental and a social BMC, are shown respectively. The nine categories are adapted for each model canvas as following: [47]

- Environmental BMC
    i. Supplies and out-sourcing
    ii. Production
    iii. Materials
    iv. Functional value
    v. End-of-life
    vi. Distribution
    vii. Use Phase
    viii. Environmental Impacts
    ix. Environmental Benefits

- Social BMC
    i. Local communities
    ii. Governance
    iii. Employees
    iv. Social value
    v. Societal culture
    vi. Scale of outreach
    vii. End-user
    viii. Social Impacts
    ix. Social benefits

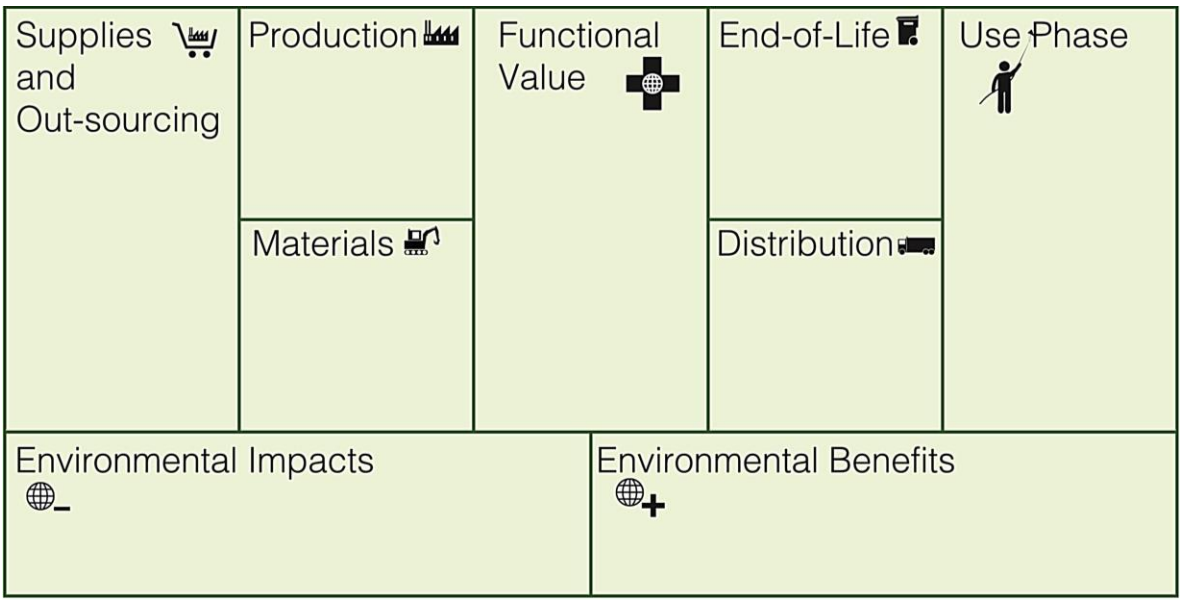


Figure 11: Example of an Environmental Business Model Canvas. [47]

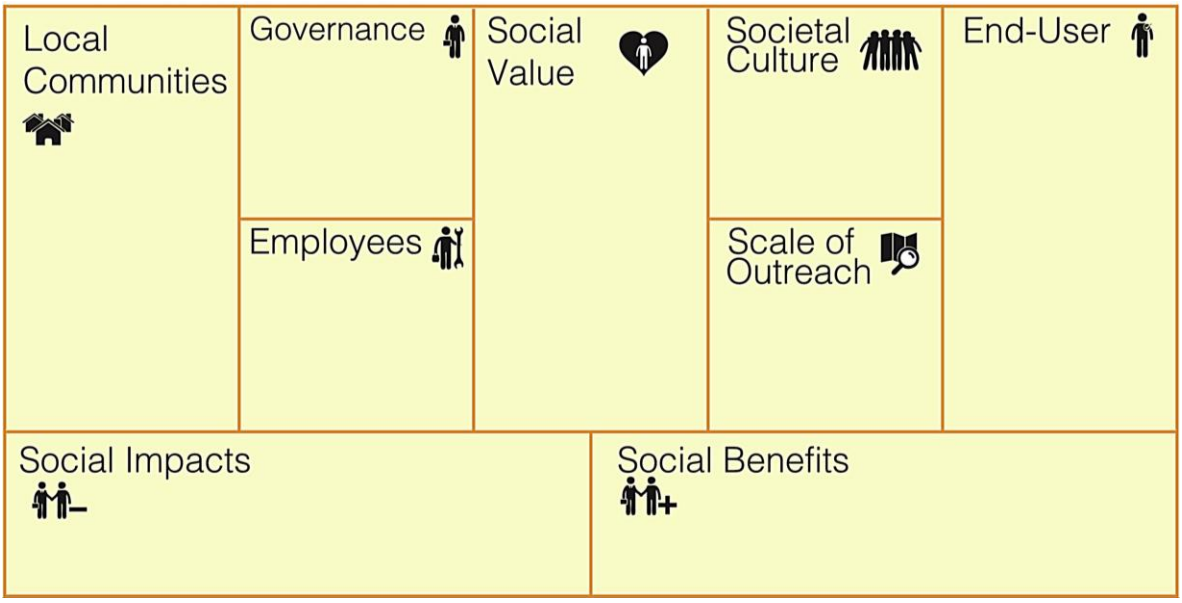


Figure 12: Example of a Social Business Model Canvas. [47]

Regarding the Demand Response Business Model Canvas, it is better applicable to fast changing markets. [49] An example is the effective integration of power produced from renewable energy sources into the electricity market, that presents a time-to-time value variation, according to weather conditions and consumer demand. [49] The nine categories of the Demand Response Business Model Canvas are the following, while an example is presented in Figure 13. [49]

- Demand Response BMC
    i. Demand response source
    ii. Resource availability
    iii. Flexibility mechanism
    iv. Flexibility product
    v. Communication channel
    vi. Service attributes
    vii. Flexibility market segment
    viii. Cost structure
    ix. Revenue model

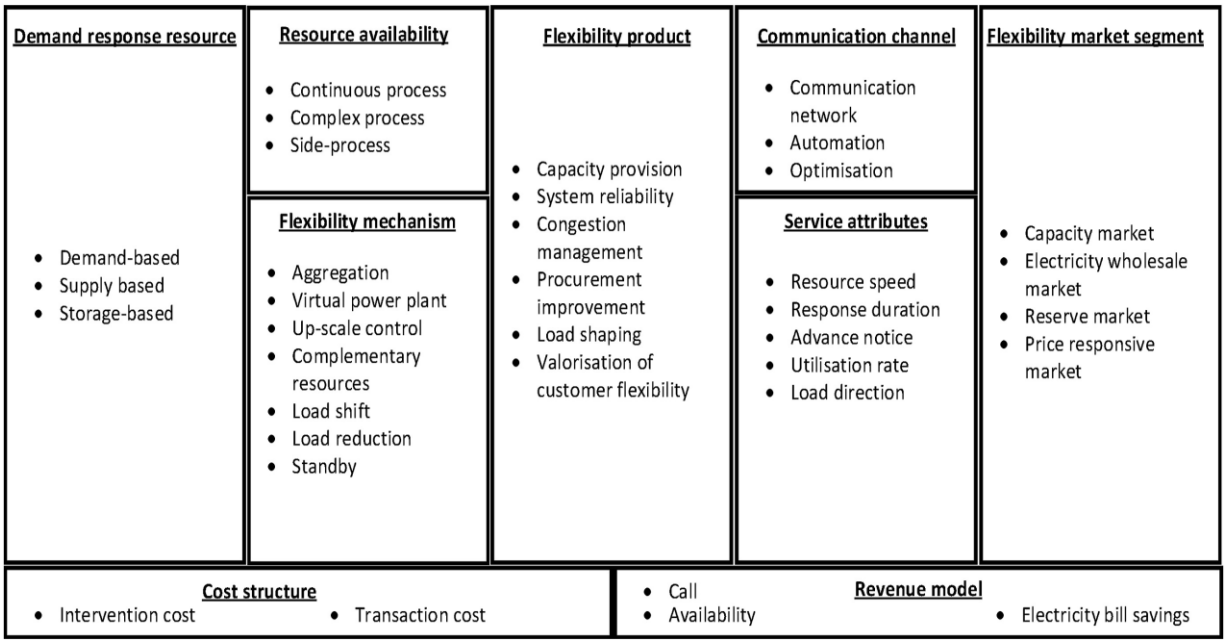


Figure 13: Example of a Demand Response Business Model Canvas. [49]

In addition, due to the exponential advance of artificial intelligence (AI) and the extended use of algorithms, more and more voices suggest that companies should take into account an ethical perspective on their use and impact. The Ethical Business Model Canvas was created, in order to achieve a meaningful response to that threat, without weakening stakeholders' position. [50] It is based on *Markkula's Center for Applied Ethics of Santa Clara University* ethical principles (utility, rights, justice, common good, virtue) [51], with the parallel consideration of stakeholders' position.

[50] The Ethical BMC has eight categories instead of nine, as shown below, while in Figure 14 an example of an Ethical Business Model Canvas is presented. [50]

- Ethical BMC
    i. Virtue
    ii. Users and Customers
    iii. Solution ideas
    iv. Stakeholders
    v. Utility
    vi. Common good
    vii. Justice
    viii. Rights

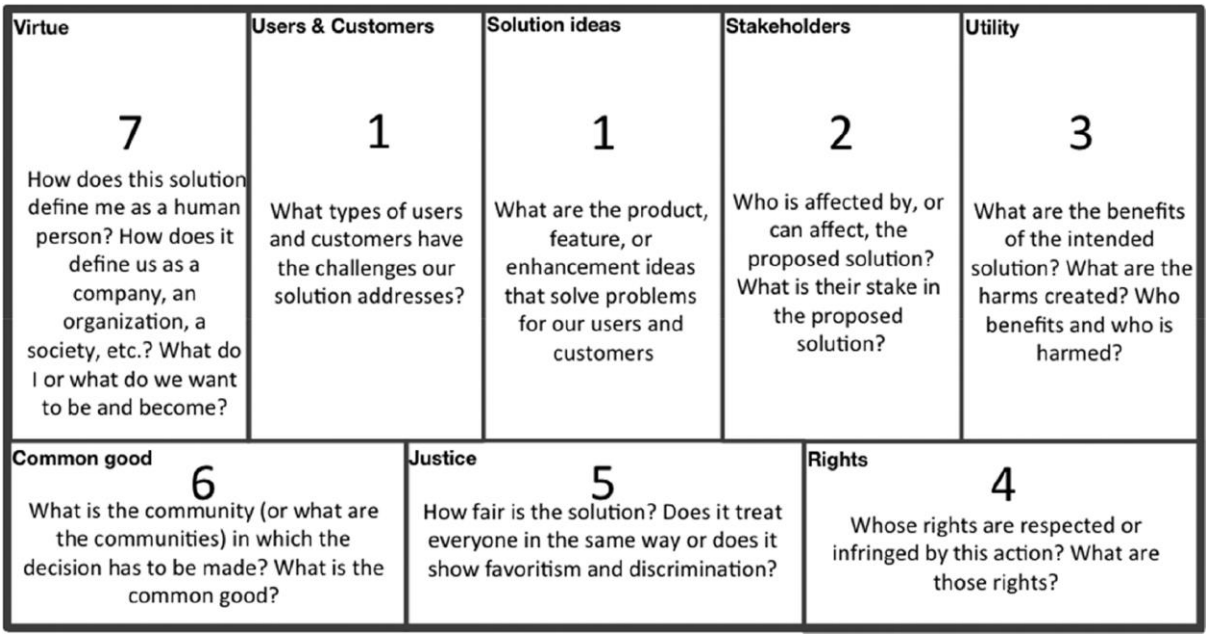


Figure 14: Example of an Ethical Business Model Canvas, with the eight categories, their contents and sequence of completion. [50]

4.2 SWOT Analysis

Moreover, for a better and more complete analysis, the BMC method is usually accompanied by a SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis. [52] The SWOT analysis provides

a view for the firm from both the inside and the outside and has as a goal to link possible strengths and weaknesses (internal factors) with opportunities and threats from the market (external factors). In that way strategies can be suggested to uncover hidden potential and thrust further development. [52] [53] [54] From the combination of the four categories in pairs, the possible strategies for the firm can be extracted, showing the ways to overcome difficulties and threats, assert advantages and built on the already achieved milestones, while a ranking score can show the importance, necessity and order for these strategies' implementation. [54] Figure 15 shows an example of a SWOT analysis template, with the four categories and the questions that accompany them in order to be completed. [53]

	INTERNAL COMPONENTS	EXTERNAL COMPONENTS
POSITIVE	**STRENGTHS** • WHAT is the strength of the identified challenge? • WHY it is considered a strength? • HOW it could be used to overcome the problem?	**OPPORTUNITIES** • WHAT is the opportunity in the surrounded environment of the identified challenge? • WHY it is considered an opportunity? • HOW it could be used to overcome the problem?
NEGATIVE	**WEAKNESSES** • WHAT is the weakness of the identified challenge? • WHY it is considered a weakness? • HOW it could be treated to overcome the problem?	**THREATS** • WHAT is the threat to the identified challenge? • WHY it is considered a threat? • HOW it could be avoided to overcome the problem?

Figure 15: Example of a SWOT analysis and how it should be completed. [53]

The SWOT analysis can be implemented to many fields and businesses, from pedagogics and material sciences to forestry and bioeconomy and from the food sector to large architecture plans and complex energy sectors investments. [53] [54] [55] [56] [57] [58] [59]

5. Greek market analysis

The Greek Market analysis on ready meals is based on the respective sector study of November 2020 from ICAP Group. Ready meals are defined as "standardized foods that do not need further process or material addition, with the exception of baking or heating […] offering solution to the immediate need of eating at home or at work, being full meals". [60] However, this category of food does not contain foods such as standardised meat, fish, vegetable and salad cans, unless pre-cooked and chilled or frozen afterwards. [60] The remaining foods in this category can be divided into three different groups depending on their conservation conditions: [60]

1. Ambient ready meals
    a. Canned (or wet) ready meals (i.e., jar, aseptic sachet etc., that do not require water addition)
    b. Dried ready meals (i.e., noodles, rice and pasta mixes etc., that require water addition)
2. Refrigerator foods
3. Fresh frozen foods
    a. Frozen ready meals
    b. "Hot section" ready meals

According to ICAP's sector study, the trends that shape the demand for ready meals are driven by the same worldwide needs of less house cooking, increased working time, fast pace of life and different types of families (e.g., one-parent family), among others. [61] According to Eurostat, Greeks have the higher mean weekly working time in EU, with 41.7 hours per week for 2019, when the EU-27 mean is 37.1 hours per week, while according to ELSTAT (Hellenic Statistical Agency) 25.7% of Greek families in 2019 were one-parent families. [61] Moreover, a crucial factor that regulates the demand for ready meals is the disposable income of the Greek household, which in 2019 was decreased by 24.6%, in regard with the disposable income in 2008 and which is further affected by the ongoing Covid-19 pandemic. [61] The main core of the 39 Greek enterprises in the ready meals sector of that study are productive and a small number import their products.

However, there are large differences in the scale and type (Société Anonyme (SA), Limited company and Cooperative partnership) of these enterprises and their products, while many of them also trade other products in different food sectors, which produce the majority of their revenues. The total revenues of these enterprises for 2019 are calculated to be 1.15b€, with ELAIS – UNILEVER HELLAS SA having the largest, although decreasing, sales in euros from 2015 through 2018. [62] Furthermore, according to ICAP's Credit Risk and Credit Ability for 2020, 47.1% of the enterprises are in medium

credit risk, 32.4% are in high credit risk, 14.7% are in very high credit risk, 5.9% are in low credit risk and 0% is in very low credit risk, with 79.4% remaining in the same credit risk scale as in 2019, 14.7% improving their place and 5.9% worsening their place. [63] Regarding the effect of the Coronavirus pandemic and the implemented lockdowns, the study concludes that: "the sector of ready meals […] is not expected to encounter important loss of sales and operating profits for the next 12 months, since they are benefited by the increased demand in short-term. Any losses will occur by the possible decrease of demand due to the restriction of dispensable income". [63]

For the financial analysis, ICAP computed 16 different ratios[1] of some of the most important enterprises in the study during the period of 2015-2019: [64]

1. Profitability
    a. Mean gross profit margin from 2015 through 2019 was 29.0%, with annual decrease
    b. Mean net profit margin from 2015 through 2019 was 3.7%, with annual fluctuations
    c. Mean EBITDA (Earnings Before Interest, Taxes, Depreciation and Amortization) from 2015 through 2019 was 8.1%
2. Efficiency
    a. Mean return on equity from 2015 through 2019 was 17.6%, with annual fluctuations
    b. Mean return on assets from 2015 through 2019 was 6.2%
3. Liquidity
    a. Mean current ratio from 2015 through 2019 was 1.78, without significant fluctuations
    b. Mean quick ratio from 2015 through 2019 was low, at 0.36
4. Leverage
    a. Mean debt to equity ratio from 2015 through 2019 was 2.93, with annual decrease from 2016 onwards
    b. Mean fixed to total assets ratio from 2015 through 2019 was 37.5%
    c. Mean financial cost coverage ratio from 2015 through 2019 was high, at 65.4, with annual fluctuations and large differences among the enterprises
    d. Mean short-term bank debt to equity from 2015 through 2019 was 83.5%
    e. Mean short-term bank debt to sales from 2015 through 2019 was 17.1%
5. Activity
    a. Average collection period (or days sales outstanding) from 2015 through 2019 was 118 days, without significant fluctuations
    b. Days payable outstanding from 2015 through 2019 was 105 days

[1] The formulae for the calculation of the above ratios are shown in Table 49 in Annex IV

c. Mean day sales of inventory (Days of inventory) from 2015 through 2019 was 61 days, with medium annual fluctuations
d. Mean cash conversion cycle from 2015 through 2019 was 68 days

From the grouped balance sheets of 13 of the study's enterprises arise that from 2015 through 2019: [64]

1. The assets increased by 19.9% in 264.8 million euros
2. The equity increased by 13.8% in 113.7 million euros
3. The medium- and long-term liabilities and provisions increased by 134%
4. The short-term liabilities increased by 5.5%
5. The total sales increased by 13.6% in 271.4 million euros
6. The gross profits increased by 8.9%
7. The net profits decreased by 37.8%
8. The EBITDA decreased by 26.4%
9. 11 out of 13 enterprises were profitable

Worldwide, the total sales of ready meals for 2020 are expected to be around 508.325 billion dollars, significantly increased due to the coronavirus pandemic, and, after a small decline, they are expected to reach around 522b$ in 2025, while the per capita expenditure is expected to reach $68.3 for 2020 and decline to $62.99 in 2021. [65] Until 2007 the Greek ready meals market was growing significantly every year, due to the modern way of living with increasing working hours and decreasing free time. [66] However, after 2007 and until 2013 the market's value started decreasing due to the strike of the economic crisis, the decline of the dispensable income and the economic strife that Greece entered. From 2014 onwards there were fluctuations in the market's growth, with a value of 116 million euros in 2019. [66] The reasons for the growth since 2017 can be found in the increase of the dispensable income, the high percentage of one-parent families, the high working week hours and the increase of the tourism sector and the foreign visitors, among others. [66] For 2020, the ready meals sector is considered to be one of the few sectors that have benefited from the coronavirus pandemic and is expected to increase by 5% and reach the value of 122 million euros. [66] All the above can be seen in Figure 16.

*Figure 16: Development of the Greek ready meals market from 2010 to 2020. The values are in million €. * Prediction. [66]*

Regarding the different ready meal categories and their progress and share since 2000, frozen ready meals have increased their share from 28.2% to 47.8% and refrigerator ready meals from 6.7% to 15.0%, whereas canned ready meals decreased from 49.0% to 25.9%, "hot section" ready meals from 12.0 to 9.5 and dried ready meals from 4.1% to 1.8%. The ready meal sector value was increased by 116.8%, from 53.5 million euros to 116 million euros. [66] Yet, the five larger companies have 34% of the ready meals market share, so there is room for competition, even if the newly entered enterprises will have to overcome a series of obstacles (i.e., already existing brand names and private labels, high number of competing enterprises etc.) to achieve consumer recognition and win a critical market share. [66] [67]

According to ICAP's study, trademark, advertisement, negotiating power and selling points are very important factors for a successful entry in the Greek ready meals market, competing not only against trademarked competitors, but also against private labels, which are extremely strong in all product categories. [67] For an enterprise to strengthen its position in the market should develop new products that answer consumers' demands, invest in advertisement and product promotion, reach new and younger consumers through internet by adapting to the new technology breakthroughs, and expand to new markets abroad. [67] In respect to imports of ready meals, the trade balance was positive for 2018 and 2019; imports of ready meals in 2019 increased by 6%, having a value of 114.9 million euros, with the majority of them coming from Italy, Germany and the Netherlands; exports of ready meals in 2019 increased by 14.6%, having a value of 152 million euros, with the majority of them going to Germany, USA and UK. [66] Finally, the future of the Greek market of ready meals is uncertain,

because the winter lockdown might cause a short-term growth, but on the other hand the resulting recession might undermine this growth in the long-term. [67] Under the condition that the pandemic will end in 2021 and unless a further unexpected event occurs, the market is expected to grow in 2021 and 2022 by 1.3% and 1.2% and reach the value of 123.6 and 125.1 million euros, respectively. [67]

As can be seen from the above percentages, the dried foods category constitutes a small part of the whole sector, with 1.8% and a value of 2.1 million euros in 2019. [66] According to enterprises that have a share in the dried food market, this situation is due to the small variety of products in comparison with the other ready meal categories and to the fact that the creation of new flavours has only short-term results. [66]

6. Methodology and Processes

In order to design and develop the new food product by incorporating innovations, a number of necessary steps were followed. The process of designing a product is complicated and depends on various factors. It consists of four steps, following the pattern presented in Figure 17. [68]

Figure 17: Pattern followed in order to design, develop and launch a new product in a market. [68]

The steps followed for the design and development of the product were part of the steps presented in Figure 17. The conception and creation of the new product idea or idealization and the concept creation are part of the *Idea Creation*. The small-scale experimentation, the medium-scale experimentation, the HACCP control for safety, the constant evaluation of the food's sensorial quality, the consumer acceptance and feedback, the packaging, the ingredients' supply, the assessment of the economic viability of the project and the marketing and business plan are subgroups of the *Product Design and Development*. The freeze-drying process can, also, be categorized into the *Process Design*, although, since its use is part of the small and medium scale experimentation for the prototyping session, it should better be regarded as part of the *Product Design and Development,* too. Once these steps were completed, the next ones would be the assessment of scaling up to industrial scale, the adjustment and designing of the production process and dealing with the supply of the retailers in the market, as well as with the legal verification of all aspects of the project; all these steps were not dealt with in this thesis. In this section, all the above steps will be analysed and specified for the design and development of a new Maggi Soup concept idea.

6.1 Consumer Needs, Creation and Selection of Idea

Initially, with the help of my Nestlé supervisors, the main directions and necessities of the project were defined. A new product was in need with specific requirements for the consumer, such as its sustainability, its nutritional value, i.e., the presence of dietary fibres. After setting the frame for a new product, the creation of a pool of ideas for a new product rich in dietary fibres (prebiotics) and/or in probiotics began. From the many product ideas created, the one proposing a new soup product was finally selected. Hence, the new project was to develop a novel, more exciting soup product for Nestlé's Maggi.

