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(EVALUATION OF e-GOVERNMENT SERVICE QUALITY)

ΔΙΔΑΚΤΟΡΙΚΗ ΔΙΑΤΡΙΒΗ

Ξένη Γ. Παπαδομιχελάκη

ΑΘΗΝΑ ΙΟΥΝΙΟΣ 2011

Μέτρηση Ποιότητας Υπηρεσιών Ηλεκτρονικής Διακυβέρνησης

(Evaluation of e-Government Service Quality)

Ξένη Γ. Παπαδομιχελάκη

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Περίληψη

Η διδακτορική διατριβή τοποθετείται στον ευρύτερο επιστημονικό χώρο της ποιότητας ηλεκτρονικών υπηρεσιών (quality of e-services) και συγκεκριμένα επικεντρώνεται στη μελέτη της μέτρησης της ποιότητας υπηρεσιών που παρέχονται από σελίδες ηλεκτρονικής διακυβέρνησης (assessment of quality of e-government services). Δεδομένων των προβλημάτων των υπαρχόντων μεθόδων μέτρησης, προκύπτει η ανάγκη επιστημονικού προσδιορισμού των κριτηρίων αξιολόγησης της ποιότητας και της σημαντικότητας τους, αλλά και της δυνατότητας επιλογής μεθόδου αξιολόγησης της ποιότητας.

Το μοντέλο ποιότητας που αναπτύχθηκε καθορίζει τους βασικούς άξονες και παράγοντες της ποιότητας ηλεκτρονικών υπηρεσιών και ιστοχώρων, που πρέπει να ληφθούν υπ' όψιν κατά την μέτρηση της, απαντώντας στο ερώτημα σχετικά με το 'τι πρέπει να μετρηθεί'.

Στην συνέχεια απαντώντας στο ερώτημα σχετικά με το 'πώς πρέπει να μετρηθεί;' δημιουργήθηκαν δύο εργαλεία μέτρησης της ποιότητας υπηρεσιών ηλεκτρονικής διακυβέρνησης. Το πρώτο εφαρμόζει τη μέθοδο συμπλήρωσης ερωτηματολογίων, αποτελείται από 4 άξονες και 21 παράγοντες και εφαρμόστηκε στις έξι δημοφιλέστερες ιστοσελίδες ηλεκτρονικής διακυβέρνησης της Ελλάδος ενώ το δεύτερο εφαρμόζει την μέθοδο ευρετικής αξιολόγησης, αποτελείται από 3 άξονες, 15 παράγοντες και 50 δείκτες μέτρησης και εφαρμόστηκε σε 50 ιστοτόπους δημοσίων υπηρεσιών, που ανήκουν σε 5 Ευρωπαϊκές χώρες (Ελλάδα, Μεγάλη Βρετανία, Ιρλανδία, Μάλτα, Φιλανδία).

Λέξεις Κλειδιά

Αξιολόγηση Ποιότητας, Εργαλεία Μέτρησης Ποιότητας, Ηλεκτρονική Υπηρεσία, Μοντέλο Ποιότητας, Ηλεκτρονική Διακυβέρνηση

Abstract

This doctoral thesis focuses on the domain of quality of services in electronic government. Considering the problems of the existing methods for measuring the quality of e-government services there is a need to define scientifically the quality evaluation criteria and their relative importance, as well as to provide organizations and practitioners with alternative and flexible ways to assess the quality of the electronic services they deliver, in order to fit their needs and their resources.

The developed quality model determines the dimensions and the attributes that should be evaluated in the assessment of e-government service quality and answers to the question ‘what to assess’.

Next, for answering the question ‘how the assessment should be done’ two instruments were developed. The first instrument applies inquiry method, constitutes of 4 dimensions and 21 attributes and was implemented on the six most popular e-government sites of Greece, while the second instrument applies inspection method, constitutes of 3 dimensions, 15 attributes and 50 metrics and was implemented on 50 websites of public authorities, which belong to 5 European countries (Greece, United Kingdom, Ireland, Malta and Finland).

Keywords

Quality Evaluation, Instruments of Quality Evaluation, e-Service, Quality Model, e-Government

Ευχαριστίες

Η παρούσα διδακτορική διατριβή αποτελεί το επιστέγασμα μίας προσπάθειας πεντέμισι ετών, στα πλαίσια του προγράμματος μεταπτυχιακών σπουδών του τμήματος Ηλεκτρολόγων Μηχανικών και Μηχανικών Ηλεκτρονικών Υπολογιστών του Εθνικού Μετσόβιου Πολυτεχνείου. Η συναναστροφή με συναδέλφους, αλλά και το κλίμα δημιουργικότητας αποτέλεσαν βασικές πηγές έμπνευσης και συνάβαλαν σημαντικά στη βελτίωση της προσωπικής αντιμετώπισης και επίλυσης ερευνητικών προκλήσεων.

Το αποτέλεσμα που παρουσιάζεται στις σελίδες αυτές οφείλεται στο μέγιστο βαθμό στη βοήθεια και στην καθοδήγηση που είχα από τον επιβλέποντα Καθηγητή κ. Γρ. Ν. Μέντζα. Του οφείλω ιδιαίτερες ευχαριστίες για τις ευκαιρίες που μου μου προσέφερε και την πίστη του σε εμένα. Τα μαθήματα επιστημονικής κατάρτισης, ερευνητικού ζήλου, αλλά και ηθικής ακεραιότητας που πήρα από αυτόν αποτελούν τα σημαντικότερα εφόδια για την μελλοντική μου πορεία.

Θα ήθελα να ευχαριστήσω τα άλλα δύο μέλη της τριμελούς εισηγητικής μου επιτροπής, τον Καθηγητή κ. Β. Ασημακόπουλο και τον Καθηγητή κ. Ν. Ουζούνογλου, καθώς και τον Καθηγητή κ. Ι. Ψαρρά τον Αναπληρωτή Καθηγητή κ. Δ. Ασκούνη και τους Επίκουρους Καθηγητές κ. Δ. Αποστόλου και κ. Κ. Κούτσικο για την τιμή που μας έκαναν να συμμετάσχουν στην επιτροπή εξέτασης της διατριβής.

Θέλω επίσης να ευχαριστήσω τους συναδέλφους μου Χαράλαμπο Μαγγούτα, Δημήτρη Αποστόλου και Χρήστο Χάλαρη που υπήρξαν αρωγοί και συμπαραστάτες σε όλη αυτή την πορεία. Τέλος θα ήθελα να ευχαριστήσω τους φοιτητές Βίκυ Κουτσιούρη, Δημήτρη Κωνσταντινίδη και Σταύρο Κατσάνη.

Ξένια Παπαδομιχελάκη

Ιούνιος 2011

1 Introduction and Motivation

This doctoral thesis focuses on the domain of quality of services in electronic government. The main research goal of the thesis is the development of a quality model for e-government services as well as the development and application of two instruments for assessing e-government services – one for the inquiry method and one for the inspection method. Considering the problems of the existing methods for measuring the quality of e-government services there is a need for measuring e-service quality in a manner developed for governmental and not for commercial sites. With tools refined, validated and confirmed by citizens' and not by customers' replies. Furthermore, there is a need to provide organizations and practitioners with alternative and flexible ways to assess the quality of the electronic services they deliver, in order to fit their needs and their resources.

This chapter is structured as follows. In section 1.1, some introductory aspects for e-government services and their quality are highlighted. Section 1.2 describes the challenges that motivated the development of the proposed quality model and the two instruments. In section 1.3 the thesis' theoretical foundation is presented. Section 1.4 provides an overview of the main contributions of the present doctoral thesis. Section 1.5 describes how the thesis is structured, while a discussion about how the structure of the thesis is related to the papers published, is given in section 1.6. Finally, in section 1.7 the research project which supported partially the present thesis, as well as its relation to the thesis, is discussed.

1.1 e-Government Services and their quality

Technology is changing our lives in many ways, and changing the way that public services are governed and delivered.

Nowadays we are confronted by a new paradigm. One where the heightened expectations of customers must be delivered with constrained public resources. The short term economic crisis has resulted in a long-term fiscal and public budget crisis. Yet there is much more than just economic and budget considerations that will cause grass root changes.

Information and Communication Technology (ICT) is no longer the servant to business' and organizations' operations; it has become an integral partner. New devices (the 4th screen) have become commonplace. Social networking is very much on the rise. We are offered access through multiple (technology) channels that offer substantially lower costs and in many instances better service levels. Such change offers profoundly greater opportunities for active engagement and participation. Technologies enable visibility, structuring and transfer of information that can deliver more seamless services, from need to fulfillment. Business intelligence systems offer the potential to deliver customer insights to support choice and tailoring of services. It will also enable performance to be managed in far better ways.