Research with tools such as Mintel were necessary for a better understanding of the soup market: what was this product's requirements and market, the existence of similar and competitive products, its market value and consumers, among others. After this preliminary research, the creation of the product's concept began: why, what, how and for whom. Following these drivers, three different concepts were created, targeting different consumer needs: dried soup powder with bigger pieces of vegetables in sachets, soup in a cup (dried powder with big pieces in an already existing or a one-use special cup) and a special vending machine for soups for professional use.

6.2 Product Design and Development

6.2.1 Creation of the recipes

Once the concept story was completed (five different soups, each one based on recipes and ingredients from a different continent of the world), the recipes were developed through research of different regional recipes using local ingredients. These recipes were then put to small scale testing in the "Creative Food Lab" department, in order to check their compatibility, taste and appearance.

6.2.2 Small-scale prototyping sessions

6.2.2.1 Procurement of ingredients

After the development of the recipes on kitchen scale, the focus was moved towards the production of these products in a dry format. In order to get the final product, a series of processes were required,

the main one being the drying process. Before continuing with the testing, the Health and Safety Department was consulted which confirmed that all the restrictions and safety rules, such as HACCP rules, were followed. For the first round of the prototyping session, air- and sun-dried ingredients were ordered. Jaworski and SILVA supplied the majority of the dried vegetables, while some few, mostly dried fruits and grains, were bought from local suppliers (Coop, Migros, Para alimentation, Globus, Mekong, Uchitomi, Inside Africa, La biotique, L' epicérie du Pont du Chailly etc). In addition, regarding some ingredients needed in dry form, but unable to be found and ordered in that form, they were bought raw and dried in the oven to be used later. Their suitability to be used was verified by measuring their water activity, which needed to be below 0.65 [20], while the specification sheets from the suppliers Jaworski and SILVA were sent to the Health and Safety Department to verify their compliance with the safety thresholds and/or suggest necessary safety measures.

6.2.2.2 Recipe adjustment

Once the necessary ingredients were procured and verified, the newly created recipes were tasted and adjusted in the "Creative Food Lab", as already mentioned, in order to acquire the desired taste, consistency, colour and general appearance (basic sensorial characteristics). In order to make the relevant adjustments and proceed to the next step, the necessary feedback from food specialists and supervisors was taken into account. For the next step, the prototyping sessions were scaled-up from the laboratory and the kitchen-scale "Creative Food Lab" to the pilot scale. In that step the drying and reconstitution processes were checked and used for the production of the product prototypes.

6.2.3 Freeze-drying and Safety measurements

The already produced and cooked soups, around 2L each, were put in special pans into the freeze dryer (an example of a freeze dryer is shown in Picture 1). With the help of the pilot-plant team the drying profile shown in Table 13 was chosen, which needed two days to be correctly completed (48.6h). The process was consisted of seven steps (freezing, extra freezing, 1^{st}, 2^{nd}, 3^{rd}, 4^{th} heating ramp and secondary drying) with varying durations and temperatures ranging from -45°C to 40°C.

Table 13: Freeze-drying profile used for the drying of the prototypes.

Freeze-drying profile						
		Starting Temperature (°C)	End Temperature (°C)	Time (h)	Cumulated Time (h)	Time (min)
Freezing	Freezing	-45	-45	0.033	0.033	2
	Extra Freezing	-45	-40	0.25	0.283	15
Primary Drying	1st heating ramp	-40	-30	16.667	16.950	1000
	2nd heating ramp	-30	0	15	31.950	30
	3rd heating ramp	0	40	10	41.950	600
	4th heating ramp	40	40	6	47.950	360
Secondary Drying	Secondary drying	40	25	0.6	48.550	36
				Total Time (h)	48.6	

Once the freeze-drying process was completed, each soup powder was collected in special container-bags, sealed and had its water activity checked, according to the Health and Safety Department's instructions, before being used. All the water activity measurements were made at a Novasina Water Activity Meter, where the samples were put for 1 - 1.5h at 25°C. Then, the reconstitution of 60g of each soup was tested in respect of time, taste, consistency, colour, flavour and appearance, again with the help of specialists, in order to get specific corrective suggestions and a wide variety of feedback and taste palette. This process was repeated until the aforementioned sensorial characteristics of the prototypes after reconstitution were improved.

Picture 1: The LYOVAC freeze dryer, example of a small-scale freeze dryer from GEA. [69]

6.2.4 Packaging

At the same time, another important factor of the product design was advancing: the package and the image for each one of the five products were being discussed and created in a primer level, side by side with the designers' team. It was decided that each soup would have its own package according to its origins, with its name, colour, slogan and symbols, all under a general theme. Once all of these, as well as the style of the package were chosen, the design was started to be developed. In order to be thoroughly completed, the nutritional information and claims needed to be clarified. This was achieved through information taken from the USDA Food Composition Databases [70] and was based on the recipe and portion size of each soup.

6.2.5 Nutritional Value data collection

The nutritional value and the possible claims of each soup were calculated using information from the USDA Food Composition Database, as mentioned above. The nutritional data per 100g and the recommended daily value percentage (NRV %) of each ingredient in the five soup products were found. Then, the ingredients' percentages were calculated according to their presence in the recipe, followed by the estimation of the nutritional data of each soup per 100g and per portion (30g), as well as of the ingredients' percentage of the recommended daily value and of the nutritional claims.

6.2.6 Business Plan and Market Selection

In parallel with the accumulation of data and information concerning the product and the target consumers of the product's concept plan, the creation of the business plan and the marketing strategy was initiated. The right test-market was specified (market statistics, population, product market share etc.) with the help of market analysis tools, such as Mintel. In addition, with the insight of the responsible specialists and Nestlé Departments, the product's business plan and market strategy were brought in line with the "Innovation and Research" (I&R) plan of the relevant Nestlé Food business. The Net Net Sales (NNS) and the Total Resales Value (SOP) were calculated in order to complete the Top-Down analysis.

In order to choose the target market, necessary information and market analysis tools were required. Important information included, among others, the population of the candidate markets and its age

classification, the volume and value market share of the biggest competitors in each market and the price range of relevant products. In the current project, the possible markets were European countries, such as the Netherlands, the UK, Germany, France, Italy and Spain. Population statistics were collected from the CIA World Factbook, while market statistics were accessed and processed via Mintel. Mintel is a company based in London, UK, offering tools and information on global market research, as well as market insight for a number of different products and product categories worldwide. The acquired information was then incorporated into an internal Nestlé "Volume Forecasting Tool" Excel sheet, in which the population number of the targeted market, its expected annual growth and the percent of the share target population of the total population were added. In all market scenarios, the annual population growth was put at 0% and the share target population at 50%. Then, the retail selling price per unit was chosen at 2.00€ and the unit weight (two times the portion size) at 60g. The NNS was put at 1.50€ and the total margin was 25% (assumed simplification incorporating Total Trade Spend and Retailer Margin). Two different models were used, based on the weekly frequency of consumption: the "Low Scenario" at 0.25 units per consumer and the "High Scenario" at 1 unit per consumer. From these data, the annual estimated frequency was calculated. Finally, the market estimated penetration was put at 3.00%, a good initial estimation for a new product, according to Nestlé specialists. From these inputs it was possible to calculate for each scenario the target population segment, the potential consumers, the total unit sell-out, the total volume sell-out in tonnes, the total retail sales value and the total NNS value annually, for a five-year period. In addition, a SWOT analysis with the strengths, weaknesses, opportunities and threats was also conducted for this project, while using all the available data a business canvas was constructed in order to facilitate the analysis.

6.2.7 Raw materials costs

Regarding the ingredients supply cost analysis, the purchase prices of the raw, air-dried and freeze-dried ingredients were obtained through Alibaba [71], SILVA [72] and Jaworski [73] in US$ per ton. In cases where the necessary ingredient could not be found in the required form (raw, air-dried or freeze-dried), its cost was calculated following the main motif observed through each category. Specifically, from raw to air-dried and from air-dried to freeze-dried it was multiplied by a factor of 2. Once these tables were completed, each soup's recipe was analysed based on its ingredients' percentage. Finally, each ingredient's cost per unit (60g) was calculated by multiplying the percentage of each ingredient with the price per ton. This was applied to each of the three differently processed groups of ingredients (raw, air-dried, freeze-dried).

6.2.8 Greek market analysis

Finally, in addition to all the above, a preliminary study was conducted concerning the Greek market of ready meals – under which dry soup products are classified –, as well as the recognizability and the market penetration of Maggi versus Unilever's Knorr, its main competitor in the Greek market. For that, a brand recognizability survey via telephone and online questionnaire was held. 98 individuals participated, aged between 20 and 60 years old, representing the product's target group. The survey was divided into three different parts. The first part consisted of a broader comparison between Knorr and Maggi products and their recognizability, the second one was more specified into Maggi products, whereas the third was focused on Maggi's dry soups.

7. Results and Discussion

7.1 Product Idealization and Creation

The concept story for the design of the new soup products was developed with the contribution of Mintel, as well as Nestlé, tools and departments. Consumers wish and need more natural, easy-to-make and healthy products, new tastes and experiences and have shown a tendency for the homemade aspect of the products they choose and buy. Regarding the ready-to-eat soups, they are thought as a cheap, easy-to-make and low-quality copy of the original, homemade and traditional recipe. Hence, there is room for improvement in all these aspects, with the production of a premium, easy-to-make, healthy and high-quality soup product, that offers at the same time new flavours and experiences to the consumers. Having specified the above, the target consumer for such a product becomes clearer: health-conscious adults and students that have time limitations due to work, university and other activities and want to have a convenient, relatively light but fulfilling, meal afterwards. Germany was chosen as the first test market for reasons explained later.

The three concepts that were created had a different approach regarding the packaging and the way that they would be sold at the consumers. The first one was the already existing packaging in sachets that the consumers empty into a bowl and add warm water, while stirring. The second package was either a one-use carton cup already containing the soup powder and needing reconstitution with warm water followed by consumption and disposal, or a reusable cup with its own re-purchasable sachets of soup powders. The third one was targeted to professionals: a vending machine-like equipment from which the consumers could choose their soup base recipe and adjust it to their needs. From these three concepts, the first one – the sachets – was chosen to work on and used in a market test, while the others remained in consideration for future research and application.

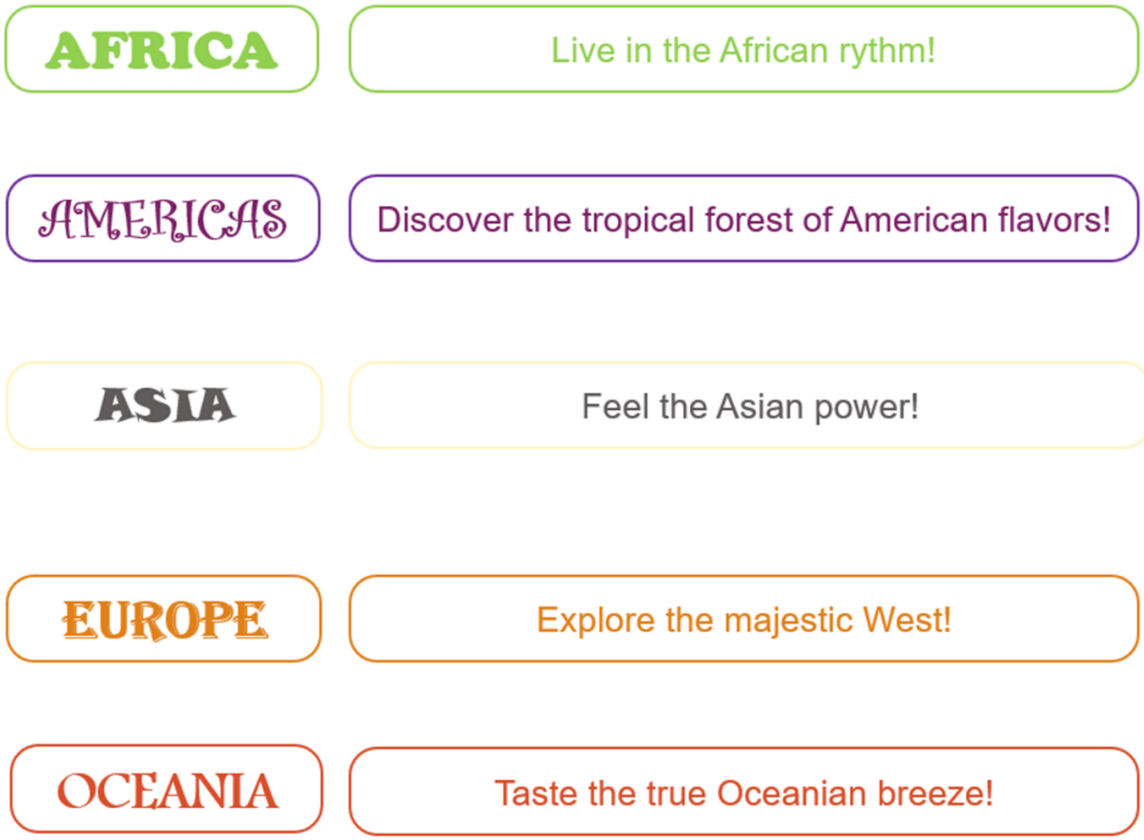
In order to answer the above needs, the product idea of “Around the world in 5 soups” was developed. This idea was based on the diversity of cultures, food, ingredients and flavours that exist in the world and the adventure to feel and taste them. This project idea contains five different soups, based on numerous recipes coming from different regions and cultures of the Earth: from African, American, Asian, European and Oceanian ingredients and recipes. Each one was meant to have its own colour, symbol, name, slogan and general characteristics in order to complete the consumer’s experience.

Picture 2: The five soups constituting the project. From left to right: Amerinca, Celtae, Dragonlong, Africana and Oceander.

Once the concept story and the targeted consumers were identified, the recipes were developed, based on traditional and local recipes from around the world, as mentioned before. In order to be more fulfilling, every soup contained a starch-based ingredient, such as sorghum, orange sweet potato, barley, rice noodles and kumara (a kind of an oceanian sweet potato). Next, several vegetables were used as a source of vitamins, minerals and fibres, as well as ingredients containing proteins, such as mushrooms, beans, peas, tofu and meat for an equilibrated diet. In addition to these, special ingredients to add flavour and regional character were added, i.e., wakame, tamarind and soy sauce, and spices, such as berbere (an African hot spice mix) and chipotle powder. Finally, dried toppings were added, such as banana chips, taco stripes, croutons, sesame seeds and fried onions, to give a crunchier overall feeling. Regarding the chosen names, the African soup was named “Africana”, the American “Amerinca”, the European “Celtae”, the Asian “Dragonlong” and the Oceanian “Oceander” (Picture 2). Table 14 presents the ingredients of each soup according to their percentage of content. Picture 3 shows in addition the respective slogans of each soup, that were developed alongside with the designer team.

Table 14: Ingredients and toppings of each soup

Soups				
AFRICANA	AMERINCA	CELTAE	DRAGONLONG	OCEANDER
Sorghum	Orange sweet potato	Pearled barley	Tofu	Orange sweet potato (kūmara)
Cassava root	Black beans	Broccoli	Rice noodles	Chickpeas
Spinach leaves	Corn	Carrot	Miso paste	Smoked beef
Okra	Pumpkin	Porcini mushrooms	Shiitake mushrooms	Celery sticks and leaves
Tamarind	Fried onion	Onions	Wakame	Garlic, paprika
Berbere	Chipotle powder	Bouillon	Soy sauce	BBQ mix
Toppings				
Banana chips	Taco stripes	Croutons	Sesame seeds	Fried onions



Picture 3: Colours and slogans of every soup.

7.2 Nutritional Value and Claims

In order to find the nutritional values of each soup, the following process was followed. The nutritional composition of every ingredient used in the soups was found, based on the respective information of the raw materials. Then, the nutritional composition of the final product was calculated by adding the respective nutrient amounts of each ingredient, according to the percent participation of each ingredient in the final product. During the process, the loss of micronutrients is very likely and, thus, after the end of the process, the nutritional composition must be measured with the appropriate methods in the laboratory. In particular, the nutritional values (calories, carbohydrates, proteins, sugars, fats, fibres, vitamins and minerals) of every ingredient of the soup were found via the USDA database and a table was filled with the analogous percentages of each ingredient's participation, according to the developed recipes. Then a final table was completed with the amount of every nutritional value per 100g and per portion (30g), as well as with the daily values percentage (NRV %). Finally, according to the specific limits for food and nutritional claims, the claims of each soup were specified for increased market value and differentiation**.** The specific thresholds that apply for the

characterization of a food as “high in”, “good source of”, “low in” or “free of” are presented in Annex I, Table 30. A summary of the used main claims’ thresholds is shown in Table 15.

Table 15: Summary of claims' thresholds in order for a product to carry said claim, according to EU Regulation No 1169/2011 and Table 30 of Annex I.

Claims thresholds, according to EU Reg. No 1196/2011	
Low energy	<40 kcal/100g
Low fat	<3 g/100g
Low sodium	<120 mg/100g
Source of fibre	≥3 g/100g
High in fibre	≥6 g/100g
Source of protein	≥12% of the energy coming from proteins
High in protein	≥20% of the energy coming from proteins
Source of vitamins or minerals	≥15% of NRV/100g
High in vitamins or minerals	≥30% of NRV/100g

As seen in Tables 39 through 43 in Annex III, the Africana and the Celtae soups, although being able to claim numerous labels per 100g, they can only claim a handful per portion, while the Amerinca Dragonlong and Oceander soups can claim even fewer. Due to lack of space, only one of the final tables is presented here, while the rest of the tables, as well as relevant raw data and preliminary tables are presented in Annex III.

Table 16: Nutritional value and claims per 100g and per portion of the Africana Soup.

AFRICANA							
Claims' colours:	High in	Source of	Low in	Free of			
	per (g)	483	per 100g			per portion	
		NRV %		NRV %	Claims	30	DV %
Calories (kcal)	894	45	185	9		55.5	2.8
Carbohydrates (g)	192	67	39.7	15		11.9	4.6
Fibers (g)	19	76	3.9	16	Source of	1.2	4.7
Sugar (g)	19	0	3.9			1.2	0.0
Proteins (g)	23	36	4.7	9		1.4	2.8
Fats (g)	11	18	2.3	3	Low in	0.7	1.0
Salt	1	0	0.2			0.1	0.0
Vitamins							
Vitamin C (mg)	72	103	15	19	Source of	4.5	5.6
Vitamin A (IU)	17	0	4	0			
Vitamin A (mg)	1	62	0.3	0		0.1	0.0
Thiamin (mg)	1	28	0.2	17	Source of	0.1	5.0
Riboflavin (mg)	0	61	0.1	7		0.0	2.0
Niacin (mg)	8	64	1.7	11		0.5	3.3
Pantothenic acid (mg)	1	27	0.1	2		0.0	0.7
Vitamin B6 (mg)	1	71	0.2	15	Source of	0.1	4.6
Folic acid (µg)	299	99	62	31	High in	18.6	9.3
Vitamin B12 (mg)	0	0	0	0		0.0	0.0
Vitamin D (µg)	0	0	0	0		0.0	0.0
Vitamin K (µg)	502	479	104.0	139	High in	31.2	41.6
Vitamin E (mg)	3	16	0.7	6		0.2	1.7
Choline (mg)	4	0	0.9	0		0.3	0.1
Minerals							
K (mg)	1833	32	380	19	Source of	113.9	5.7
Ca (mg)	197	19	41	5		12.3	1.5
Mg (mg)	412	89	85.2	23	Source of	25.6	6.8
P (mg)	579	80	119.8	17	Source of	36.0	5.1
Fe (mg)	9	72	1.9	14		0.6	4.1
Cu (mg)	0	0	0	10		0.0	2.9
Manganese (mg)	4	161	0.9	43	High in	0.3	12.8
Zn (mg)	4	42	0.8	8		0.2	2.5
Se (µg)	19	0	4	7		1.2	2.1
Fluoride (µg)	0	0	0	0		0.0	0.0
Na (mg)	514	10	106	4	Low in	31.9	1.3

Apart from the nutritional claims that a food product can claim, there are also other types of claims that can be gained, if specific procedures and rules are followed. Some of them are the gluten-free label, the bio/organic label, the ethically sourced meat label and the vegetarian and/or vegan label, among others. In the case of the five soups, some claims and labels are specific and unique for each

soup, while others are common in all of them. The “Africana” can fulfil the prerequisites for the following labels per 100g: gluten-free, vegetarian, bio/organic, high in vitamin K, folic acid and manganese, source of fibres, vitamin C, thiamine, vitamin B6, potassium, magnesium and phosphorus, and low in fat and sodium. The “Amerinca” can hold the claims for: gluten-free product, bio/organic, ethically sourced meat, high in proteins and vitamin A, source of fibres, vitamin B6, folic acid and potassium, and low in fat and sodium. The “Celtae” can be vegetarian, bio/organic, high in fibres, copper, manganese and selenium, source of proteins, vitamin C, niacin, pantothenic acid, vitamin B6, folic acid, vitamin K, potassium, phosphorus and zinc, and low in fat. The “Dragonlong” can maintain the claims for gluten-free (it depends on the soy sauce used for its production), vegetarian, bio/organic, high in proteins and manganese and source of calcium, phosphorus, iron, copper and selenium. Finally, the “Oceander” can be labelled as a gluten-free, bio/organic, ethically sourced meat, high in proteins and vitamin A, source of fibres and manganese, and low in fat product. In addition to the above, all the soup products, except for Celtae, can also carry the claim of “no added sugars, contains naturally occurring sugars”. The Figures 18 and 19 show altogether the main nutritional values and claims of each soup, all of which are pre-requisites for the development of the package of the soups.

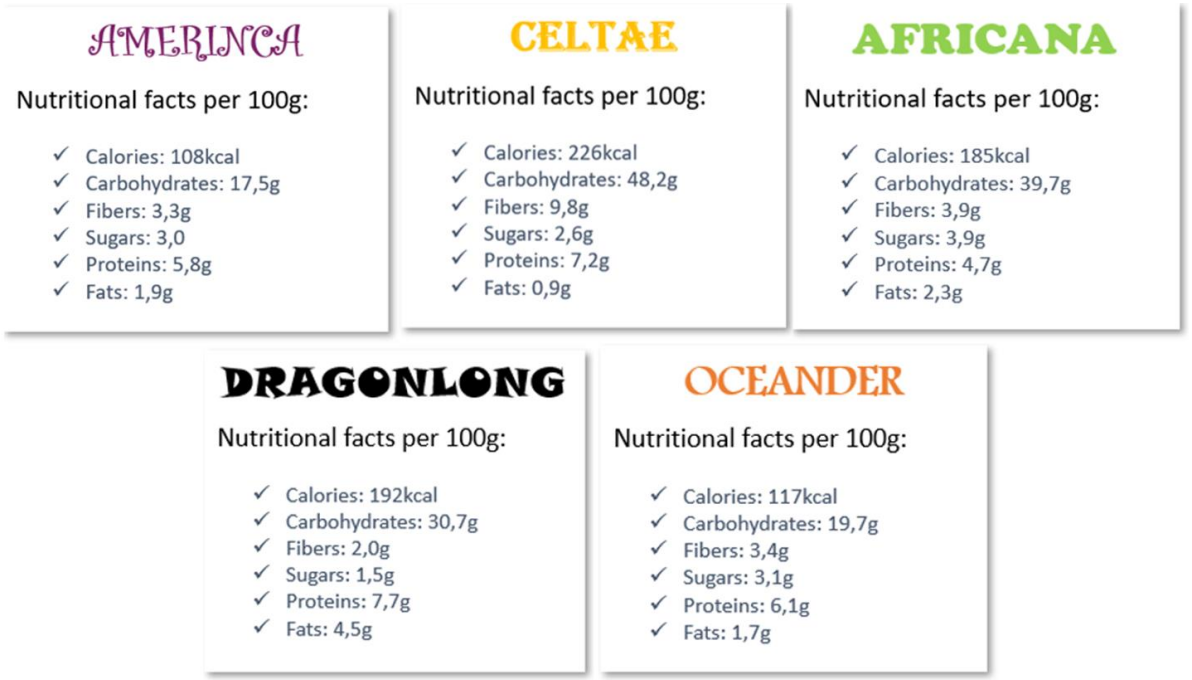


Figure 18: Nutritional facts for each soup per 100g.