There are challenges however in these developments. Building and retaining citizen confidence in the ability of Administration to appropriately manage personal information is a prerequisite. Providing choice in how personal information is managed will be important. Data security has thus become a priority concern.

Increased focus on and involvement of the citizen in service delivery is a common trait across Europe. Features like personalization (e.g. 'myportal'); orientation of service information and provision in a way that is more meaningful to the customer (e.g. life-event); access through multiple connected channels; participation in service delivery process (e.g. problem reporting); and progress tracking of cases (e.g. job search) are all examples of this shift. Alongside providing better quality services, this can offer cost and efficiency savings for Public Administrations.

Participation on the other hand is presently low. The availability of web 2.0 technologies (social networking and the like) offers an opportunity to address this. Much must be done to understand and engage the citizen through user-centered service provision, as a foundation to built trust and confidence. This will help increase online participation. Low levels of user take-up, particularly for citizen services, are observed. Against a backdrop of demographic change, aging, retirement of a high proportion of the public workforce, spiraling healthcare costs, environmental and climate change awareness, and growing customer expectations, this will place continued and heightened pressures on public service providers to improve service quality.

"Quality in a product or service is not what you put into it. It is what the client or customer gets out of it." These words of Peter Drucker capture the essence of quality. The true definition of quality is a combination of two previously independent interpretations (Herbig and Genestre 1996): quality is consistent conformance to customer expectation (Crosby 1979) and "fitness for purpose" (Juran 1988). It is partially objective and partially subjective. The product or service must possess certain characteristics and be judged by customers or citizens to serve them in a way they want it to. There is no better judge of quality, therefore, than customers/citizens themselves.

Perceptions of e-government service quality may include a number of dimensions. Attributes for example, such as speed of download and use of multimedia, have been discussed in terms of viewer perceptions. Citizens without the benefit of high-speed modems may experience long download times, which can cause dissatisfaction. This may lead to a decrease in perceived quality (Lightner, Bose & Salvendy 1996). The effective use of multimedia on Web sites is also a means to improve customer satisfaction and increase the perception of quality (Merritt 1996). However, because increasing levels of multimedia result in increased download times, the use of relevant and not excessive pictures, charts, and audio is necessary to maintain consumer satisfaction and perceived quality. Thus, e-government site design involves a number of tradeoffs. Without a valid instrument, the extent to which these design tradeoffs affect the quality of an e-government site cannot be determined.

1.2 Motivation

Traditionally, government organizations have provided their services in brick and mortar office settings (offline). However, with the advent of the internet, an increasing number of government services are being provided online over the internet. With the emergence of the new technology and new ways of performing transactions with the government, citizens face the question of whether to continue using the traditional offline service channel or switch to the new online channel. Citizens' willingness to adopt e-Government services depends on the perceived quality of e-government services.

In the field of e-commerce there are some validated instruments for assessing service quality. Nevertheless, turning to the study of e-government service quality, we note that although some of the quality evaluation criteria will be generic in nature (i.e. may be suitable for either e-commerce or e-government sites), others may apply only to e-commerce and some may apply only to e-government. According to Parasuraman et al. (1988) quality of service has to do with expectations and perceptions of the customers/citizens. Do customers have the same expectations of an e-commerce site with the expectations that citizens have of an e-government site? Are the quality criteria of an e-commerce site the same with the quality criteria of an e-government site? Do they group under the same dimensions? According to Barzilai-Nahon and Scholl (2007) there are significant differences on the above aspects.

Unfortunately only limited academic research exists on e-government service quality nevertheless, it is mostly descriptive and only discusses some aspects. Since the existing literature of e-government service quality is not yet rich enough to provide a sound conceptual foundation, exploratory research is required to develop an understanding of the detailed determinants in the e-gov service quality and their impact on citizen attitude. While certain aspects of Web site design might seem intuitive, other concepts may not be so straightforward and still others have yet to be identified. Hence, an empirical study is essential for the development and validation of such an instrument. The provision of such a scale will further enhance the e-government's ability to exploit and further attract more citizens to make their transactions through the web.