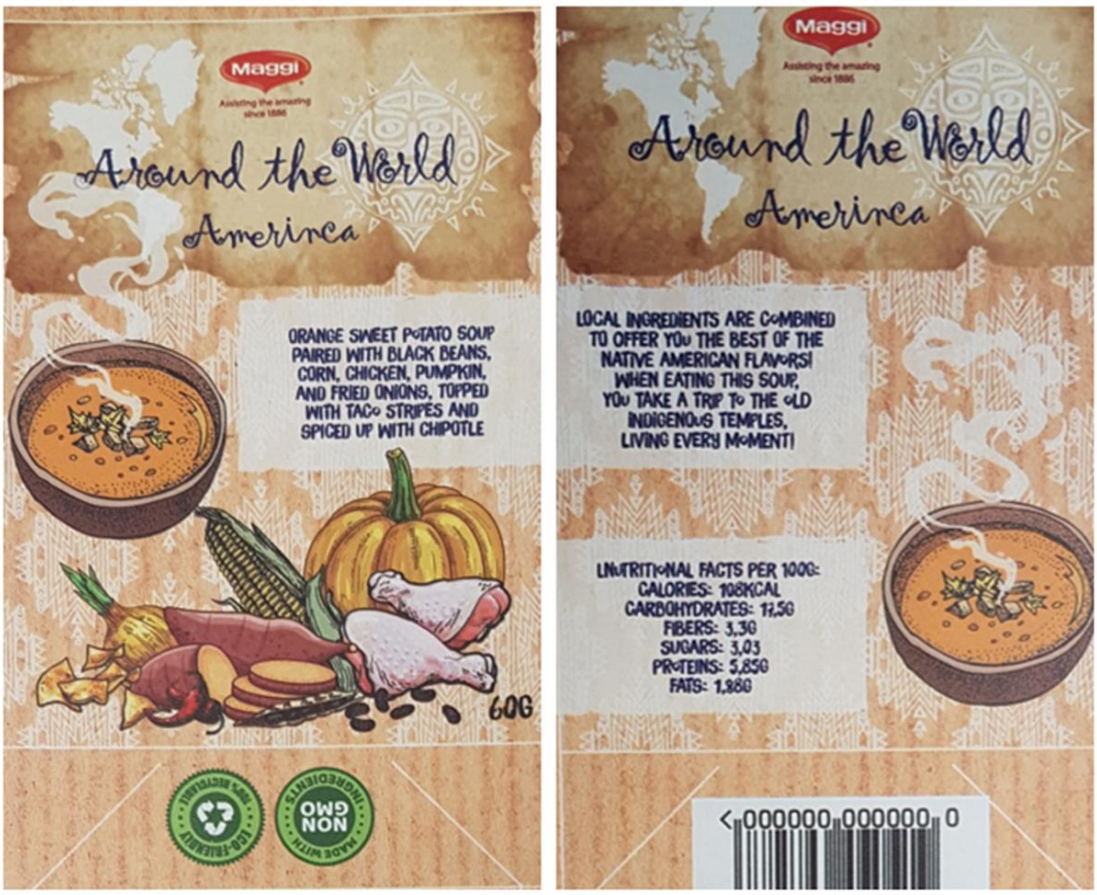
Figure 19: Possible claims that each soup can carry, according to its nutritional composition and the EU regulations and guidelines.

After concluding all the above steps, there was enough information to allow for the creation and design of the packages of every soup. As mentioned before, the package must include specific information, necessary for the consumers to be able to choose among all the competitive products, according to their needs and priorities, but at the same time it has to be appealing and different enough to be distinguished from the other products on the shelf of the retail shop. The package shown below in Picture 5 was created with the help of the designer team of the Lausanne Nestlé Research Centre. It is a paper package in style of sachets that includes the dry mix of ingredients, coated with a protective waterproof layer on the inside to prevent moisture and air to penetrate and destroy the product. Each sachet can stand on its own due to its triangulate pyramidal shape, thus facilitating the storage on the shelf, as well as in the kitchen of the consumer, while being elegant at the same time. The package also includes the brand name, “Maggi”, the title of the product series, “Around the world”, as well as the name of each variety of the soup, “Africana”, “Amerinca”, “Celtae”, “Dragonlong” and “Oceander”.

On the front side of the sachet there are also the symbol of each soup, based on the culture of every region that was the source of the recipe, a graphical image of the ingredients that constitute the soup, a small and appealing description of the soup’s ingredients, as well as the weight of the product. On the back side, there are the nutritional value per 100g and a description embodying the slogan of each soup and motivating the consumer to try the soup and all the amazing experiences that come with it. Lastly, the stamps of the labels that each soup can hold are meant to be presented on the bottom side. At this point, it must be mentioned again that the phrasing of all the above information must be simple, straightforward and in a language that the targeted consumer can understand. The symbols of each soup and the small descriptions are presented in Picture 4 and Figure 20, respectively. Finally, as mentioned before, the soups are meant to be sold in two different ways, as individual sachets and as a combo box of five in one deal.

Figure 20: Names and descriptions of the five soups, that are meant to appear on the package for product promotion.

Picture 4: Symbols of each soup. From upper left to right: Amerinca, Celtae, Dragonlong, Africana and Oceander.



Picture 5: Virtual prototype of a sachet-package of the Amerinca soup, with the name of the company, the name of the product series, its own name, its description, symbol, ingredients, portion size, nutritional data and special claim stamps.

7.3 Raw material costs

The next step in the development of a food product, also playing a major role in the final price of the product, is the procurement of the ingredients and their nature. In this project, two different roads to approach the final product existed, either the preparation of a dry mix of all the ingredients according to the recipes or the cooking of the soups and their subsequent drying. Each of the two approaches has its advantages and disadvantages. The dry mix approach is cheaper, easier to run industrially, already installed and used in the production line and can offer a larger range of choice regarding the suppliers. On the other hand, it is much more difficult to adjust the ingredients and recreate the right mix for each recipe, without losing important sensorial characteristics of the soup, like taste and flavour. The approach of cooking the soups and then freeze-drying them maintains the sensorial characteristics of the soup after reconstitution, due to the freeze-drying technique. However, it is an energy intensive process that requires large amounts of energy in industrial scale and, thus, its use is discouraged because of the high cost. In addition, it would require an investment on equipment to adjust the production line.

For the development of the prototypes and the finalization of the recipes, the cooking and freeze-drying approach was used, because of the small quantities needed for their preparation. All the used ingredients were either fresh or air-dried and the final product, after having been cooked, was freeze-dried. However, since this method is much more expensive, the choice of the preparation method for the production of the final product in industrial scale was based on the economic factor. The dry mix method was chosen, as more efficient and cost effective. However, a new problem appeared, due to the different conditions and nature of the ingredients. For this reason, three different processed ingredient categories were considered and analysed financially: the use of raw ingredients, the use of air-dried ingredients and, lastly, the use of freeze-dried ingredients. In addition, some ingredients, such as potatoes, should be precooked and then dried in order to be used. The tables that show the cost of each ingredient in raw, air-dried and freeze-dried form can be found in Table 34 and 35 in Annex II, while the cost comparisons of each soup, in respect to the origin source of their ingredients are shown in the following Tables 17 to 21. The majority of the data were taken from Alibaba.com in order to verify the existence of the ingredients as products and to estimate their cost. It is expected that with bulk purchases these costs would be reduced but, at the same time, the transportation costs would be increased. For a more detailed analysis, specific costs of the first materials should be procured by their suppliers.

Table 17: Cost analysis in respect to the ingredients' pre-processing for the Africana soup

AFRICANA												
Recipe				RAW INGREDIENTS			AIR DRIED INGREDIENTS			FREEZE DRIED INGREDIENTS		
	g	a/a	%	$/t	$*%		$/t	$*%		$/t	$*%	
Cassava root	150	1.5	31	250	77.64		500	155.28		1000	310.56	
Spinach	100	1	21	500	103.52		1000	207.04		800	165.63	
Okra	50	0.5	10	200	20.70		5000	517.60		10000	1035.20	
Tamarind, raw	15	0.15	3	450	13.98		900	27.95		1800	55.90	
Berbere	1	0.01	0	6610	13.69		6610	13.69		6610	13.69	
Banana chips	15	0.15	3	12000	372.67		400	12.42		10000	310.56	
Sorghum grain	150	1.5	31	150	46.58		150	46.58		150	46.58	
Bouillon	2	0.02	0	0	0		0	0		0	0	
	483		100		648.78	$/t		980.56	$/t		1938.12	$/t
					0.65	$/kg		0.98	$/kg		1.94	$/kg
					0.06	$/100g		0.10	$/100g		0.19	$/100g
					0.04	$/60g		0.06	$/60g		0.12	$/60g

Table 18: Cost analysis in respect to the ingredients' pre-processing for the Amerinca soup

AMERINCA												
Recipe				RAW INGREDIENTS			AIR DRIED INGREDIENTS			FREEZE DRIED INGREDIENTS		
	g	a/a	%	$/t	$*%		$/t	$*%		$/t	$*%	
Corn	60	0.6	11	140	15.22		100	10.87		130	14.13	
Pumpkin	50	0.5	9	200	18.12		2300	208.33		10000	905.80	
Orange sweet potato	250	2.5	45	100	45.29		1500	679.35		3000	1358.70	
Shallots, raw	5	0.05	1	150	1.36		1200	10.87		1999	18.11	
Chipotle	1	0.01	0	1000	1.81		1000	1.81		1000	1.81	
Taco shells, baked	5	0.05	1	6410	58.06		6410	58.06		6410	58.06	
Black beans	120	1.2	22	550	119.57		1100	239.13		2200	478.26	
Chicken	60	0.6	11	500	54.35		1000	108.70		18500	2010.87	
Bouillon	1	0.01	0	0	0		0	0		0	0	
	552		100		313.77	$/t		1317.12	$/t		4845.73	$/t
					0.31	$/kg		1.32	$/kg		4.85	$/kg
					0.03	$/100g		0.13	$/100g		0.48	$/100g
					0.02	$/60g		0.08	$/60g		0.29	$/60g

Table 19: Cost analysis in respect to the ingredients' pre-processing for the Dragonlong soup

DRAGONLONG													
Recipe				RAW INGREDIENTS			AIR DRIED INGREDIENTS			FREEZE DRIED INGREDIENTS			
	g	a/a	%	$/t	$*%		$/t	$*%		$/t	$*%		
Wakame	15	0.15	5	2500	112.95		4000	180.72		10000	451.81		
Miso	50	0.5	15	825	124.25		1650	248.49		3300	496.99		
Soy sauce	10	0.1	3	1260	37.95		2000	60.24		2000	60.24		
Shiitake	20	0.2	6	1230	74.10		1000	60.24		2400	144.58		
Tofu	125	1.25	38	4000	1506.02		8000	3012.05		6000	2259.04		
sesame seeds	10	0.1	3	500	15.06		500	15.06		500	15.06		
Rice noodles	100	1	30	300	90.36		300	90.36		300	90.36		
Bouillon	2	0.02	1	0	0.00		0	0.00		0	0.00		
	332		100		1960.70	$/t		3667.16	$/t		3518.08	$/t	
					1.96	$/kg		3.67	$/kg		3.52	$/kg	
					0.20	$/100g		0.37	$/100g		0.35	$/100g	
					0.12	$/60g		0.22	$/60g		0.21	$/60g	

Table 20: Cost analysis in respect to the ingredients' pre-processing for the Celtae soup

CELTAE													
Recipe				RAW INGREDIENTS			AIR DRIED INGREDIENTS			FREEZE DRIED INGREDIENTS			
	g	a/a	%	$/t	$*%		$/t	$*%		$/t	$*%		
Mushrooms boletus	25	0.25	9	1290	119.44		2600	240.74		5200	481.48		
Onions	7	0.07	3	150	3.89		1000	25.93		10000	259.26		
Carrot	35	0.35	13	300	38.89		1000	129.63		600	77.78		
Broccoli	50	0.5	19	400	74.07		800	148.15		600	111.11		
Pearled barley	150	1.5	56	200	111.11		200	111.11		200	111.11		
Bouillon	3	0.03	1	0	0.00		0	0.00		0	0.00		
	267		100		347.41	$/t		655.56	$/t		1040.74	$/t	
					0.35	$/kg		0.66	$/kg		1.04	$/kg	
					0.03	$/100g		0.07	$/100g		0.10	$/100g	
					0.02	$/60g		0.04	$/60g		0.06	$/60g	

Table 21: Cost analysis in respect to the ingredients' pre-processing for the Oceander soup

OCEANDER												
Recipe				RAW INGREDIENTS			AIR DRIED INGREDIENTS			FREEZE DRIED INGREDIENTS		
	g	a/a	%	$/t	$*%		$/t	$*%		$/t	$*%	
Orange sweet potato	250	2.5	48	100	47.71		1500	715.65		3000	1431.30	
Chickpeas	115	1.15	22	350	76.81		700	153.63		1400	307.25	
Garlic powder	1	0.01	0	600	1.15		600	1.15		600	1.15	
Celery stick	50	0.5	10	450	42.94		1500	143.13		10000	954.20	
Croutons	30	0.3	6	1333	76.32		1333	76.32		1333	76.32	
Paprika	1	0.01	0	800	1.53		800	1.53		800	1.53	
Smoked beef	75	0.75	14	10000	1431.30		10000	1431.30		10000	1431.30	
Bouillon	2	0.02	0	0	0.00		0	0.00		0	0.00	
	524		100		1677.75	$/t		2522.69	$/t		4203.03	$/t
					1.68	$/kg		2.52	$/kg		4.20	$/kg
					0.17	$/100g		0.25	$/100g		0.42	$/100g
					0.10	$/60g		0.15	$/60g		0.25	$/60g

From the above Tables it is clear that, the procurement of air-dried or freeze-dried ingredients for use in the dry mixes is viable and not too expensive in respect to the raw materials. On the contrary, there is an indication that their use will be beneficial, due to their advantages, such as their reduced volume and increased durability and sustainability. Moreover, their cooking and reconstitution times are much shorter – almost instant reconstitution – than the ones of the raw or air-dried materials (i.e., the soups with air-dried ingredients needed at least 3-5 minutes of cooking). Therefore, it is suggested to purchase, wherever possible and feasible, the freeze-dried materials and use them to produce the final dry mix of each soup, according to the recipe.

Finally, Nestlé should test and verify in its factories and production lines the use of the precooked air-dried and, especially, the precooked and freeze-dried ingredients and try to recreate the recipes. In this process Nestlé should find ways to overcome the reduced conformity to the original recipes of the freeze-dried prototypes and the subsequent sensorial deterioration of the final product, due to the production process.

7.4 Water Activity measurements

Regarding the process of preparing the test prototypes, as mentioned before, the cooked soups were put into the freeze dryer for five days and eventually their dry powders were collected. Before being used, these powders had to be checked in respect to safety control protocols and HACCP guidelines. Specifically, their water activity needed to be below 0.65 to impede the growth of pathogens that could endanger the consumer. Therefore, the water activity of the last batch of soups, prepared with the finalized recipe, was measured. As shown in Table 22, the water activity of all the soups was below the necessary threshold of 0.65, and, thus, their use and consumption were deemed as acceptable.

Table 22: Water activity measurement results for the five different soups. For the Oceanian soup two measurements were made, presented in the brackets.

Freeze-dried Soups	Results	
	Water activity (a_w)	Temperature (°C)
Africana	0.039	25.0
Amerinca	0.050	25.0
Dragonlong	0.020	25.0
Celtae	0.066	25.0
Oceander	0.117	25.0

As mentioned before, a measurement of water activity below 0.65 does not necessarily mean that the product does not contain any microorganisms, but only that the ones already present do not grow. If the dried product absorbs humidity and the water activity surpasses the 0.65 limit, the microorganisms will start growing again and might endanger the consumer. Therefore, a measurement of the microbial load is also necessary, as well as good hygiene and manufacturing practices to prevent or diminish the existence of pathogens in the product.

7.5 Market analysis and Business plan

One of the most challenging stages in the process of developing a new product is the choice of the driver market in which it is going to be sold, because each market has its own characteristics, preferences and competitors. Therefore, the product was designed in parallel with the process of the market choice. Initially, the profile of the target population was checked, in respect to the concept story of the product. Several markets were considered, such as markets of developed countries, whose citizens enjoy eating soups and are willing to pay for a better quality of food. These characteristics suggested markets such as the European Union, Switzerland, the United States of America, Canada, Australia, New Zealand and Japan. Every market has its particularities, and a more specific analysis and formation of guidelines was necessary. Thus, it was suggested by consumer specialists that mainly European people are more open to try and taste new types of recipes with flavours from around the world and that the focus to find a test market should be within the European Union. With the help of Mintel tools of market analysis, three markets stood out: Germany, United Kingdom and France, because of their soup market size, their consumers' purchase potential and habits, their proximity and better understanding and the modern way of life of their consumers. Those were researched in more depth, in respect of competitors, market share, volume of market and possible income.

With the above information, as well as available company data, a SWOT analysis was conducted, including all the strengths, weaknesses, opportunities and threats of the company and the product in the market vis a vis the consumers. In addition, again using all the available data, a business canvas was completed showing the structure of the new soup project, in order to better visualise and organise all the different steps, data and information. These two analyses are presented below in Tables 23 and 24, respectively.

Table 23: SWOT analysis regarding the product's project and the company's assets and disadvantages.

SWOT Analysis	
STRENGTHS	**WEAKNESSES**
1. Existing brand 2. Existing customer base 3. Existing distribution and retail centres 4. Existing ingredients suppliers 5. Existing capital for development (R&D) 6. Entrepreneurial spirit 7. Experienced and dedicated personnel	1. Slow moving innovation process (from idea to product launch) 2. Company perception from part of the population
OPPORTUNITIES	**THREATS**
1. Market and consumer trends 2. Diversification (variety) of new products and experiences 3. Easy-to-make, small time consuming 4. Premium feeling 5. Relatively low cost 6. Multiple label claims (natural, clean, sustainable, ethical etc.) 7. Small competition (new approach) 8. More economical process by the time (FD) → cheaper and better-quality ingredients	1. Competitors new entrances 2. Competitors bigger market share and penetration 3. Possible retailers' conflicts

Using Nestlé's Volume Forecasting Tool, all the specific and necessary details were completed, such as the target population of each of the three countries (Germany, UK and France), the share target population segment, the frequency scenarios and the estimated market penetration. For these scenarios to run, and according to the concept story of the soups' product, the population of each country between 15 and 54 years old were chosen as the representative target consumers. The share target population was set at 50% of the above population and the estimated market penetration was put at 3%, while the product's price was set at 2€ per unit and the NNS at 1.5€ per unit, with each unit weighing 60g and the assumed simplification incorporating the Total Trade Spend and Retailer Margin at 25%. The two different frequency scenarios were purchase once every month (low frequency scenario) and once every week (high frequency scenario). From this calculation, the values of Total Retail Sales Value (SOP) and Total NNS Value were extracted in millions of euros, as mentioned before, and are presented for comparison in Table 25.

Table 24: Business canvas of the new soup project.

<table>
<tr><th colspan="5">BUSINESS CANVAS</th></tr>
<tr>
<td rowspan="2">KEY PARTNERS

• Food and Safety department
• Legal department
• Design department
• Advertising department
• Suppliers
• Distributors
• Retail shops
• Factories
• R&D optimization</td>
<td>KEY ACTIVITIES

• R&D development
• Optimization
• Increase market share and penetration
• Food safety
• Process
• Distribution</td>
<td rowspan="2">VALUE PREPOSITIONS

• Supply series of 5 different soup recipes from around the world
• New flavours and ingredients
• Nutritionally balanced
• Sustainable packaging
• Premium and homemade feeling
• Vegetarian choices
• Ethically sourced ingredients
• Gluten-free choices</td>
<td>CUSTOMER RELATIONSHIPS

• Customer feedback (telephone, web, surveys)
• New suggestions

*Trust, safety, satisfaction, new experiences</td>
<td rowspan="2">CUSTOMER SEGMENTS

• Health-conscious adults & students who do not have enough time to prepare full and healthy meals
• EU+ (Germany)</td>
</tr>
<tr>
<td>KEY RESOURCES

• Technology (FD process)
• R&D development
• Process
• Retail agreements, deals and promotion</td>
<td>CHANNELS

• Advertising (TV, web, etc.)
• Retail promotion
• Samples and deals</td>
</tr>
<tr>
<td colspan="3">COST STRUCTURE

• R&D development and optimization
• Procurement of ingredients
• Process
• Advertising (product promotion, market share and penetration)</td>
<td colspan="2">REVENUE STREAMS

• Product sales
• Other company investments and revenues</td>
</tr>
</table>

Table 25: Market analysis of target population in Germany, the United Kingdom and France in respect of Total Retail Sales Value and Total NNS Value, in millions of euros, for the two frequency scenarios (Low and High)

Total Retail Sales Value, SOP (mn €)		
Frequency scenario	Low	High
GER	15.1	60.5
UK	13.1	52.5
FRA	12.9	51.6
Total NNS Value (mn €)		
Frequency scenario	Low	High
GER	11.3	45.4
UK	9.8	39.4
FRA	9.7	38.7

As seen in the above table, Germany is a better candidate for a test market, as it can generate higher revenue from the product launch, while the UK and France respond in the same way, but lagging behind Germany. This can be explained by the difference in population between Germany's 80 million and UK's and France's 65 and 67 million, respectively, as well as their population structure, with France having an older population than both Germany and the UK.

The data concerning the populations and their details regarding the age structure for citizens between 15 and 54 years old were taken from the 2020 estimation of the CIA's World Factbook. The age structure of each of the three countries is presented in Table 26 below.

Table 26: Estimated age structure and total population of France, Germany and the United Kingdom for 2020 from the CIA World Factbook. [74]

Age group	Markets		
	France	Germany	United Kingdom
0-14	18.36%	12.89%	17.63%
15-24	11.88%	9.81%	11.49%
25-54	36.83%	38.58%	39.67%
55-64	12.47%	15.74%	12.73%
65+	20.46%	22.99%	18.48%
Total population (est. 2020)	67,848,156	80,159,662	65,761,117

After the selection of Germany as a test market, its soup market analysis was completed with the help of Mintel's tools that calculated the company retail market share by volume of the prepared soup, as well as the company retail market share by value, all in percentages. With this analysis, presented in

Figures 21 and 22 and Table 27, the five main competitors of Maggi and their respective market share (Continental Foods, Struik Foods, WW International, Unilever and Rila Feinkost) were found.

Table 27: Competitors in the German Prepared Soup market and their market shares by volume and value in percentages. Own label products represent the retailers' private label products.

Competitors	Volume (%)	Value(%)
Continental Foods Europe BVBA	15.9	29.0
Struik Foods Europe N.V.	13.0	8.2
WW International, Inc.	7.2	5.0
Unilever PLC	3.6	6.3
Rila Feinkost-Importe GmbH & Co. KG	1.9	2.6
Own Label	44.4	27.3
Other	14.0	21.5

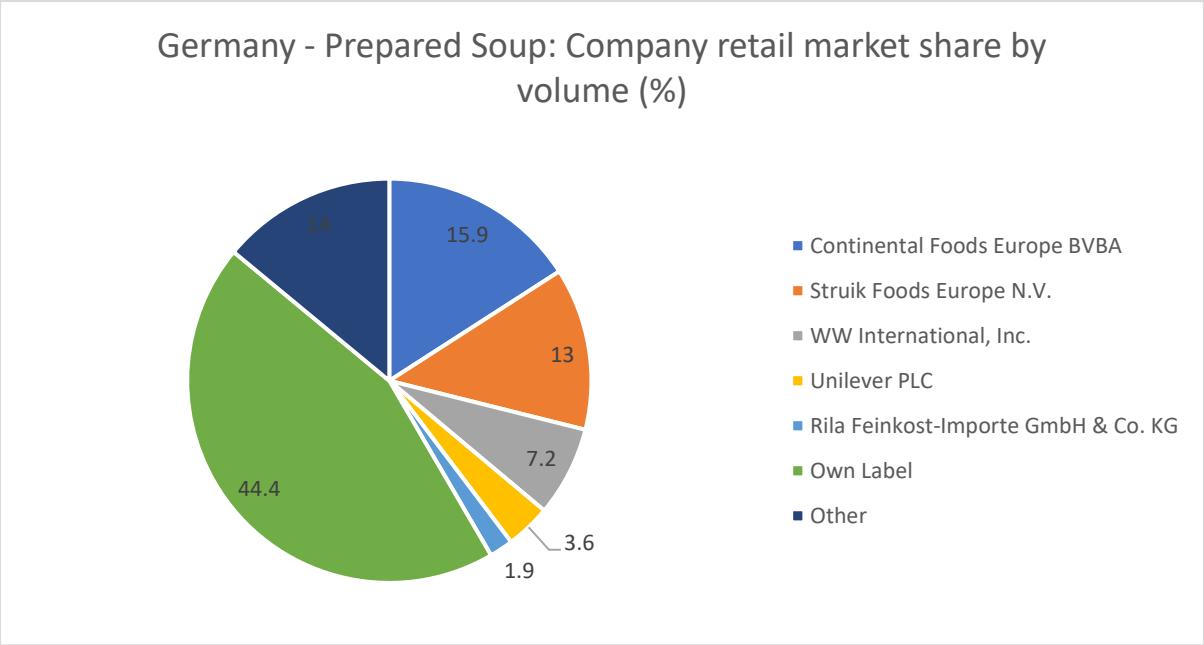


Figure 21: Percentage of the company retail market share by volume for prepared soups in Germany.

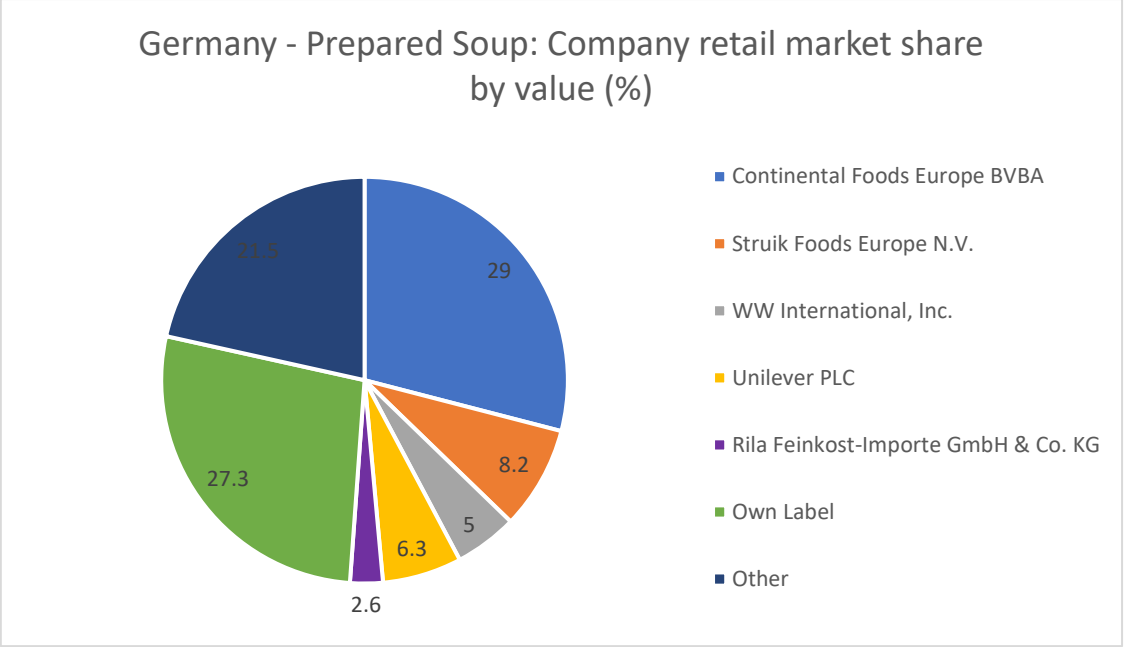


Figure 22: Percentage of the company retail market share by value for prepared soups in Germany.

From the above Figures, it appears that the prepared soup market (dry and wet) in Germany is highly competitive, with five companies occupying more than half of the market's share value, while more than a quarter of it belongs to own label products (retailers' private label products), leaving almost one fifth of the market to the rest of the companies. Regarding the market's volume share, almost 45% of the market is dominated by own label products, 41% by the five biggest companies and only 14% belongs to the rest of the competition.

7.6 Greek market analysis

7.6.1 Consumer Survey

In addition to the above analysis, a smaller and preliminary study concerning the smaller Greek market was conducted. As a first step of this analysis, a small-scale survey was conducted via telephone and questionnaires in 98 participants, aged between 20 and 60 years old, representing the target group. The survey, as mentioned, was divided in three distinct parts: a first, broader and more generic part, a second more specified on Maggi and a third one focused on Maggi's dry soups.

In the first part, the target was to find and analyse the recognizability of Maggi products versus Knorr, its main competitor in the Greek market. The vast majority of the participants had heard about both

Knorr and Maggi, as shown in Figure 23, and knew at least one of their products. However, a small number of the participants had not heard about them.

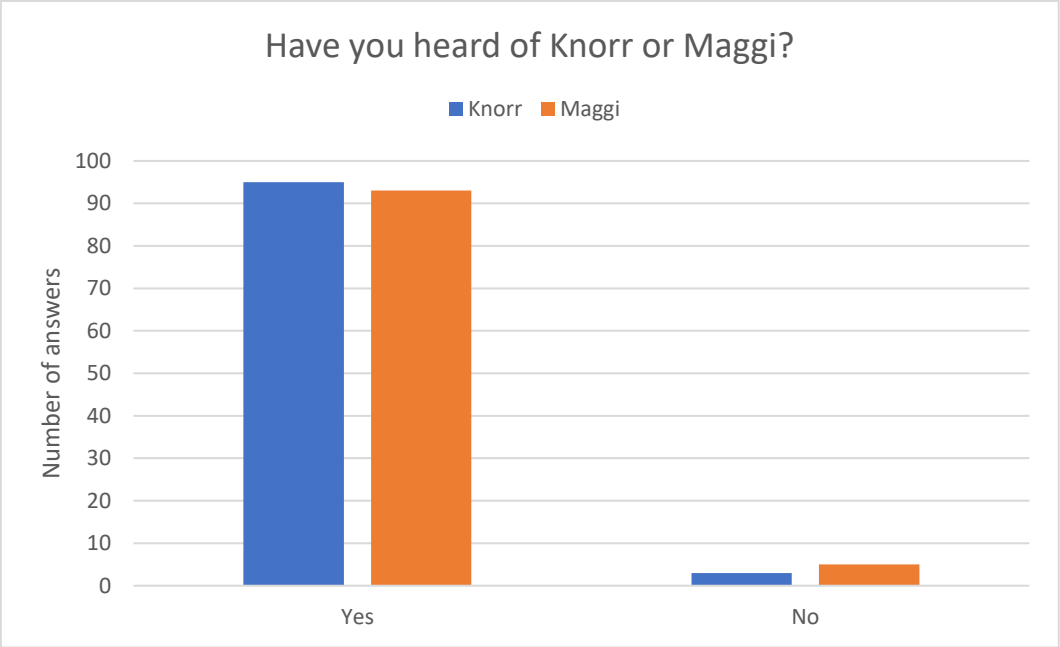


Figure 23: Question 1: Brand recognition.

When asked to mention which Knorr and Maggi products they knew, it was concluded from their answers that Knorr had a better recognizability on the shelf than Maggi, as more participants knew more Knorr products. Moreover, in the Greek market, the most recognizable product of both companies were the cooking cubes. Again, more people knew the Knorr cubes than the Maggi ones, as shown in the following Figures 24 and 25.

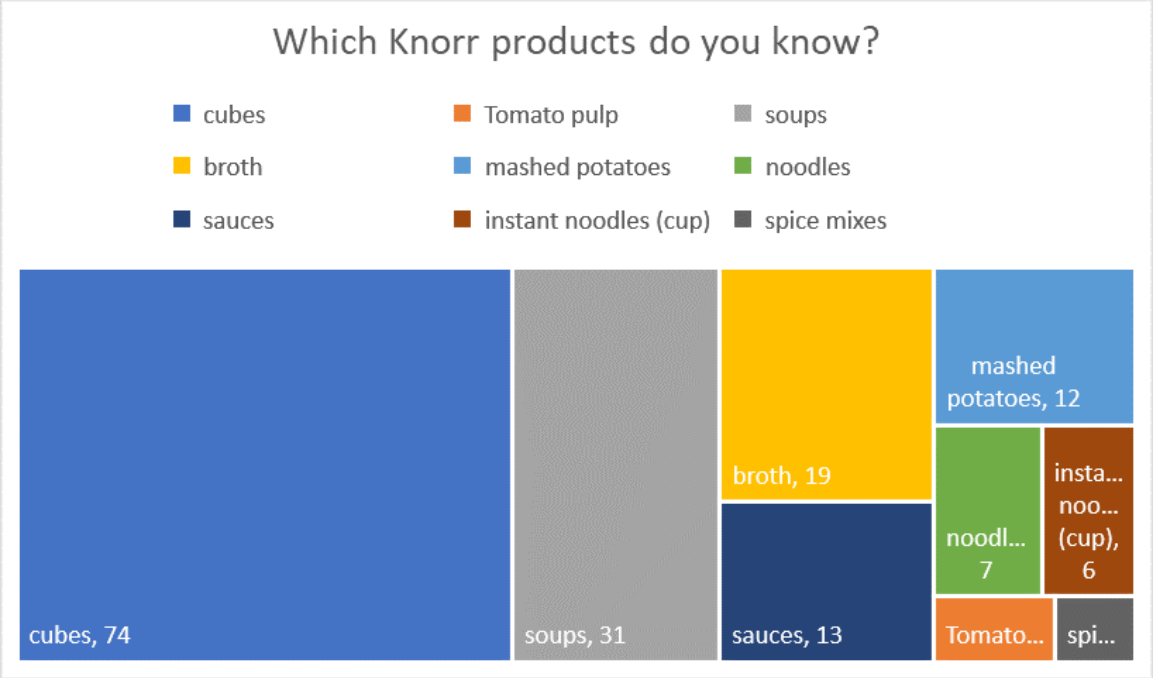


Figure 24: Question 2: Recognizability of Knorr products.

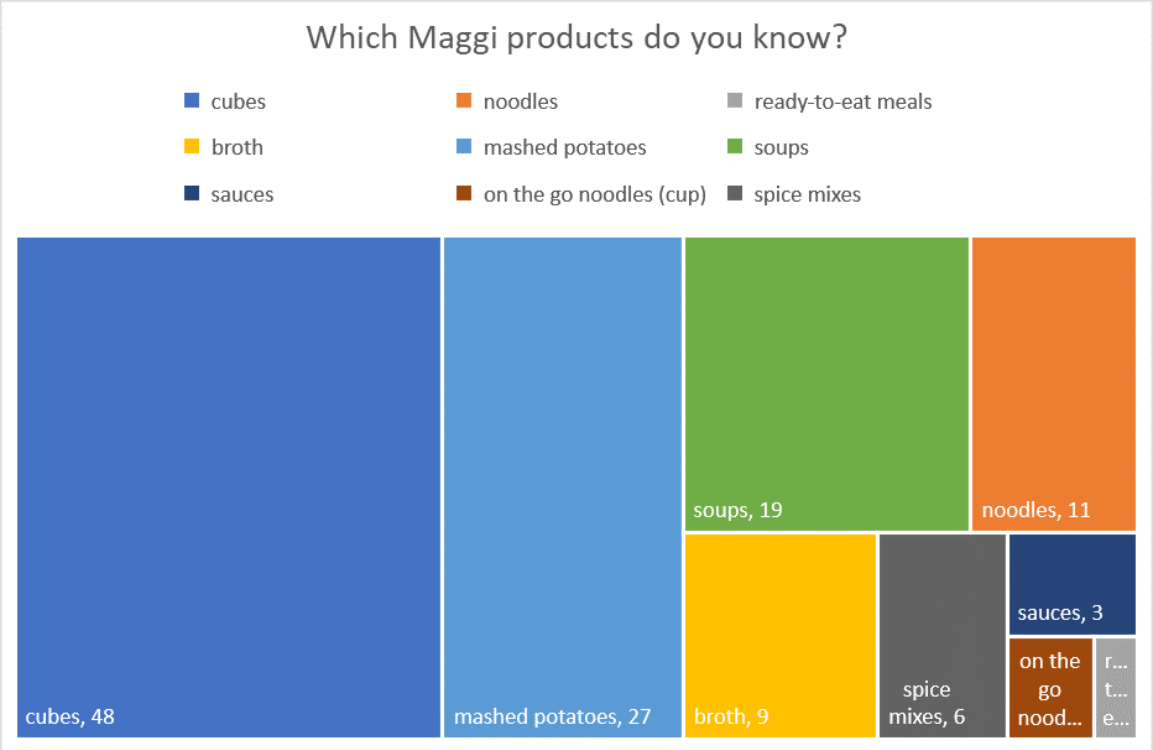


Figure 25: Question 3: Recognizability of Maggi products.

Next, the participants were asked if they had ever bought and/or used any of these companies' products and the majority of them answered positively. Those that had answered favourably, were

further asked to mention which Knorr and Maggi products they use more frequently and with what frequency. All their answers are presented in Figures 26 through 28 below.

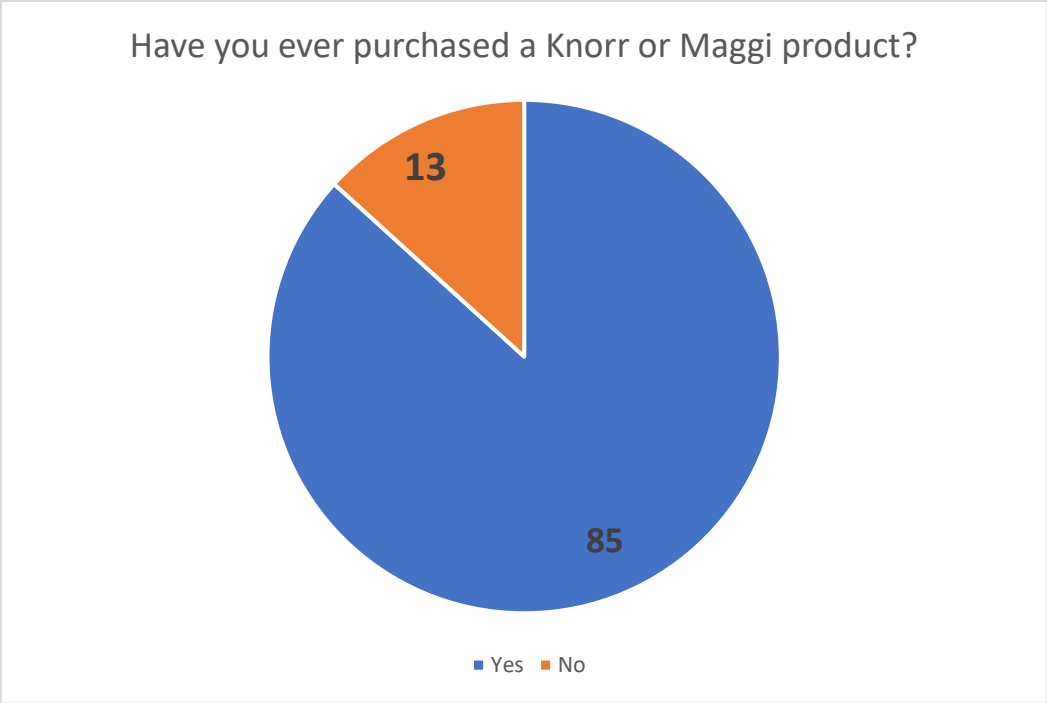


Figure 26: Question 4: Knorr and Maggi penetration in the Greek market.

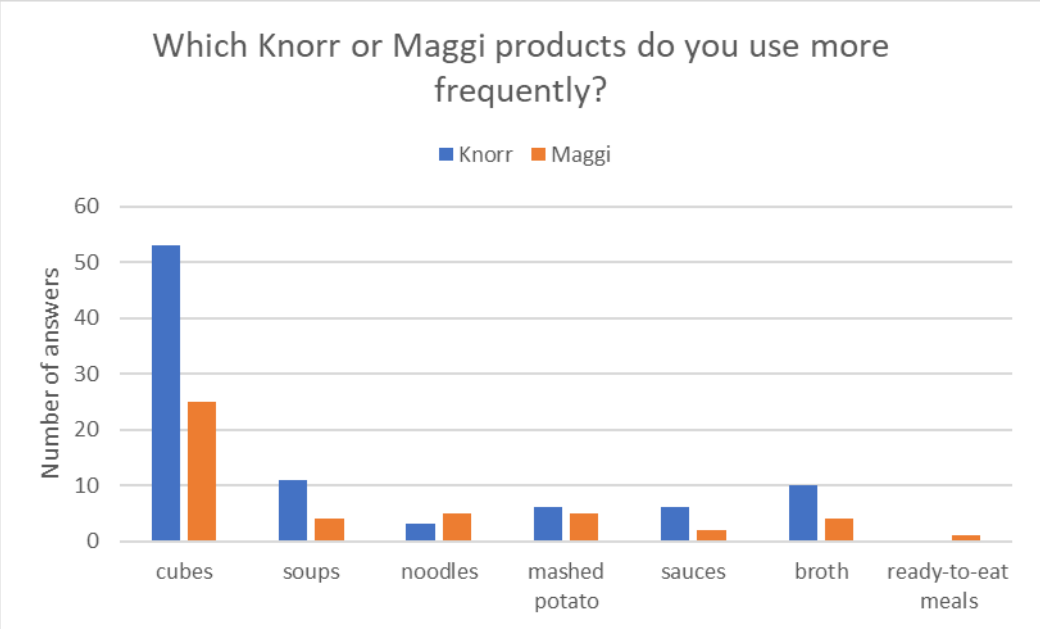


Figure 27: Question 5: Most frequent purchases of Knorr and Maggi products.

Their answers were consistent with the previous ones, since the participants use with bigger frequency Knorr and Maggi cooking cubes. In addition, Knorr is preferred by the consumers for its cooking cubes, soups, mashed potato, sauces and broths, while Maggi is preferred for its noodles and ready-to-eat meals. Only 13 of the participants (13.3%) responded that they had never used a Knorr or Maggi product, while approximately half of them use the products 1 to 4 times per month or less (22.5% and 26.5%, respectively) and 1 out of 3 uses them once or more than once per week (15.3% and 21.4%, respectively). Finally, only 1% of the participants use the products daily.

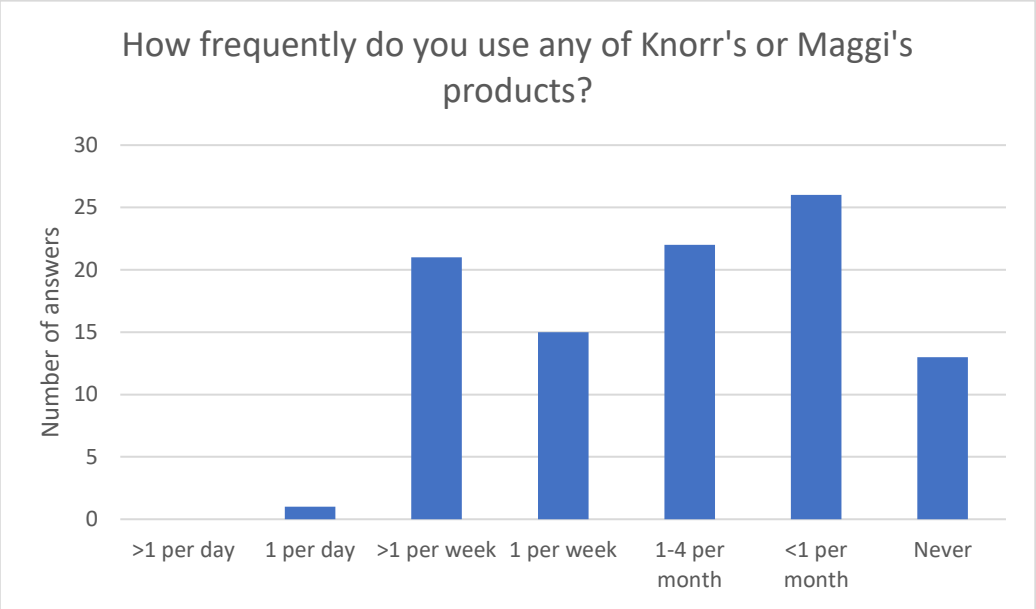


Figure 28: Question 6: Frequency of Knorr or Maggi product purchase.

In this first part of the survey, it was indicated that Knorr has a larger part in the Greek market and a better recognizability from the Greek consumers. At the same moment, it seems that, although Greek consumers are aware of these companies' products and use them, many of them were not able to differentiate between Maggi and Knorr products. However, the results from those being able to answer are promising for further growth, improvement and good product-quality reputation.

In the second part of the survey, questions were focused entirely on Maggi's products. Participants were asked about their satisfaction with Maggi's products and their answers verified some of the indicated conclusions from the first part of the survey, in respect to Maggi's recognizability, as shown in Figure 29.

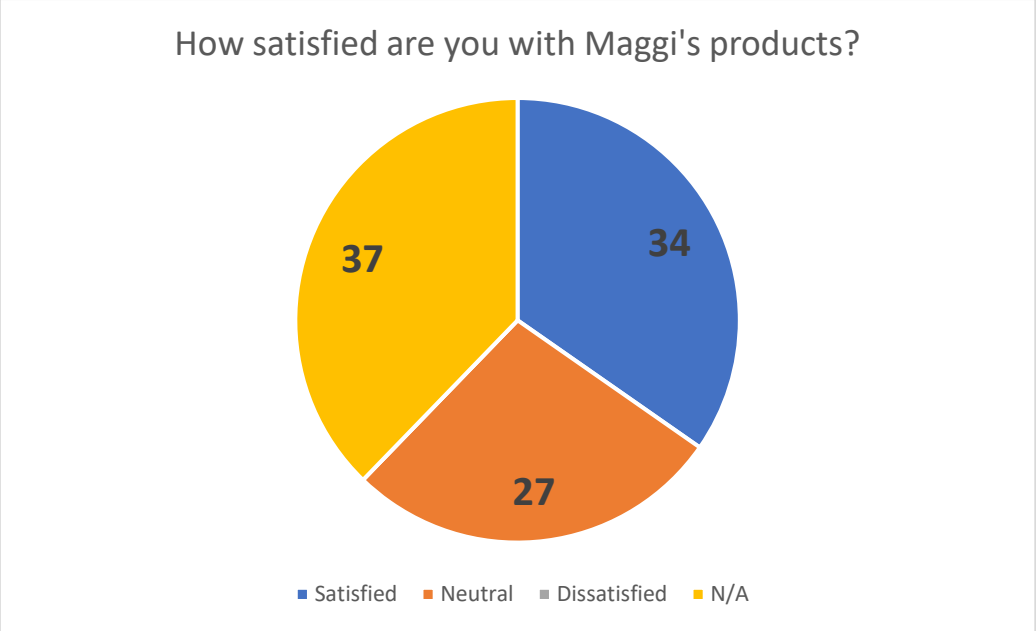


Figure 29: Question 7: Consumer satisfaction from Maggi products.

In the next question, the participants were presented a list of Maggi products, were asked to reply whether they were aware of the products and, if yes, if they had tried them and appreciated them. As presented in Figures 30 and 31, most of the participants knew most of the list's Maggi products, even if they did not seem to remember them previously. Specifically, approximately half or more than half of them knew about the cooking aids (cubes, broths etc.), the mashed potato and the soups, around 40% of them knew about the noodles (in sachets and in cups), 25% were aware of the sauces, while less than 10% were not aware of any Maggi product from the presented list. In respect to those who had tried one or more of these Maggi products, half of them liked the cooking aids, 40% liked the mashed potato, approximately 20% of them liked the soups and the noodles in sachets and 10-15% liked the noodles in a cup and the sauces. Additionally, 20% did not like any of the Maggi products they had previously tried.

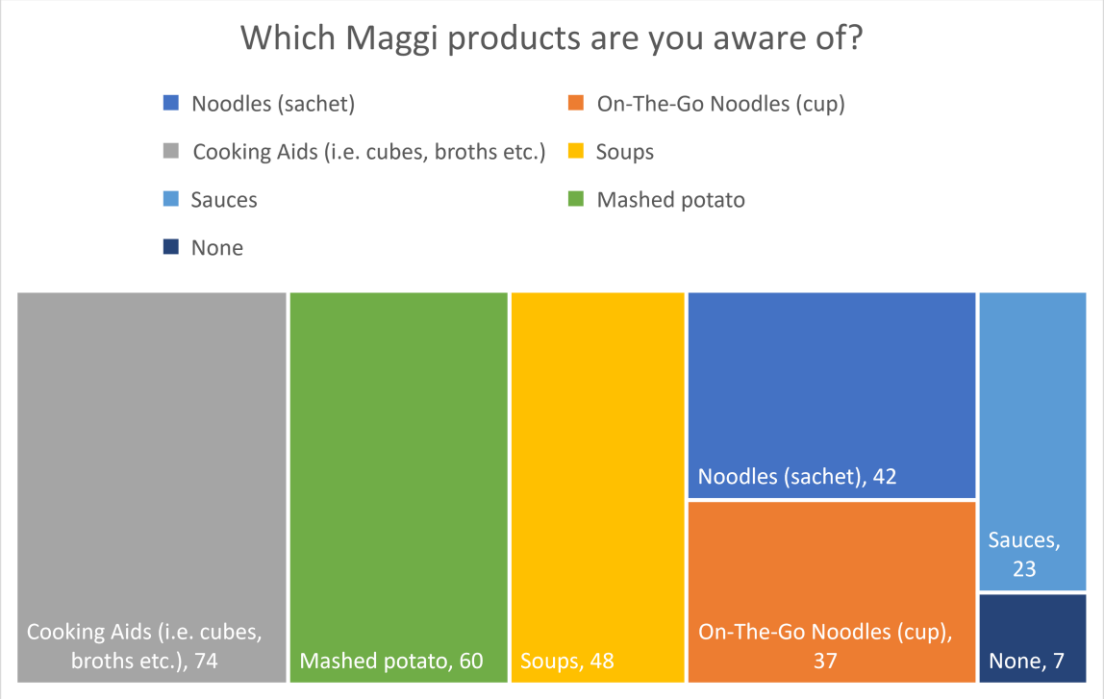


Figure 30: Question 8: Brand recognizability for Maggi.

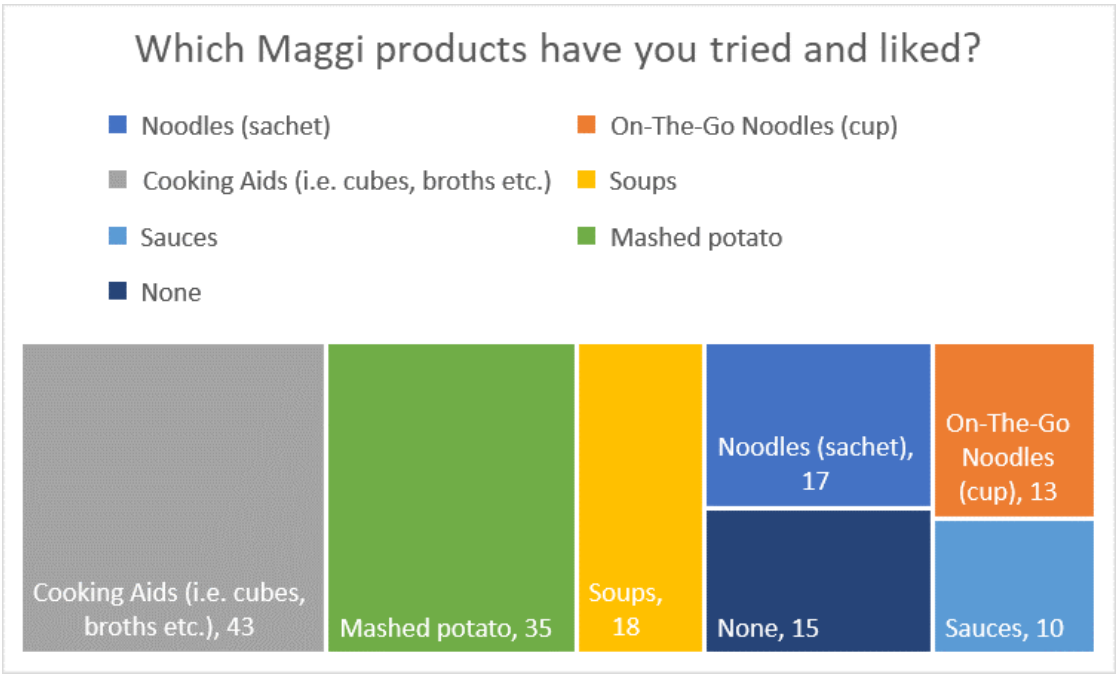


Figure 31: Question 9: Consumer satisfaction from Maggi products.

After these questions, the participants were asked if they would participate in a free-sample survey of novel or uncommon to them Maggi products and, in case they were satisfied by the trial, if they would consider purchasing that product. As their answers in Figures 32 and 33 show, the majority of the

participants (two thirds) would likely take part in a free-sample survey and about 3 out of 4 of them would consider purchasing that product, were they satisfied by the trial.

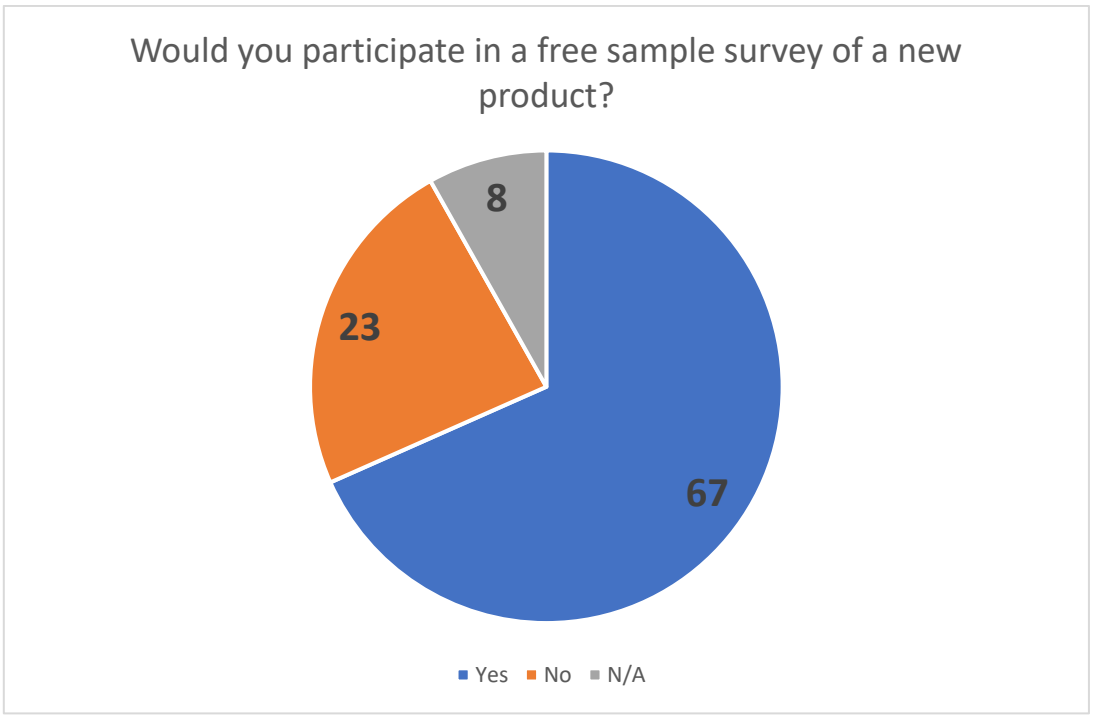


Figure 32: Question 10: Consumer willingness to participate in a product-feedback and familiarisation trial survey.

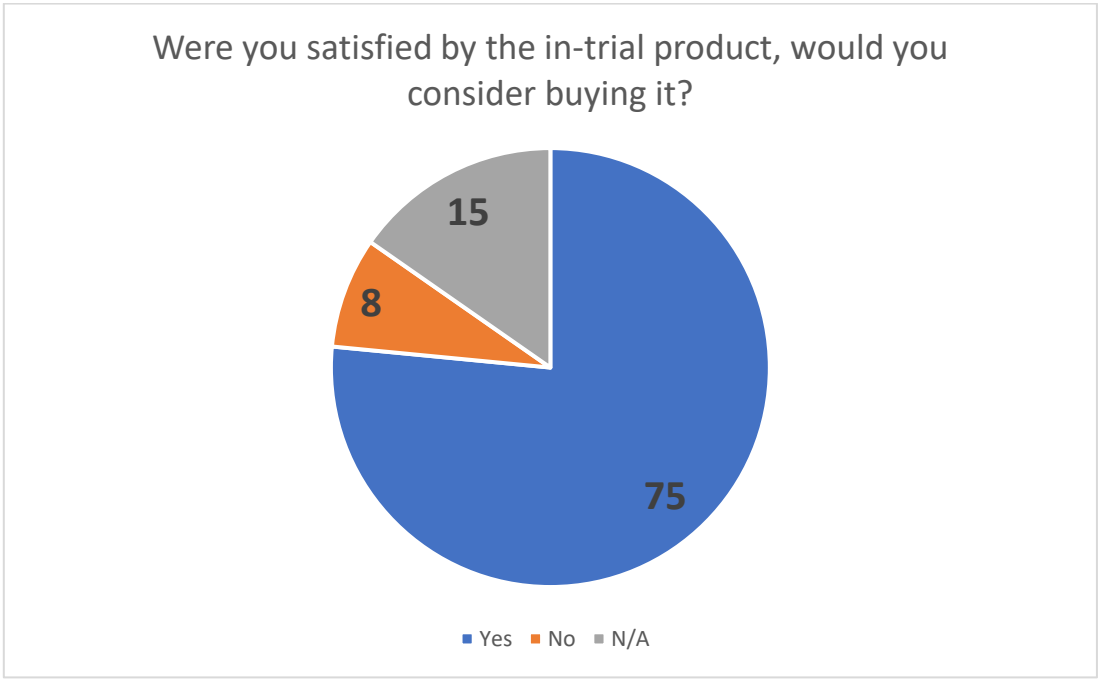


Figure 33: Question 11: Familiarisation result of the trial survey.

These questions concluded the second part of the survey, concerning Maggi's recognition and reputation in the Greek market vis a vis the consumers. As mentioned before, the results of that part suggested that Maggi stands in a relatively good point, nevertheless, there is still plenty of room for improvement and market share to be acquired.

The third part of the survey focused on Maggi's dry soups. When participants were asked about their opinion towards Maggi's dry soups, the majority replied that they did not had an opinion, because they had never tried them, while those that had tried them (30% of the participants) were split between a favourable and a neutral opinion, with only less than 10% of the participants having a poor opinion for them, as shown in Figure 34 below.

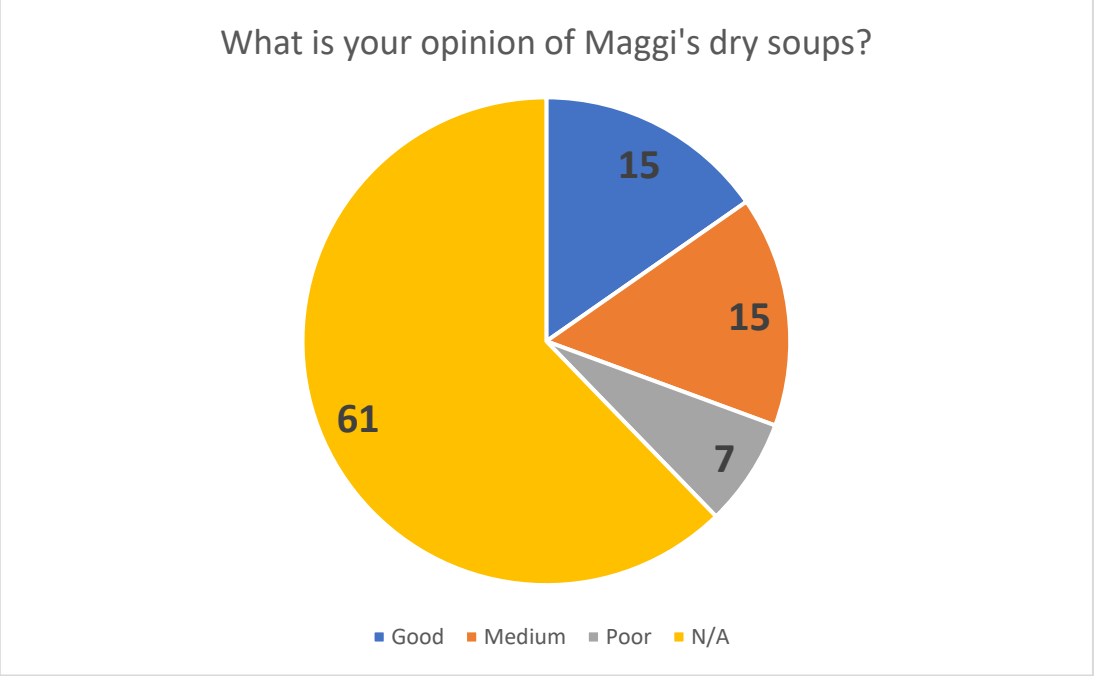


Figure 34: Question 12: Consumer acceptability of Maggi's dry soups.

Next, the participants were asked what in their opinion Maggi's dry soups lacked. Their answers are spread over 11 different factors, from advertisement and portion size to taste and nutritional value, as shown in Figure 35. According to the consumers' perception, Maggi's dry soups are not healthy, fresh or light enough and do not have any significant nutritional value, while they also lag behind in sensorial characteristics, such as taste, flavour, texture and general appeal. These two broader answer categories comprise 41.3% and 47.8% of the total answers, respectively. Finally, a few of the participants, think that Maggi's dry soups are not widely or correctly advertised and that they have small portion sizes.

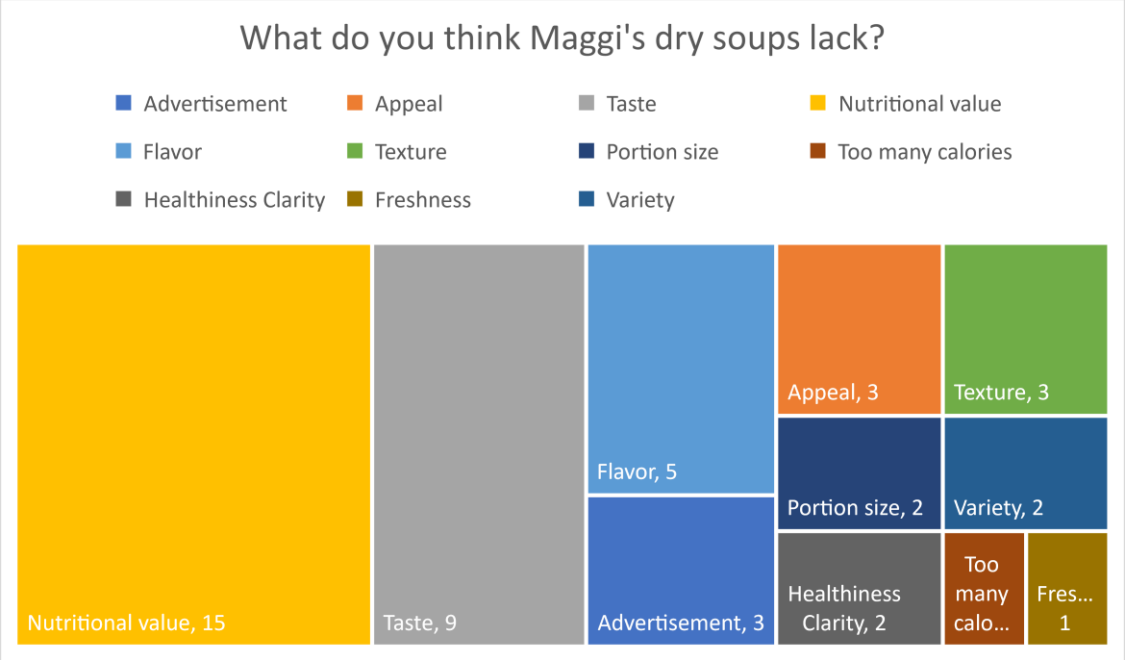


Figure 35: Question 13: Room for improvement for Maggi's dry soups, according to consumers.

Finally, the last question put to the participants was whether they would purchase Maggi's dry soups, if the aforementioned factors were improved, to which, as the presented results of Figure 36 show, the majority of them (53.1%) answered positively, with the remaining participants being uncertain (37.8%), since they had never tried them before, or negative (less than 1 in 10) and would not consider buying Maggi's dry soups.

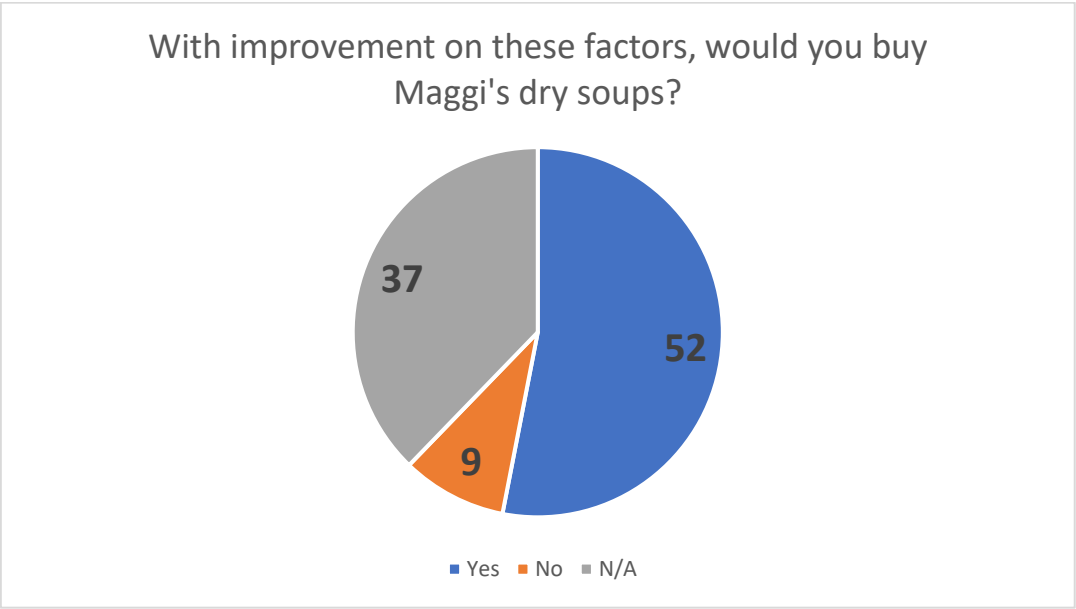


Figure 36: Question 14: Possible consumer attitude towards an improved Maggi dry soup.

With the conclusion of the third part of the survey, it was verified to a further extent that there is area for improvement and that, perhaps, a new approach is needed in order to present to the consumers the new products of Maggi, inform them of all their benefits, use their valuable feedback to further improve and adjust the products and claim a larger share of the market and its profits.

7.6.2 Market analysis

Although the Greek consumers are familiar with the existence of Maggi products, they are reluctant, at this point, to buy dry soup products, since they regard that they lack either nutritional value or sensorial characteristics, such as taste and flavour, and are, thus, unhealthy. For the evaluation of the possible revenues for the Greek market, the same tool (Nestlé's Forecasting Tool) and parameters were used, as for the calculations for France, Germany and the UK (50% of the total population as the targeted population, two frequency scenarios with 3% penetration, unit weight 60g (2 portions), retail selling price 2€ per unit, NNS 1.5€ per unit and 25% margin). The following data were recovered from the CIA World Factbook, regarding the Greek population:

Table 28: Demographic data of Greece, estimated for 2020, presenting the percentages of different age groups in the total population. [74] [accessed 12/2020]

Age group	Market
	Greece
0-14	14.53%
15-24	10.34%
25-54	39.60%
55-64	13.10%
65+	22.43%
Total Population (est. 2020)	10,607,051

The targeted population belongs to the age groups 15-24 and 25-54, hence 49.94% of the total population. According to the Forecasting tool the following data arise:

Table 29: Market analysis of target population in Greece, in respect of Total Retail Sales Value and Total NNS Value, in millions of euros, for the two frequency scenarios (Low and High).

Total Retail Sales Value, SOP (mn €)		
Frequency scenario	Low	High
GRE	2.1	8.3
Total NNS Value (mn €)		
Frequency scenario	Low	High
GRE	1.5	6.2

As it can be seen, the SOP and Total NNS values are quite small in relation with the ones for Germany, France and the United Kingdom, mainly due to the smaller market size. In addition to these numbers and based on ICAP's sector study, dry foods represent a small part of the Greek ready meals market and the dry soup market is an even smaller part of dry foods. As a consequence, the calculated values might be optimistic. For all these reasons, the Greek market cannot be regarded as a driver market for the launch of a new product such as a new dry soup and can only work as a secondary market, once the product has been launched in a different market.

In order for the market to grow, Maggi should invest on the advertisement and promotion of its products to Greek consumers and interact with them to show that the new dry soup product and in general all its products are healthy. The company should try to overcome the prevailing concept that dry soups are overprocessed and unhealthy by adopting new drying processes and communicating their benefits to the consumers. Finally, as for every market, Maggi's products should abide to the new trends of the market, the good manufacturing guidelines and instructions for protection of the environment and working place.

8. Conclusions and future challenges

8.1 Conclusions

The present study deals with the creation, development and launch of a new food product in the market. The product was developed during a Nestlé internship and consisted of five new dry soups, with new ingredients, recipes and a palate of taste and flavours from around the world. New means of packaging were also explored, aiming to further aid to the adaptation to the new trends of living and working, while facilitating the product's use by the consumers. An overview of the existing and developing drying methods was presented, focusing on freeze-drying, its benefits and challenges. In addition, a detailed review of the different norms, guidelines and regulations of WHO, FAO and EU regarding labelling practices, nutrition declaration and product claims was performed. The business plan and the strategy for the product launch were developed and an analysis of the possible driver markets was conducted. Moreover, a recognizability and liking survey of the Greek market was performed, as well as an analysis for the sector of ready meals in the Greek market, in which dry soups are included.

Consumer insight showed that most consumers want to follow the trends of healthy, easy to prepare and carry meals, due to the modern way of living and working. At the same time, consumers consider that ready to eat meals, especially dried products, are not healthy enough and, as a consequence, the consumption of dry soup sells was stagnant, if not decreasing. Thus, for Maggi an opportunity arose: re-innovate and re-invent a new dry soup product.

The result of the above was the design of five new soups based on recipes and ingredients from around the world. Prototypes were developed, in order to improve the recipes by trial and error and develop the final balanced and nutritious products. The production of the aforementioned prototypes for the pilot scale was made through the implementation of the freeze-drying process. After the cooking, freeze-drying and reconstitution of the soup prototypes, their sensorial characteristics were evaluated. The reconstitution of the freeze-dried ingredients was instant with the addition of warm water with no cooking time required, in contrast to air-dried ingredients that needed at least 3-5 minutes of cooking. Thus, the freeze-drying method is preferable regarding reconstitution times. Freeze-drying is also less destructive towards the ingredients enabling them to keep their structure and sensorial characteristics. As a consequence, the products are more appealing to the consumers, since they can see what they eat, leading to the generation of a more "home-made" feeling. However, freeze-drying is an expensive process requiring large amounts of energy and, thus, is not easily

applicable in industrial scale. Hence, for the production in industrial scale the proposed process is not the freeze-drying of cooked soups, but the mixing of precooked and dried ingredients, preferably freeze-dried ingredients in order to keep as many advantages of the method as possible, such as the sensorial characteristics.

In respect to the package, the first step would be the launch of the product in sachets containing the dried soup. The future target would be the sale of the product not only in individual sachets, but also in a hard carton cup, that the consumer would be able to carry, prepare the food in it and use it to eat from it. Regarding the labelling, the nutrition declaration and the claims, the nutrients were evaluated from the ingredients used to make each prototype. Based on them and on the thresholds put by EU, FDA and FAO, the possible claims that each soup can carry were calculated. However, once the final product would be ready, a laboratory analysis should recalculate the nutrients and adapt, if needed, the claims.

As for the driver market, based on the preliminary analysis conducted, Germany appears to be the best market to launch the product, due to its larger population, the consumption habits and the already existing structure of production, distribution and retail of Nestlé products. However, Maggi needs to work in order to secure an important part of the dry soups market, which is more difficult since it is dominated by cheaper own label products. Thus, the entry of a premium dry soup might change the game. Regarding the Greek market, it appears that it is not suitable as a driver market and is not big enough to sustain itself. As a result, it can only be regarded either as a complementary market, in which products that are launched in nearby larger markets can also be launched, or as a part of a group of markets with the same characteristics that are treated with the same strategy as one market.

Finally, it should be mentioned that, although not proposed in the scope of this thesis, the use of air-dried ingredients for the production of the soups is not excluded. The use of the more expensive precooked and freeze-dried ingredients can create a premium, high quality product with instant reconstitution and minimum to non-existent cooking time, but also more expensive than the ones already existing in the market. On the other hand, if the core of the project's scope changes, the same product can be produced with the use of the cheaper precooked and air-dried ingredients, albeit with longer reconstitution and cooking time and diminished sensorial characteristics, offering a less expensive choice to the consumers.

8.2 Future Challenges

The main part of the future challenges is the improvement of the drying process. As mentioned before, although freeze-drying offers numerous advantages, it is an energy intensive and expensive process that cannot be easily implemented in industrial level for an already cooked soup. However, alternative approaches can be used for the production of the soups, with most prevailing and promising the mix of freeze-dried or precooked and freeze-dried ingredients. Thus, it should be examined whether the purchase of these already freeze-dried ingredients is viable in large quantities. In addition, the already cooked and freeze-dried materials have to arrive in large quantities and without damage to the factory to be mixed according to the recipes. Also, the problem of the consistent reproduction of the soups' recipes and taste should be addressed, by a possible addition of spices and flavours, since some of the water dissolved ingredients, that give taste to the product when cooked, are lost before the mix of the dry ingredients.

Moreover, an analysis evaluating the freeze-dried product's structure and durability after a possible pre-treatment of its ingredients (e.g., coating) should be performed, side by side with the suppliers. A variety of different freeze-drying parameters, such as temperatures and freezing cycle times, should also be tested, in order to search for any further improvement on the durability of the freeze-dried product. Although the produced prototypes had an adequate durability, improvement in this area could benefit and facilitate the packaging process, while preventing the deterioration of the product's appearance, an important sensorial characteristic for the consumers.

Regarding the packaging process, an internal, integral and global goal of Nestlé is the progress in the production of sustainable packaging that protects the environment, uses recyclable materials and answers the needs of the consumers' modern way of life. Moreover, the developed packages should be rigid enough to protect the fragile freeze-dried ingredients and light enough to be carried around easily by the consumers. Additionally, before the launch of the product, a further comparative analysis should be made for comparative claims with relevant products already in the market. Finally, once the product is launched, follow-up surveys and consumer feedback should be gathered in order to design an even better product that will answer the complex needs of the modern and future consumer.

Bibliography

[1] Grande Encyclopédie Larousse, Encyclopædia Britannica, Papyros Publishing House, "Trofika ethima kai kanones (Food customs and rules)," in *Encyclopædia Papyros Larousse Britannica (in Greek)*, vol. 58, Athens, Papyros Publishing House, To Vima, 1997, pp. 137-139.

[2] C. Ratti, "Hot air and freeze-drying of high-value foods: a review," *Journal of Food Engineering,* vol. 49, no. 4, pp. 311-319, 2001.

[3] Grande Encyclopédie Larousse, Encyclopædia Britannica, Papyros Publishing House, "Trofi (food)," in *Encyclopædia Papyros Larousse Britannica (in Greek)*, vol. 58, Athens, Papyros Publishing House, To Vima, 1997, p. 137.

[4] Grande Encyclopédie Larousse, Encyclopædia Britannica, Papyros Publishing House, "Trofima (food stuff)," in *Encyclopædia Papyros Larousse Britannica (in Greek)*, vol. 58, Athens, Papyros Publishing House, To Vima, 1997, pp. 140-143.

[5] P. T. V. O. C. Tzia, "Food Quality," in *Food Science and Food Engineering: Components-Properties-Quality-Microbiology-Rheology-Packing (in Greek)*, Athens, National Technical University of Athens, 2009, pp. 185-226.

[6] J. Slatter, Encyclopedia of Food Sciences and Nutrition, Second ed., B. Caballero, Ed., Academic Press, 2003, pp. 3023-3028.

[7] A. T. C. Tzia, "The meaning and principles of HACCP," in *Hazard Analysis Critical Control Point in Food Industry (in Greek)*, Athens, Papasotiriou, 1996, pp. 17-18.

[8] FOOD AND AGRICULTURE ORGANISATION OF THE UN, WORLD HEALTH ORGANIZATION, Codex Alimentarius - Food Hygiene - Basic Texts, Second ed., Rome, 2001.

[9] A. T. C. Tzia, "Principles of HACCP," in *Hazard Analysis Critical Control Point in Food Industry (in Greek)*, Athens, Papasotiriou, 1996, pp. 19-20.

[10] A. T. C. Tzia, "1st Principle: Hazard Analysis and Risk Categories," in *Hazard Analysis Critical Control Point in Food Industry (in Greek)*, Athens, Papasotiriou, 1996, pp. 61-73.

[11] U.S. FOOD AND DRUG ADMINISTRATION, HACCP PRINCIPLES & APPLICATION GUIDELINES, 1997.

[12] A. T. C. Tzia, "2nd Principle: Determination of the Critical Control Points (CCPs)," in *Hazard Analysis Critical Control Point in Food Industry (in Greek)*, Athens, Papasotiriou, 1996, pp. 75-87.

[13] A. T. C. Tzia, "3rd Principle: Determination of Critical Limits for the CCPs," in *Hazard Analysis Critical Control Point in Food Industry (in Greek)*, Athens, Papasotiriou, 1996, pp. 95-103.

[14] A. T. C. Tzia, "Basic Parameters: Quality, Safety, Hygiene, GMPs," in *Hazard Analysis Critical Control Point in Food Industry (in Greek)*, Athens, Papasotiriou, 1996, pp. 25-32.

[15] A. A. A. N. A. P. D. K. S. Mahadi Hasan Masud, "Experimental investigation of a novel waste heat based food drying system," *Journal of Food Engineering,* vol. 281, 2020.

[16] K. M. D. L. T. W. Z. G. B. S. Z. W. Dan Huang, "Application of ultrasound technology in the drying of food products," *Ultrasonics Sonochemistry,* vol. 63, 2020.

[17] V. O. P. Taoukis, "Chapter 10: Drying," in *Food Science and Food Engineering Processes (In Greek)*, Athens, National Technical University of Athens, 2009, pp. 293-330.

[18] V. S. S. A. T. Abhay Menon, "A systematic review on the recent advances of the energy efficiency improvements in non-conventional food drying technologies," *Trends in Food Science & Technology,* vol. 100, pp. 67-76, 2020.

[19] J. S. P. H. W. L. McCabe, "Drying of Solids," in *Unit Operations of Chemical Engineering (in Greek)*, 7th ed., S. Polimatidou, Ed., Tziola Publications, 2016, pp. 701-736.

[20] J. S. J. T. R. V.-R. J. T. Jie Xu, "Dry-inoculation methods for low-moisture foods," *Trends in Food Science & Technology,* vol. 103, pp. 68-77, 2020.

[21] A. T. C. Tzia, "Hazard Categories - Biological Hazards," in *Hazard Analysis Critical Control Points (HACCP) in Food Industry*, Athens, Papasotiriou Publications, 1996, pp. 33-52.

[22] L. R. R. V. U. Imdadul Hoque Mondal, "Effect of oven and intermittent airflow assisted tray drying methods on nutritional parameters of few leafy and non-leafy vegetables of North-East India," *Heliyon,* vol. 5, no. 11, 2019.

[23] M. M. C. R. Thanh Khuong Nguyen, "Shrinkage of cellular food during air drying," *Journal of Food Engineering,* vol. 230, pp. 8-17, 2018.

[24] W. R. P. J. R. F. S. M. W. James R. Couper, Ed., "9 - DRYERS AND COOLING TOWERS," in *Chemical Process Equipment (Revised Second Edition)*, Gulf Professional Publishing, 2010, pp. 219-271.

[25] C. S. Yong Wang, "Spray drying strategy for encapsulation of bioactive peptide powders for food applications," *Advanced Powder Technology,* vol. 31, no. 1, pp. 409-415, 2020.

[26] J. C. S. P. H. W. L. McCabe, "Drying of Solids - Spray dryers," in *Unit Operations of Chemical Engineering (in Greek)*, 7th ed., S. Polimatidou, Ed., Tziola Publications, 2016, pp. 726-727.

[27] E. A. S. M. J. Mansoureh Geranpour, "Recent advances in the spray drying encapsulation of essential fatty acids and functional oils," *Trends in Food Science & Technology,* vol. 102, pp. 71-90, 2020.

[28] A. H. M. N. Kyuya Nakagawa, "Modeling atmospheric freeze-drying of food products operated above glass transition temperature," *Chemical Engineering Research and Design,* 2020.

[29] D. C. D. F. N. S. J. C. D. Merone, "Energy and environmental analysis of ultrasound-assisted atmospheric freeze-drying of food," *Journal of Food Engineering,* vol. 283, 2020.

[30] E. B.-d. l. F. J. M. F. C. G. Getachew Assegehegn, "Freeze-drying: A relevant unit operation in the manufacture of foods, nutritional products, and pharmaceuticals," in *Advances in Food and Nutrition Research*, vol. 93, F. Toldrá, Ed., Academic Press, 2020, pp. 1-58.

[31] J. C. S. P. H. W. L. McCabe, "Drying of Solids - Freeze drying," in *Unit Operations of Chemical Engineering (in Greek)*, 7th ed., S. Polimatidou, Ed., Tziola Publications, 2016, pp. 717-718.

[32] W. G. P. S. H. D. Belitz, "Vegetables and vegetable products - Vegetable products - Dehydrated Vegetables," in *Food Chemistry (in Greek)*, 4th ed., S. N. Raphaelides, Ed., Tziola Publications, 2018, pp. 806-807.

[33] W. G. P. S. H. D. Belitz, "Meat - Dehydrated Soups and Sauces," in *Food Chemistry (in Greek)*, 4th ed., S. N. Paphaelides, Ed., Tziola Publications, 2018, pp. 620-621.

[34] R. Różyło, "Recent trends in methods used to obtain natural food colorants by freeze-drying," *Trends in Food Science & Technology,* vol. 102, pp. 39-50, 2020.

[35] D. H. R. Paul Singh, "Dehydration - Freeze dryers," in *Introduction to Food Engineering (in Greek)*, 5th ed., N. G. S. C. T. S. Gianniotis, Ed., Athens, Parisianou Scientific Publications, 2018, pp. 602-603.

[36] P. P. D. W.-R. A. W. Dorota Nowak, "Impact of material structure on the course of freezing and freeze-drying and on the properties of dried substance, as exemplified by celery," *Journal of Food Engineering,* vol. 180, pp. 22-28, July 2016.

[37] World Health Organization, Food and Agriculture Organization of the United Nations, "General standard for the labelling of prepackaged foods," in *Codex Alimentarius - Food Labelling*, Fifth ed., Rome, World Health Organization, Food and Agriculture Organization of the United Nations, 2007, pp. 1-9.

[38] World Health Organization, Food and Agriculture Organization of the United Nations, "Guidelines on nutrition labelling," in *Codex Alimentarius - Food Labelling*, Fifth ed., Rome, World Health Organization, Food and Agriculture Organization of the United Nations, 2007, pp. 25-31.

[39] World Health Organization, Food and Agriculture Organization of the United Nations, "General guidelines on claims," in *Codex Alimentarius - Food Labelling*, Fifth ed., Rome, World Health Organization, Food and Agriculture Organization of the United Nations, 2007, pp. 21-23.

[40] World Health Organization, Food and Agriculture Organization of the United Nations, "Guidelines for use of nutrition and health claims," in *Codex Alimentarius - Food labelling*, Fifth ed., Rome, World Health Organization, Food and Agriculture Organization of the United Nations, 2007, pp. 33-38.

[41] European Parliament, Council of the European Union, "Regulation (EU) No 1169/2011 of the European Parliament and of the Council of 25 October 2011 on the provision of food information to consumers," 01 01 2018. [Online]. Available: https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:02011R1169-20180101&from=EN. [Accessed 16 12 2020].

[42] U.S. Department of Health and Human Services: Food and Drug Administration, Center for Food Safety and Applied Nutrition, "Guidance for Industry: A Food Labelling Guide," Food and Drug Administration, College Park, MD, 2013.

[43] European Commission, "Nutrition and Health Claims: Nutrition Claims," [Online]. Available: https://ec.europa.eu/food/safety/labelling_nutrition/claims/nutrition_claims_en. [Accessed 17 12 2020].

[44] European Parliament, Council of the European Union, "Regulation (EC) No 1924/2006 of the European Parliament and of the Council of 20 December 2006 on nutrition and health claims made on foods," 30 12 2006. [Online]. Available: https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32006R1924&from=en. [Accessed 17 12 2020].

[45] K. T. C. J. N. S. Seán F. Keane, "Comparing how entrepreneurs and managers represent the elements of the business model canvas," *Journal of Business Venturing Insights,* vol. 9, pp. 65-74, 2018.

[46] Y. P. A. Osterwalder, Business Model Generation - A Handbook for Visionaries, Game Changers, and Challengers, Amsterdam: Self Published, 2009.

[47] R. L. P. Alexandre Joyce, "The triple layered business model canvas: A tool to design more sustainable business models," *Journal of Cleaner Production,* vol. 135, pp. 1474-1486, 2016.

[48] A. Osterwalder, The Business Model Ontology, A Proposition In A Design Science Approach (Dissertation), Lausanne, Vaud: UNIVERSITE DE LAUSANNE, ECOLE DES HAUTES ETUDES COMMERCIALES, 2004.

[49] I. L. J. L. Michael Hamwi, "Demand response business model canvas: A tool for flexibility creation in the electricity markets," *Journal of Cleaner Production,* 2020.

[50] G. H. I. R. Richard Vidgen, "Exploring the ethical implications of business analytics with a business ethics canvas," *European Journal of Operational Research,* vol. 281, no. 3, pp. 491-501, 2020.

[51] Markkula Center for Applied Ethics, "A Framework for Ethical Decision Making," Santa Clara University, 2018. [Online]. Available: https://www.scu.edu/media/ethics-center/ethical-decision-making/A-Framework-for-Ethical-Decision-Making.pdf. [Accessed 19 January 2021].

[52] E. A. R. P. I. P. A. M. O. Luis E. Quezada, "Measuring Performance Using SWOT Analysis and Balanced Scorecard," *Procedia Manufacturing,* vol. 39, pp. 786-793, 2019.

[53] M. AlMarwani, "Pedagogical potential of SWOT analysis: An approach to teaching critical thinking," *Thinking Skills and Creativity,* vol. 38, 2020.

[54] A. T. V. E. T. C. I. Pasquale Marcello Falcone, "Towards a sustainable forest-based bioeconomy in Italy: Findings from a SWOT analysis," *Forest Policy and Economics,* vol. 110, 2020.

[55] P. S. Vivek Tiwari, "SWOT analyses of high-temperature phase change materials for thermal energy storage," *Materials Today: Proceedings,* vol. 28, no. 2, pp. 949-954, 2020.

[56] A. A. D. L. Jianqiang Cui, "SWOT analysis and development strategies for underground pedestrian systems," *Tunnelling and Underground Space Technology,* vol. 87, pp. 127-133, 2019.

[57] M. N. S. A. K. B. A. Ephraim Bonah Agyekum, "Nuclear energy for sustainable development: SWOT analysis on Ghana's nuclear agenda," *Energy Reports,* vol. 6, pp. 107-115, 2020.

[58] S. A. R. R. V. U. S. M. N. Rajvikram Madurai Elavarasan, "SWOT analysis: A framework for comprehensive evaluation of drivers and barriers for renewable energy development in significant countries," *Energy Reports,* vol. 6, pp. 1838-1864, 2020.

[59] C. P. D. L. J. V.-R. Jordi Ferrer, "athematical modelling methodologies in predictive food microbiology: A SWOT analysis," *International Journal of Food Microbiology,* vol. 134, no. 1-2, pp. 2-8, 2009.

[60] ICAP Group, "1. Introduction - General Characteristics of the Sector," in *Sector Study: Ready Meals (in Greek)*, Athens, ICAP Group, 2020, pp. 3-6.

[61] ICAP Group, "3. Sector's Product Demand," in *Sector Study: Ready Meals (in Greek)*, Athens, ICAP Group, 2020, pp. 7-12.

[62] ICAP Group, "2. Sector's Offer," in *Sector Study: Ready Meals (in Greek)*, Athens, ICAP Group, 2020, pp. 13-33.

[63] ICAP Group, "4. Risk Analysis of the Sector," in *Sector Study: Ready Meals (in Greek)*, Athens, ICAP Group, 2020, pp. 34-39.

[64] ICAP Group, "5. Financial Analysis," in *Sector Study: Ready Meals (in Greek)*, Athens, ICAP Group, 2020, pp. 41-50, 68-69.

[65] ICAP Group, "7. International Ready Meal's Market Data," in *Sector Study: ready Meals (in Greek)*, Athens, ICAP Group, 2020, pp. 82-84.

[66] ICAP Group, "6. The Market of Ready Meals," in *Sector Study: Ready Meals (in Greek)*, Athens, ICAP Group, 2020, pp. 70-79.

[67] ICAP Group, "8. Conclusions - Prospects," in *Sector Study: Ready Meals (in Greek)*, Athens, ICAP Group, 2020, pp. 85-89.

[68] M. G. D. E. L. Cussler, Chemical Product Design, 2nd ed., Cambridge: Cambridge University Press, 2011.

[69] GEA, "LYOVAC™ Small-Scale Freeze Dryers," GEA Group Aktiengesellschaft, 2020. [Online]. Available: https://www.gea.com/en/products/dryers-particle-processing/lyovac-small-scale-freeze-dryer.jsp. [Accessed 30 12 2020].

[70] U.S. Department of Agriculture: Agricultural Research Service, "FoodData Central," USDA, [Online]. Available: https://fdc.nal.usda.gov/index.html. [Accessed March 2019].

[71] Alibaba.com, "Alibaba.com," Alibaba.com, [Online]. Available: https://www.alibaba.com/. [Accessed April 2019].

[72] Silva International, "Silva International - Our products," Silva International, [Online]. Available: https://silva-intl.com/products. [Accessed March 2019].

[73] Jaworski Vegetable Drying Plant, "Jaworski: Products - Dried vegetables and herbs," Jaworski, [Online]. Available: https://www.jaworski.com.pl/en/products/dried-vegetables-and-herbs/. [Accessed March 2019].

[74] Central Intelligence Agency, "The World Factbook," 2020. [Online]. Available: https://www.cia.gov/library/publications/resources/the-world-factbook/. [Accessed May 2020].

[75] European Commission, "Commission Regulation (EU) No 1047/2012 of 8 November 2012 amending Regulation (EC) No 1924/2006 with regard to the list of nutrition claims," 09 11 2012. [Online]. Available: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32012R1047. [Accessed 17 12 2020].

[76] European Parliament, Council of the European Union, "Regulation (EC) No 1924/2006 of the european parliament and of the council of 20 December 2006 on nutrition and health claims made on foods (with amendments)," 13 12 2014. [Online]. Available: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02006R1924-20141213. [Accessed 17 12 2020].

[77] J. K. J. C. K. Berman, Financila Intelligence - A manager's guide to knowing what the numbers really mean (in Greek), 1st ed., vol. 52, P. Papazachariou, Ed., Athens: Kritiki Publishing S.A., 2008, pp. 193-275.

[78] Investopedia, "Investopedia Dictionary," Dotdash Publishing, [Online]. Available: https://www.investopedia.com/financial-term-dictionary-4769738. [Accessed 17 01 2021].

Annex I

Annex I contains information regarding the conditions that must apply in order for a food to carry certain claims, the correct conversion factors for the calculation of the amount of nutrients and an example of a nutritional declaration label. The data of the tables are based mainly on EU Regulation No 1169/2011 and FDA guidelines (Table 33).

Table 30: Nutrition claims and conditions for their use, according to European Union regulations Regulation (EC) No 1924/2006 (before and after amendments), Regulation (EU) No 1169/2011 and Commission Regulation (EU) No 1047/2012. [41] [44] [75] [76]

CLAIM	CONDITIONS
Low energy	• Less than 40kcal/170kJ per 100g (solids) • Less than 20kcal/80kJ per 100ml (liquids) • Less than 4kcal/17kJ per portion (table-top sweeteners, with equivalent sweetening properties to 6g of sucrose)
Reduced energy	• Energy value reduced at least 30% (mention of the characteristic that causes the reduction)
Energy-free	• Less than 4kcal/17kJ per 100ml • Less than 0.4kcal/1.7kJ per portion (table-top sweeteners, with equivalent sweetening properties to 6g of sucrose)
Low fat	• Less than 3g per 100g (solids) • Less than 1.5g per 100ml (liquids) • Less than 1.8g per 100ml for semi-skimmed milk

Free fat	• Less than 0.5g per 100 or per 100ml
Low saturated fat	• Less than 1.5g per 100g of saturated fatty acids and trans-fatty acids (solids) • Less than 0.75g per 100ml of saturated fatty acids and trans-fatty acids (liquids) • In both cases the produced energy by saturated fatty acids and trans-fatty acids should not supersede 10% of the energy
Saturated fat-free	• Less than 0.1g per 100g or per 100ml of saturated fatty acids and trans-fatty acids
Low sugar	• Less than 5g per 100g (solids) • Less than 2.5g per 100ml (liquids)
Sugar-free	• Less than 0.5g per 100g or per 100ml
No added sugar	• No addition of any mono- or di-saccharides or sweeteners • If containing naturally present sugars, then the following must exist on the label: "CONTAINS NATURALLY OCCURING SUGARS"
Low sodium/salt	• Less than 0.12g of sodium or the equivalent for salt per 100g or per 100ml

	• For waters (not including in Directive 80/777/EEC): less than 2mg per 100ml
Very low sodium/salt	• Less than 0.04g of sodium or the equivalent for salt per 100g or per 100ml • Not applicable for natural mineral waters
Sodium/salt-free	• Less than 0.005g of sodium or the equivalent for salt per 100g
No added Sodium/salt [75]	• No addition of sodium/salt or any other ingredient containing sodium/salt • Less than 0.12g of sodium or the equivalent for salt per 100g or per 100ml
Source of fibre	• At least 3g per 100g • At least 1.5g per 100kcal
High fibre	• At least 6g per 100g • At least 3g per 100kcal
Source of protein	• At least 12% of the energy comes from protein
High protein	• At least 20% of the energy comes from protein

Source of [vitamin]/[minerals]	• At least a significant amount, according to Directive 90/496/EEC and Regulation (EC) No 1925/2006 [44], both replaced by Regulation (EU) No 1169/2011. [41] Significant amounts of vitamins and minerals are shown and explained in Annex XIII, here in Table 12
High [vitamin]/[minerals]	• At least twice the amount of the “source of”
Contains [nutrient]	• Compliance with Article 5 of Regulation (EC) No 1924/2006 (list mentioned above). • For vitamins and minerals, at least designation of “source of” must apply
Increased [nutrient]	• At least the designation “source of” of said nutrient must apply • At least 30% increase of said nutrient in comparison with a similar product • Does not apply for vitamins and minerals
Reduced [nutrient]	• At least 30% reduction in comparison with a similar product • At least 10% reduction in comparison with respective NRVs for micronutrients • At least 25% reduction for sodium or the equivalent for salt

--Reduced saturated fat [75]	• At least 30% less saturated fatty acids and trans-fatty acids than a similar product • Content of trans-fatty acids equal or less than of a similar product
--Reduced sugars [75]	• Energy amount deriving from sugars equal or less than of a similar product
Light/Lite	• As for “Reduced” with mention of the characteristic that makes the food “light” or “lite”
Naturally/Natural	• Can be added as a prefix to the claim, if it meets the necessary conditions
Source of omega-3 fatty acids [76]	• At least 0.3g of alpha-linolenic acid per 100g and per 100kcal, or • At least 40mg of eicosapentaenoic acid and docosahexaenoic acid per 100g and per 100kcal
High omega-3 fatty acids [76]	• At least 0.6g of alpha-linolenic acid per 100g and per 100kcal, or • At least 80mg of eicosapentaenoic acid and docosahexaenoic acid per 100g and per 100kcal

High mono-unsaturated fat [76]	• At least 45% of the fatty acids derives from mono-unsaturated fat • At least 20% of the energy comes from the mono-unsaturated fat of the product
High poly-unsaturated fat [76]	• At least 45% of the fatty acids derives from poly-unsaturated fat • At least 20% of the energy comes from the poly-unsaturated fat of the product
High un-saturated fat [76]	• At least 70% of the fatty acids derives from unsaturated fat • At least 20% of the energy comes from the unsaturated fat of the product

Table 31: Conversion factors for the calculation of energy, according to EU Regulation No 1169/2011. [41]

Energy conversion factors (EU Reg. No 1169/2011	
Carbohydrate (except polyols)	4 kcal/g - 17 kJ/g
Polyols	2.4 kcal/g - 10 kJ/g
Protein	4 kcal/g - 17 kJ/g
Fat	9 kcal/g - 37 kJ/g
Salatrims [sic]	6 kcal/g - 25 kJ/g
Alcohol (Ethanol)	7 kcal/g - 29 kJ/g
Organic acid	3 kcal/g - 13 kJ/g
Fibre	2 kcal/g - 8 kJ/g
Erythritol	0 kcal/g - 0 kJ/g

Table 32: Example of a nutrition declaration, according to EU Regulation No 1169/2011. Measurement units must follow the respective regulation for the in-question ingredient or value (kcal and kJ, g, mg and µg). [41]

Nutrition declaration example (EU Reg. No 1169/2011)	
Energy	kcal / kJ
Fat	g
of which	
-saturates	g
-mono-unsaturates	g
-poly-unsaturates	g
Carbohydrate	g
of which	
-sugars	g
-polyols	g
-starch	g
Fibre	g
Protein	g
Salt	g
Vitamins and Minerals	The respective units, according to Table 10

Table 33: Daily Value (DV) intakes of vitamins and minerals, according to FDA. The term "Daily Value" is the one used by FDA instead of "Nutritional Reference Value", with the same meaning. IU stands for "International Units". [42]

Food Component	DV	Units	Food Component	DV	Units
Total Fat	65	g	Niacin	20	mg
Saturated Fat	20	g	Vitamin B6	2	mg
Cholesterol	300	mg	Folate	400	µg
Sodium	2400	mg	Vitamin B12	6	µg
Potassium	3500	mg	Biotin	300	µg
Total Carbohydrate	300	g	Pantothenic acid	10	mg
Dietary Fiber	25	g	Phosphorus	1000	mg
Protein	50	g	Iodine	150	µg
Vitamin A	5000	IU	Magnesium	400	mg
Vitamin C	60	mg	Zinc	15	mg
Calcium	1000	mg	Selenium	70	µg
Iron	18	mg	Copper	2	mg
Vitamin D	400	IU	Manganese	2	mg
Vitamin E	30	IU	Chromium	120	µg
Vitamin K	80	µg	Molybdenum	75	µg
Thiamin	1.5	mg	Chloride	3400	mg
Riboflavin	1.7	mg			

Annex II

Annex II contains the data concerning the prices of the ingredients of the soups for the three different scenarios. Based on these data, the relation among the costs of the three differently processed ingredient categories was calculated and used for the pricing of the product. The presence of an asterisk in Tables 37 and 38 indicates that the respective price was not found in the databases and was calculated by the simplified rule based on the cost relation (multiplication by a factor of 2), as shown in table 35. The presence of a dash in Tables 36, 37 and 38 indicates that the ingredient's price is fixed through all categories. For the calculation of each category's mean cost, only the ingredients without an asterisk or a dash were taken into account. The average cost calculation of each category per 100g followed. Based on these costs the multiplication factors were calculated and used for ingredients with an asterisk.

Table 34: Comparative costs for the different processed ingredients.

Comparative Cost			
	Raw	Air-dried	Freeze-dried
$/ton	2762.42	5675.21	11109.43
$/kg	2.76	5.68	11.11
$/100g	0.28	0.57	1.11

Table 35: Multiplication factors for the calculation of the costs between the different processed ingredients in pairs.

Cost multiplication factor per 100g	
Air-dried/Raw	2
Freeze-dried/Air-dried	2
Freeze-dried/Raw	4

Table 36: Costs of raw ingredients in $/ton. Prices found in alibaba.com. [71]

RAW INGREDIENTS			
a/a	Ingredient	$/t	
1	Carrot stripes	300.00	
2	Celery	450.00	
3	Pumpkin sterilized	200.00	
4	Onion flakes	150.00	
5	Fried onion 8% sterilized	1000.00	-
6	Orange sweet potato flakes 3/8''	100.00	
7	Sweet corn	140.00	
8	Porcini mushroom	1290.00	
9	Chipotle powder	1000.00	-
10	Shallots 1/4''	150.00	
11	Spinach flakes	500.00	
12	Brocolli florets	400.00	
13	Tamarind paste	450.00	
14	Wakame	2500.00	
15	Miso	825.00	
16	Sesame	500.00	-
17	Croutons	1333.00	-
18	Berbere	6610.00	-
19	BBQ mix	7900.00	-
20	Black beans	550.00	
21	Tacos	6410.00	-
22	Chicken breasts	500.00	
23	Barley	200.00	-
24	Shiitake	1230.00	
25	Rice noodles	300.00	-
26	Tofu	4000.00	
27	Soy sauce	1260.00	
28	Okra	200.00	
29	Cassava root	250.00	
30	Sorghum	150.00	-
31	Banana chips	12000.00	
32	Chickpeas	350.00	
33	Smoked beef	10000.00	-
34	Paprika	800.00	-
35	Garlic	600.00	-
36	Kumara	900.00	
37	Cassava leaves	800.00	
	TOTAL	66298.00	
	MEAN	2762.42	
-, Fixed price, * multiplied price by 2			

Table 37: Costs of air-dried ingredients in $/ton. Prices found in alibaba.com. [71]

AIR DRIED INGREDIENTS			
a/a	Product	$/t	
1	Carrot stripes	1000.00	
2	Celery root flakes	1500.00	
3	Pumpkin sterilized	2300.00	
4	Onion flakes	1000.00	
5	Fried onion 8% sterilized	1000.00	
6	Orange sweet potato flakes 3/8''	1500.00	
7	Sweet corn	100.00	
8	Porcini mushrooms	2600.00	*
9	Chipotle powder	1000.00	-
10	Shallots 1/4''	1200.00	
11	Spinach flakes	1000.00	
12	Brocolli florets	800.00	*
13	Tamarind paste	900.00	*
14	Wakame	4000.00	
15	Miso	1650.00	*
16	Sesame	500.00	-
17	Croutons	1333.00	-
18	Berbere	6610.00	-
19	BBQ mix	7900.00	-
20	Black beans	1100.00	*
21	Tacos	6410.00	-
22	Chicken breasts	1000.00	*
23	Barley	200.00	-
24	Shiitake	1000.00	
25	Rice noodles	300.00	-
26	Tofu	8000.00	*
27	Soy sauce	2000.00	
28	Okra	5000.00	
29	Cassava root	500.00	*
30	Sorghum	150.00	-
31	Banana chips	400.00	
32	Chickpeas	700.00	*
33	Smoked beef	10000.00	-
34	Paprika	800.00	-
35	Garlic	600.00	-
36	Kumara	1800.00	*
37	Cassava leaves	1600.00	*
	TOTAL	79453.00	
	MEAN	5675.21	
-, Fixed price, * multiplied price by 2			

Table 38: Costs of freeze-dried ingredients in $/ton. Prices found in alibaba.com.

FREEZE DRIED INGREDIENTS			
a/a	Product	$/t	
1	Carrot stripes	600.00	
2	Celery	10000.00	
3	Pumpkin sterilized	10000.00	
4	Onion flakes	10000.00	
5	Fried onion 8% sterilized	2000.00	*
6	Orange sweet potato flakes 3/8''	3000.00	*
7	Sweet corn	130.00	
8	Porcini mushrooms	5200.00	*
9	Chipotle powder	1000.00	-
10	Shallots 1/4''	1999.00	
11	Spinach flakes	800.00	
12	Brocolli florets	600.00	
13	Tamarind paste	1800.00	*
14	Wakame	10000.00	
15	Miso	3300.00	*
16	Sesame	500.00	-
17	Croutons	1333.00	-
18	Berbere	6610.00	-
19	BBQ mix	7900.00	-
20	Black beans	2200.00	*
21	Tacos	6410.00	-
22	Chicken breasts	18500.00	
23	Barley	200.00	-
24	Shiitake	2400.00	
25	Rice noodles	300.00	-
26	Tofu	6000.00	
27	Soy sauce	2000.00	-
28	Okra	10000.00	
29	Cassava root	1000.00	*
30	Sorghum	150.00	-
31	Banana chips	10000.00	
32	Chickpeas	1400.00	*
33	Smoked beef	10000.00	-
34	Paprika	800.00	-
35	Garlic	600.00	-
36	Kumara	3600.00	*
37	Cassava leaves	3200.00	*
	TOTAL	155532.00	
	MEAN	11109.43	
-, Fixed price, * multiplied price by 2			

Annex III

Annex III contains the final tables with the nutritional composition of the soups, showing the possible claims that each one can carry. Moreover, Annex III contains the tables with the nutrition composition of the raw ingredients, based on the USDA database, that were used for the estimation of the nutritional composition of the final products. Due to the confidentiality agreement, the tables with the recipes of the five soups, are not presented in this Annex.

Table 39: Nutritional value and claims per 100g and per portion of the Africana Soup.

AFRICANA							
Claims' colours:	High in	Source of	Low in	Free of			
	per (g)	483	per 100g			per portion	
		NRV %		NRV %	Claims	30	DV %
Calories (kcal)	894	45	185	9		55.5	2.8
Carbohydrates (g)	192	67	39.7	15		11.9	4.6
Fibers (g)	19	76	3.9	16	Source of	1.2	4.7
Sugar (g)	19	0	3.9			1.2	0.0
Proteins (g)	23	36	4.7	9		1.4	2.8
Fats (g)	11	18	2.3	3	Low in	0.7	1.0
Salt	1	0	0.2			0.1	0.0
Vitamins							
Vitamin C (mg)	72	103	15	19	Source of	4.5	5.6
Vitamin A (IU)	17	0	4	0			
Vitamin A (mg)	1	62	0.3	0		0.1	0.0
Thiamin (mg)	1	28	0.2	17	Source of	0.1	5.0
Riboflavin (mg)	0	61	0.1	7		0.0	2.0
Niacin (mg)	8	64	1.7	11		0.5	3.3
Pantothenic acid (mg)	1	27	0.1	2		0.0	0.7
Vitamin B6 (mg)	1	71	0.2	15	Source of	0.1	4.6
Folic acid (µg)	299	99	62	31	High in	18.6	9.3
Vitamin B12 (mg)	0	0	0	0		0.0	0.0
Vitamin D (µg)	0	0	0	0		0.0	0.0
Vitamin K (µg)	502	479	104.0	139	High in	31.2	41.6
Vitamin E (mg)	3	16	0.7	6		0.2	1.7
Choline (mg)	4	0	0.9	0		0.3	0.1
Minerals							
K (mg)	1833	32	380	19	Source of	113.9	5.7
Ca (mg)	197	19	41	5		12.3	1.5
Mg (mg)	412	89	85.2	23	Source of	25.6	6.8
P (mg)	579	80	119.8	17	Source of	36.0	5.1
Fe (mg)	9	72	1.9	14		0.6	4.1
Cu (mg)	0	0	0	10		0.0	2.9
Manganese (mg)	4	161	0.9	43	High in	0.3	12.8
Zn (mg)	4	42	0.8	8		0.2	2.5
Se (µg)	19	0	4	7		1.2	2.1
Fluoride (µg)	0	0	0	0		0.0	0.0
Na (mg)	514	10	106	4	Low in	31.9	1.3

Table 40: Nutritional value and claims per 100g and per portion of the Amerinca Soup.

AMERINCA							
Claims' colours:	High in	Source of	Low in	Free of			
	per (g)	552	per 100g			per portion	
		NRV %		NRV %	Claims	30	DV %
Calories (kcal)	594	30	108	5		32.3	1.6
Carbohydrates (g)	97	34	17.5	7		5.2	2.0
Fibers (g)	18	74	3.3	13	Source of	1.0	4.0
Sugar (g)	17	0	3.0			0.9	0.0
Proteins (g)	32	50	5.8	12	High in	1.8	3.5
Fats (g)	10	16	1.9	3	Low in	0.6	0.8
Salt	0	0	0.1			0.0	0.0
Vitamins							
Vitamin C (mg)	17	48	3.1	4		0.9	1.2
Vitamin A (IU)	1	0	0.2	0			
Vitamin A (mg)	2021	31	366	46	High in	109.8	13.7
Thiamin (mg)	1	20	0.1	9		0.0	2.6
Riboflavin (mg)	0	8	0.1	4		0.0	1.2
Niacin (mg)	4	20	0.6	4		0.2	1.2
Pantothenic acid (mg)	3	19	0.6	10		0.2	3.0
Vitamin B6 (mg)	1	24	0.2	15	Source of	0.1	4.4
Folic acid (µg)	222	9	40	20	Source of	12.1	6.0
Vitamin B12 (mg)	0	0	0	1		0.0	0.4
Vitamin D (µg)	0	0	0	0		0.0	0.0
Vitamin K (µg)	11	1	2.0	3		0.6	0.8
Vitamin E (mg)	1	3	0.2	1		0.1	0.4
Choline (mg)	39	0	7.0	1		2.1	0.4
Minerals							
K (mg)	1690	33	306	15	Source of	91.8	4.6
Ca (mg)	135	1	24	3		7.3	0.9
Mg (mg)	167	18	30.3	8		9.1	2.4
P (mg)	378	24	68.5	10		20.5	2.9
Fe (mg)	7	11	1.2	9		0.4	2.6
Cu (mg)	0	13	0.1	5		0.0	1.6
Manganese (mg)	1	20	0.3	13		0.1	3.9
Zn (mg)	3	5	0.5	5		0.1	1.4
Se (µg)	2	0	0	1		0.1	0.2
Fluoride (µg)	0	0	0	0		0.0	0.0
Na (mg)	647	3	117.3	5	Low in	35.2	1.5

Table 41: Nutritional value and claims per 100g and per portion of the Dragonlong Soup.

DRAGONLONG							
Claims' colours:	High in	Source of	Low in	Free of			
	per (g)	332	per 100g			per portion	
		NRV %		NRV %	Claims	30	DV %
Calories (kcal)	639	32	192	10		57.7	2.9
Carbohydrates (g)	102	35	30.7	12		9.2	3.5
Fibers (g)	7	26	2.0	8		0.6	2.4
Sugar (g)	5	0	1.5			0.5	0.0
Proteins (g)	26	40	7.7	15	High in	2.3	4.6
Fats (g)	15	23	4.5	6		1.3	1.9
Salt	1	0	0.2			0.1	0.0
Vitamins							
Vitamin C (mg)	1	5	0	0		0.1	0.1
Vitamin A (IU)	1	0	0	0		0.1	0.0
Vitamin A (mg)	2	1	0.6	0		0.2	0.0
Thiamin (mg)	0	6	0.1	8		0.0	2.3
Riboflavin (mg)	0	16	0.1	7		0.0	2.1
Niacin (mg)	3	10	0.8	5		0.2	1.5
Pantothenic acid (mg)	1	12	0.2	4		0.1	1.1
Vitamin B6 (mg)	0	12	0.1	7		0.0	2.1
Folic acid (µg)	74	10	22	11		6.7	3.4
Vitamin B12 (mg)	0	0	0	0		0.0	0.0
Vitamin D (µg)	0	1	0.0	0		0.0	0.1
Vitamin K (µg)	18	15	5.6	7		1.7	2.2
Vitamin E (mg)	0	1	0.1	1		0.0	0.2
Choline (mg)	46	0		0		0.0	0.0
Minerals							
K (mg)	437	3	132	7		39.5	2.0
Ca (mg)	608	22	183	23	Source of	54.9	6.9
Mg (mg)	136	13	41.0	11		12.3	3.3
P (mg)	468	16	140.9	20	Source of	42.3	6.0
Fe (mg)	11	23	3.2	23	Source of	1.0	6.9
Cu (mg)	1	0	0.2	22	Source of	0.1	6.6
Manganese (mg)	2	33	0.7	34	High in	0.2	10.3
Zn (mg)	4	16	1.2	12		0.4	3.7
Se (µg)	31	0	9.3	17	Source of	2.8	5.1
Fluoride (µg)	0	0	0	0		0.0	0.0
Na (mg)	3067	134	924	38		277.1	11.5

Table 42: Nutritional value and claims per 100g and per portion of the Celtae Soup.

CELTAE							
Claims' colours:	High in	Source of	Low in	Free of			
	per (g)	270	per 100g			per portion	
		NRV %		NRV %	Claims	30	%
Calories (kcal)	611	31	226	11		67.9	3.4
Carbohydrates (g)	130	45	48.2	19		14.4	5.6
Fibers (g)	26	106	9.8	39	High in	2.9	11.8
Sugar (g)	7	0	2.6			0.8	0.0
Proteins (g)	19	30	7.2	14	Source of	2.2	4.3
Fats (g)	3	4	0.9	1	Low in	0.3	0.4
Salt	1	0	0.5			0.1	0.0
Vitamins							
Vitamin C (mg)	53	58	19.6	25	Source of	5.9	7.4
Vitamin A (IU)	1	0	0.5	0		0.1	0.0
Vitamin A (mg)	309	41	115	14		34.4	4.3
Thiamin (mg)	0	7	0.2	14		0.0	4.1
Riboflavin (mg)	0	12	0.1	7		0.0	2.2
Niacin (mg)	9	13	3.4	21	Source of	1.0	6.4
Pantothenic acid (mg)	2	18	0.6	10		0.2	2.9
Vitamin B6 (mg)	1	13	0.2	17	Source of	0.1	5.2
Folic acid (µg)	157	20	58	29	Source of	17.4	8.7
Vitamin B12 (mg)	0	0	0.0	0		0.0	0.0
Vitamin D (µg)	0	0	0	0		0.0	0.0
Vitamin K (µg)	59	54	21.8	29	Source of	6.6	8.7
Vitamin E (mg)	1	4	0.2	2		0.1	0.6
Choline (mg)	60	0	22.4	4		6.7	1.2
Minerals							
K (mg)	854	8	316	16	Source of	94.9	4.7
Ca (mg)	97	4	36	4		10.8	1.3
Mg (mg)	140	5	51.7	14		15.5	4.1
P (mg)	404	9	149.5	21	Source of	44.8	6.4
Fe (mg)	5	5	1.7	12		0.5	3.6
Cu (mg)	1	5	0.3	32	High in	0.1	9.5
Manganese (mg)	2	8	0.8	41	High in	0.2	12.4
Zn (mg)	5	9	1.7	17	Source of	0.5	5.2
Se (µg)	57	0	21.1	38	High in	6.3	11.5
Fluoride (µg)	0	0	0	0		0.0	0.0
Na (mg)	549	3	203	8		61.0	2.5

Table 43: Nutritional value and claims per 100g and per portion of the Oceander Soup.

OCEANDER							
Claims' colours:	High in	Source of	Low in	Free of			
	per (g)	524	per 100g			per portion	
		NRV %		NRV %	Claims	30	%
Calories (kcal)	614	31	117	6		35.2	1.8
Carbohydrates (g)	103	36	19.7	8		5.9	2.3
Fibers (g)	18	71	3.4	14	Source of	1.0	4.1
Sugar (g)	16	0	3.1			0.9	0.0
Proteins (g)	32	50	6.1	12	High in	1.8	3.6
Fats (g)	9	14	1.7	2	Low in	0.5	0.7
Salt	1	0	0.2			0.0	0.0
Vitamins							
Vitamin C (mg)	8	18	1	2		0.4	0.6
Vitamin A (IU)	743	0	142	3		42.6	0.9
Vitamin A (mg)	1809	223	345	43	High in	103.6	12.9
Thiamin (mg)	0	31	0.1	9		0.0	2.6
Riboflavin (mg)	0	18	0.1	6		0.0	1.7
Niacin (mg)	7	17	1.3	8		0.4	2.5
Pantothenic acid (mg)	3	53	0.5	9		0.2	2.6
Vitamin B6 (mg)	1	67	0.2	14		0.1	4.1
Folic acid (µg)	147	20	28	14		8.4	4.2
Vitamin B12 (mg)	1	0	0	10		0.1	3.0
Vitamin D (µg)	0	4	0.0	0		0.0	0.0
Vitamin K (µg)	19	0	4	5		1.1	1.5
Vitamin E (mg)	1	17	0.3	2		0.1	0.7
Choline (mg)	4	1	0.8	0		0.2	0.0
Minerals							
K (mg)	1472	34	281	14		84.3	4.2
Ca (mg)	179	10	34	4		10.2	1.3
Mg (mg)	126	35	24.0	6		7.2	1.9
P (mg)	405	43	77.2	11		23.2	3.3
Fe (mg)	6	38	1.2	9		0.4	2.7
Cu (mg)	0	25	0	7		0.0	2.2
Manganese (mg)	2	128	0.4	18	Source of	0.1	5.3
Zn (mg)	5	24	0.9	9		0.3	2.8
Se (µg)	30	16	5.7	10		1.7	3.1
I	0	0	0	0		0.0	0.0
Na (mg)	1943	11	371	15		111.3	4.6

Table 44: Nutritional composition of the ingredients of the Africana soup, based on USDA database. [70]

AFRICANA								
	Ingredients (per 100g)							
	Cassava root	Banana chips	Spinach	Okra	Tamarind, raw	Berbere	Sorghum grain	Bouillon
Calories (kcal)	160	519	23	33	239	333	329	214
Carbohydrates (g)	38.06	58.4	3.6	7.45	62.5	33.3	72.09	31
Fibers (g)	1.8	7.7	2.2	3.2	5.1	33.3	6.7	4.8
Sugar (g)	1.7	35.34	0.4	1.48	38.8	0	2.53	21
Proteins (g)	1.4	2.3	2.9	1.9	2.8	0	10.62	14
Fats (g)	0.28	33.6	0.4	0.19	0.6	0	3.46	2.5
Salt								41.1
Vitamins								
Vitamin C (mg)	20.6	6.3	28	23	3.5	40	0	
Vitamin A (IU)		83			30		0	
Vitamin A (µg RAE)		4	0.469	0.036	2		0	
Vitamin B1 (mg)	0.087	0.085	0.078	0.2	0.428		0.332	
Viatmin B2 (mg)	0.048	0.017	0.189	0.06	0.152		0.096	
Vitamin B3 (mg)	0.854	0.71	0.724	1	1.938		3.688	
Vitamin B5 (mg)		0.62			0.143		0.367	
Vitamin B6 (mg)	0.088	0.26	0.195		0.066		0.443	
Vitamin B9 (µg)	27	14	194	60	14		20	
Vitamin B12 (µg)		0			0		0	
Vitamin D (µg)		0			0		0	
Vitamin K (µg)	1.9	1.3	483	31.3	2.8			
Vitamin E (mg)	0.19	0.24	2	0.27	0.1		0.5	
Choline (mg)		21.3			8.6			
Minerals								
K (mg)	271	536	558	299	628		363	
Ca (mg)	16	18	99	82	74	0	13	
Mg (mg)	21	76	79	57	92		165	
P (mg)	27	56	49	61	113		289	
Fe (mg)	0.27	1.25	2.71	0.62	2.8	12	3.36	
Cu (mg)		0.205			0.086		0.284	
Manganese (mg)	0.383	1.56	0.897				1.605	
Zn (mg)	0.34	0.75	0.53	0.58	0.1		1.67	
Se (µg)		1.5			1.3		12.2	
Fluoride (µg)								
Na (mg)	14	6	79		28	7667	2	16440

Table 45: Nutritional composition of the ingredients of the Amerinca soup, based on USDA database. [70]

AMERINCA									
	Ingredients (per 100g)								
	Corn	Pumpkin	Orange sweet potato	Shallots, raw	Chipotle	Taco shells, baked	Red kidney beans	Chicken	Bouillon
Calories (kcal)	86	26	86	72	75.1	476	127	219	214
Carbohydrates (g)	18.7	6.5	20.1	16.8	10	63.49	22.8	0	31
Fibers (g)	2	0.5	3	3.2	2.5	6.7	7.4	0	4.8
Sugar (g)	6.26	2.76	4.2	7.87	3.9	1.5	0.32	0	21
Proteins (g)	3.27	1	1.6	2.5	2.1	6.41	8.67	24.68	14
Fats (g)	1.35	0.1	0.1	0.1	3.8	21.79	0.5	12.56	2.5
Salt									41.1
Vitamins									
Vitamin C (mg)	6.8	9	2.4	8	86.8	0	1.2	0	
Vitamin A (IU)				4		17	0		
Vitamin A (µg RAE)	9	426	709	0	368.1	1	0	44	
Vitamin B1 (mg)	0.155	0.05	0.078	0.06		0.216	0.16		
Viatmin B2 (mg)	0.055	0.11	0.061	0.02		0.08	0.058		
Vitamin B3 (mg)	1.77	0.6	0.557	0.2		1.867	0.578		
Vitamin B5 (mg)	0.717	0.298	0.8	0.29			0.22	0.667	
Vitamin B6 (mg)	0.093	0.061	0.209	0.345		0.203	0.12	0.6	
Vitamin B9 (µg)	42	16	11	34		69	130		
Vitamin B12 (µg)				0		0	0	0.3	
Vitamin D (µg)				0		0	0		
Vitamin K (µg)		1.1		0.8		8.6	8.4		
Vitamin E (mg)		0.44	0.26	0.04		0.69	0.03		
Choline (mg)				11.3		29.9	30.5		
Minerals									
K (mg)	270	340	337	334	350.7	231	403		
Ca (mg)		21	30	37	10.4	100	28	15	
Mg (mg)	37	12	25	21		83	45	29	
P (mg)	89	44	47	60		233	142		
Fe (mg)	0.52	0.8	0.61	1.2	1.134	1.64	2.94	1.16	
Cu (mg)				0.088		0.113	0.242		
Manganese (mg)	0.163	0.125	0.258	0.292		0.56	0.477		
Zn (mg)	0.46	0.32	0.3	0.4		1.61	1.07		
Se (µg)				1.2		4.8	1.2		
Fluoride (µg)									
Na (mg)		1	55	12	242.1	324	238	67	16440

Table 46: Nutritional composition of the ingredients of the Dragonlong soup, based on USDA database. [70]

DRAGONLONG									
	Ingredients (per 100g)								
	Daikon	Wakame	Miso	Soy sauce	Tofu	sesame seeds	Rice noodles, dry	Shiitake	Bouillon
Calories (kcal)	18	45	199	53	76	573	364	34	214
Carbohydrates (g)	4.1	9.14	26.47	4.93	1.87	23.45	80.18	6.8	31
Fibers (g)	1.6	0.5	5.4	0.8	0.3	11.8	1.6	2.5	4.8
Sugar (g)	2.5	0.65	6.2	0.4	0.62	0.3	0.12	2.4	21
Proteins (g)	0.6	3.03	11.69	8.14	8.08	17.73	5.95	2.2	14
Fats (g)	0.1	0.64	6.01	0.57	4.78	49.67	0.56	0.5	2.5
Salt									41.1
Vitamins									
Vitamin C (mg)	22	3	0	0	0.1	0	0	3.5	
Vitamin A (IU)				0		9			
Vitamin A (µg RAE)			4	0		0	0		
Vitamin B1 (mg)	0.02	0.06	0.098	0.033	0.081	0.791	0.031	0.02	
Viatmin B2 (mg)	0.02	0.23	0.233	0.165	0.052	0.247	0.017	0.22	
Vitamin B3 (mg)	0.2	1.6	0.906	2.196	0.195	4.515	0.221	3.88	
Vitamin B5 (mg)	0.138	0.697	0.337	0.297	0.068	0.05	0.051	1.5	
Vitamin B6 (mg)	0.046		0.199	0.148	0.047	0.79	0.015	0.29	
Vitamin B9 (µg)	28	196	19	14	15	97	3	13	
Vitamin B12 (µg)				0	0	0	0		
Vitamin D (µg)				0	0	0		0.4	
Vitamin K (µg)		5.3	29.3	0	2.4	0			
Vitamin E (mg)		1	0.01	0	0.01	0.25	0.11		
Choline (mg)				18.3	28.8	25.6	5.5		
Minerals									
K (mg)	227		210	435	121	468	30	304	
Ca (mg)	27	150	57	33	350	975	18	2	
Mg (mg)	16	107	48	74	30	351	12	20	
P (mg)	23	80	159	166	97	629	153	112	
Fe (mg)	0.4	2.18	2.49	1.45	5.36	14.55	0.7	0.4	
Cu (mg)				0.043	0.193	4.082	0.078		
Manganese (mg)	0.038	1.4	0.859	1.018	0.605	2.46	0.498	0.2	
Zn (mg)	0.15	0.38	2.56	0.87	0.8	7.75	0.74	1	
Se (µg)				0.5	8.9	34.4	15.1	5.7	
Fluoride (µg)									
Na (mg)	21	872	3728	5493	7	11	182	9	16440

Table 47: Nutritional composition of the ingredients of the Celtae soup, based on USDA database. [70]

CELTAE						
	Ingredients (per 100g)					
	Carrot	Bouillon	Broccoli	Pearled barley	Mushrooms boletus	Onions, dehydrated flakes
Calories (kcal)	41	214	34	352	81.8	349.00
Carbohydrates (g)	9.6	31	6.64	77.72		83.3
Fibers (g)	2.8	4.8	2.6	15.6		9.2
Sugar (g)	4.7	21	1.7	0.8		37.41
Proteins (g)	0.93	14	2.82	9.91	7.39	8.95
Fats (g)	0.24	2.5	0.37	1.16	1.7	0.46
Salt		41.1				
Vitamins						
Vitamin C (mg)	5.9		89.2	0	4.2	75.0
Vitamin A (IU)						18.0
Vitamin A (µg RAE)	835		31	1		1
Vitamin B1 (mg)	0.066		0.071	0.191	0.1	0.500
Viatmin B2 (mg)	0.058		0.117	0.114	0.1	0.100
Vitamin B3 (mg)	0.983		0.639	4.604	6.1	0.990
Vitamin B5 (mg)	0.273		0.573	0.282	2.6	1.380
Vitamin B6 (mg)	0.138		0.175	0.26	0.1	1.600
Vitamin B9 (µg)	19		63	23	290.0	166
Vitamin B12 (µg)				0		0.0
Vitamin D (µg)						0.0
Vitamin K (µg)	13.2		101.6	2.2		4
Vitamin E (mg)	0.66		0.78	0.02		0.18
Choline (mg)				37.8		53.90
Minerals						
K (mg)	320		316	280	203.3	1622
Ca (mg)	33		47	29	1.195	257
Mg (mg)	12		21	79		92
P (mg)	35		66	221	22.26	303
Fe (mg)	0.3		0.73	2.5	0.739	1.55
Cu (mg)				0.42	0.786	0.416
Manganese (mg)	0.143		0.21	1.322		1.389
Zn (mg)	0.24		0.41	2.13	4.172	1.89
Se (µg)				37.7		5.0
Fluoride (µg)						
Na (mg)	69	16440	33	9		21

Table 48: Nutritional composition of the ingredients of the Oceander soup, based on USDA database. [70]

OCEANDER								
	Ingredients (per 100g)							
	Orange sweet potato	Chickpeas canned, drained solids	Garlic powder	Celery stick	Paprika	Smoked beef	Croutons, plain	Bouillon
Calories (kcal)	86	139	331	14	282	133	407	214
Carbohydrates (g)	20.1	22.53	72.73	2.97	53.99	1.86	73.5	31
Fibers (g)	3	6.4	9	1.6	34.9	0	5.1	4.8
Sugar (g)	4.2	4.01	2.43	1.34	10.34			21
Proteins (g)	1.6	7.05	16.55	0.69	14.14	20.19	11.9	14
Fats (g)	0.1	2.77	0.73	0.17	12.89	4.42	6.6	2.5
Salt								41.1
Vitamins								
Vitamin C (mg)	2.4	0.1	1.2	3.1	0.9	0	0	
Vitamin A (IU)		23	0	449	49254		0	
Vitamin A (µg RAE)	709	1	0	22	2463		0	
Vitamin B1 (mg)	0.078	0.027	0.435	0.021	0.33	0.083	0.623	
Viatmin B2 (mg)	0.061	0.015	0.141	0.057	1.23	0.175	0.272	
Vitamin B3 (mg)	0.557	0.14	0.796	0.32	10.06	4.577	5.439	
Vitamin B5 (mg)	0.8		0.743	0.246	2.51	0.59	0.429	
Vitamin B6 (mg)	0.209	0.116	1.654	0.074	2.141	0.35	0.026	
Vitamin B9 (µg)	11	48	47	36	49	8	132	
Vitamin B12 (µg)		0	0	0	0	1.73	0	
Vitamin D (µg)		0	0	0	0			
Vitamin K (µg)		3.4	0.4	29.3	80.3			
Vitamin E (mg)	0.26	0.29	0.67	0.27	29.1			
Choline (mg)			67.5	6.1	51.5			
Minerals								
K (mg)	337	126	1193	260	2280	377	124	
Ca (mg)	30	45	79	40	229	8	76	
Mg (mg)	25	26	77	11	178	21	31	
P (mg)	47	85	414	24	314	181	115	
Fe (mg)	0.61	1.07	5.65	0.2	21.14	2.85	4.08	
Cu (mg)		0.253	0.533	0.035	0.713	0.026	0.163	
Manganese (mg)	0.258	0.846	0.979	0.103	1.59	0.029	0.5	
Zn (mg)	0.3	0.63	2.99	0.13	4.33	3.93	0.89	
Se (µg)		3.1	23.9	0.4	6.3	19.7	37.5	
Fluoride (µg)								
Na (mg)	55	246	60	80	68	1258	698	16440

Annex IV

Annex IV contains the indicators that help conduct the financial analysis of an enterprise and are based on ICAP's study of the sector of ready meals. [64] [77] [78]

Table 49: Table presenting the formulae, through which the Financial Indicators are calculated for the financial evaluation of an enterprise or an industry sector. [64]

Formulae of Financial Indicators		
Profitability Ratios		
Gross Profit Margin	$\frac{Gross\ Profit^{1}}{Sales} * 100$	Not applicable when: Sales = 0 or Sales = Gross Profit Margin. Range: -500≤R≤99
Operating Profit Margin	$\frac{Operating\ Profit^{2}}{Sales} * 100$	Not applicable when: Sales = 0. Range: -500≤R≤500
Net Profit Margin	$\frac{Net\ Income^{3}}{Sales} * 100$	Not applicable when: Sales = 0. Range: -500≤R≤500
EBITDA[4] Margin	$\frac{EBITDA}{Sales} * 100$	Not applicable when: Sales = 0. Range: -500≤R≤500
Efficiency Ratios		
Return on Equity	$\frac{Net\ Income}{Average\ Shareholders'\ Equity} * 100$	Not applicable when: Equity = 0. Range: -500≤R≤500

[1] Gross Profit = Revenue – Cost of Goods Sold
[2] Also known as EBIT: Earnings Before Interest and Taxes
[3] Net Income = Revenue – Cost of Goods Sold – Operating and other Expenses – Interest - Taxes
[4] EBITDA = Net Income + Interest + Taxes + Depreciation + Amortization

Return on Assets	$\frac{Profit\ before\ Taxes}{Liabilities}^{5} * 100$	Not applicable when: Liabilities = 0. Range: -500≤R≤500
Liquidity Ratios		
Current Ratio	$\frac{Current\ Assets}{Current\ Liabilities}^{6} * 100$	Not applicable when: Short-term Liabilities = 0. Range: 0≤R≤50
Quick Ratio	$\frac{AR^{7} + Cash\ \&\ Cash\ Equivalents + MS^{8}}{Current\ Liabilities} * 100$	Not applicable when: Short-term Liabilities = 0. Range: 0≤R≤30
Cash Ratio	$\frac{Cash\ \&\ Cash\ Equivalents}{Current\ Liabilities} * 100$	Not applicable when: Short-term Liabilities = 0. Range: 0≤R≤30
Working Capital	$Current\ Assets - Current\ Liabilities$	Not applicable when: Short-term Liabilities = 0. Range: N/A
Leverage Ratios		
Debt to Equity Ratio	$\frac{Total\ Liabilities}{Total\ Shareholders'\ Equity}$	Not applicable when: Equity = 0. Range: 0<R≤100
Fixed to Total Assets Ratio	$\frac{Fixed\ Assets}{Total\ Assets} * 100$	Not applicable when: Fixed Assets = 0.

[5] Also, the denominator can be "Total Assets", since Total Assets = Total Liabilities

[6] Current Assets = Cash + Cash Equivalents + Inventory + Accounts Receivable + Marketable Securities + Prepaid Expenses + Other Liquid Assets

[7] Accounts Receivable

[8] Marketable Securities

		Range: >0
Financial Cost Coverage Ratio	$\frac{Profit\ before\ Tax + Fianancial\ Costs}{Financial\ Costs} * 100$	Not applicable when: Financial Costs = 0 or Profit before Tax + Financial Costs ≤ 0. Range: 0<R≤1000
Short-term Bank Debt to Equity[9]	$\frac{Long\ term\ Bank\ Instalment\ Debt}{Equity} * 100$	Not applicable when: Equity ≤ 0. Range: 0<R≤500
Short-term Bank Liabilities to Sales	$\frac{Long\ term\ Bank\ Instalment\ Debt}{Sales} * 100$	Not applicable when: Banks & Long-term Loan Instalments = 0. Range: 0<R≤1000
Activity Ratios		
Average Collection Period or Days Sales Outstanding	$\frac{Average\ Balance\ of\ Accounts\ Receivable}{Total\ Net\ Credit\ Sales} * 365$	Not applicable when: Sales = 0. Range: 0<R≤720
Days Payable Outstanding	$\frac{Accounts\ Payable}{Cost\ of\ Goods\ Sold} * 365$	Not applicable when: Cost of Goods Sold = 0. Range: 0<R≤720
Day Sales of Inventory (Days of Inventory)	$\frac{Average\ Inventory}{Cost\ of\ Goods\ Sold} * 365$	Not applicable when: Cost of Goods Sold = 0. Range: 0<R≤720
Total Assets Turnover Ratio	$\frac{Sales}{Liabilities}$[10]	Not applicable when: Liabilities = 0 or Sales = 0. Range: 0<R≤100

[9] As defined by ICAP. The same for the next ratio.

[10] Also, the denominator can be "Total Assets", since Total Assets = Total Liabilities

Cash Conversion Cycle	$Days\ of\ Inventory$ $+ Days\ of\ Collection\ of\ Receivables$ $- Days\ of\ Supplier\ Repayment$	Not applicable when: Days of Inventory Traffic Speed = out of limits, Days of Collection of Receivables = out of limits, Days of Supplier Repayment = out of limits. Range: N/A

Annex V

Annex V contains the questionary that was completed by the participants of the survey for the Greek market analysis by phone, online or in writing.

Have you ever heard of Knorr?	
Yes	
No	
N/A	

Have you ever heard of Maggi?	
Yes	
No	
N/A	

Do you know any of their products?	
Yes	
No	
N/A	

If yes, which ones?	
Knorr	Maggi

Have you ever purchased and/or used any of these companies' products?	
Yes	
No	
N/A	

If yes, which of their products do you use more frequently?	
Knorr	Maggi

How frequently?	
>1 per day	
1 per day	
>1 per week	
1 per week	
1-4 per month	
<1 per month	
Never	

How satisfied are you with Maggi's products?	
Satisfied	
Neutral	
Dissatisfied	
N/A	

Which of Maggi's products are you aware of?	
Noodles	
On-The-Go Noodles (cup)	
Cooking Aids (i.e., cubes, broths etc.)	
Soups	
Sauces	
Mashed potato	

Which of Maggi's products do you like more?	
Noodles	
On-The-Go Noodles (cup)	
Cooking Aids (i.e., cubes, broths etc.)	
Soups	
Sauces	
Mashed potato	

In case of a free sample survey of new or uncommon to you products, would you take part in it?	
Yes	
No	
N/A	

If the results of this survey were satisfying, would you think of purchasing that product?	
Yes	
No	
N/A	

What is your opinion on Maggi's dry soups?	
Good	
Neutral	
Poor	
N/A	

What do you think they lack (i.e., flavour, taste, nutritional value, appeal etc.)?

With improvement on these factors, would your opinion change and purchase these products?	
Yes	
No	
N/A	