Moreover quality evaluation models in e-government usually encompass several quality criteria, and each criterion is further split into numerous sub-criteria. However, how to best balance these indicators is an important issue. An incomplete measurement model can result in inappropriate actions that may harm organizations' e-government service delivery. When choosing an appropriate range of service quality measures, it is necessary to balance these measures, to ensure that one quality criterion, sub-criterion or a set of criteria or sub-criteria, is not emphasized to the detriment of the others.

Furthermore, the quality indicators selected must be measurable, and allow practitioners to monitor service quality.

1.3 Thesis Theoretical Foundation

This doctoral thesis is focused in the area of e-government service quality and proposes an integrated model and two instruments for assessing quality of services provided. The theoretical foundations of this work are based on SERVQUAL model (Parasuraman, Zeithaml & Berry, 1988) as far as service quality is concerned and on Churchill's paradigm (Churchill, 1979) for creating measures of marketing constructs.

To the degree that service quality is concerned Brady and Cronin (2001) suggest that researchers of service quality generally adopt one of two conceptualizations in their work, the American or the European perspective. The focus on functional quality attributes is referred to as the American perspective of service quality (i.e. SERVQUAL model), while the European perspective suggests that service quality considers two more components, technical quality and image (i.e. Gronroos's model – Gronroos, 1982).

SERVQUAL provides a technology for measuring and managing service quality. Since 1985, when the technology was first published, its innovators Parasuraman, Zeithaml and Berry, have further developed, promulgated and promoted the technology through a series of publications (Parasuraman et al., 1985; 1988; 1994; Zeithaml et al., 1990). The developers of SERVQUAL initially suggested that service quality consists of functional (process) and technical (outcome) dimensions (Parasuraman et al., 1985). However, the SERVQUAL instrument does not include any measure of the technical

quality dimension. Essentially, technical quality has been neglected in efforts to study and measure service quality.

Being explicitly influenced by the European perspective, Parasuraman et al. (1985) suggested that quality evaluations are not made solely on the outcome of service; they also involve evaluations of the service delivery process. While the dimensions are inter-correlated, the primary basis for the dichotomy rests with when the evaluation occurs. For process quality, the evaluation occurs while the service is being performed. For outcome quality, evaluation happens after service performance and focuses on "what" service is delivered. However, their measurement of service quality (i.e. SERVQUAL) does not explicitly reflect both dimensions, but a functional dimension only (Kang & James, 2004).

On the other hand, with the suggestion that the "perceived service quality model" replace the product features of a physical product in the consumption of services, Gronroos (1982) identified two service quality dimensions, the technical aspect ("what" service is provided) and the functional aspect ("how" the service is provided). The customers perceive what s/he receives as the outcome of the process in which the resources are used, i.e. the technical or outcome quality of the process. But s/he also and often more importantly, perceives how the process itself functions, i.e. the functional or process quality dimension.

Whereas service quality is known to be based on multiple dimensions (Gronroos, 1982, 1990; Parasuraman et al., 1985), there is no general agreement as to the nature or content of the dimensions (Brady and Cronin, 2001).

In this doctoral thesis we decided to follow the American perspective and used SERVQUAL. For some services the "what" (or technical quality) might be difficult to evaluate. For example, in health care the service providers' technical competence, as well as the immediate results from treatments, may be difficult for a patient (a customer) to evaluate. Lacking an ability to assess technical quality, consumers rely on other measures of quality attributes associated with the process (the "how") of health care delivery. For health care service, consumers would likely rely on attributes such as reliability and empathy to assess quality. Another reason for adopting the American perspective was that the maturity of e-government services in Greece is still low and collecting a

sufficient data sample of citizens having completed full transactions through e-government would be extremely difficult.

While the SERVQUAL instrument has been widely used, it has been subject to criticism (Asubonteng et al., 1996; Buttle, 1996; Gronroos, 1990; Mangold and Babakus, 1991; Richard and Allaway, 1993). Criticisms include the use of difference scores, dimensionality, applicability and the lack of validity of the model, especially with respect to the dependence or independence of the five main variables (Babakus and Boller, 1992; Carman, 1990; Cronin and Taylor, 1992).

Despite this criticism, much of the research to date has focused on measuring e-service quality using the SERVQUAL instrument. Subsequently, research on the instrument has been widely cited in the marketing literature and its use in industry has become quite widespread (Brown et al., 1993). SERVQUAL seems to be moving rapidly towards institutionalized status[1]. As Rust and Zahorik (1993) have observed, "the general SERVQUAL dimensions … should probably be put on any first pass as a list of attributes of service".

Concerning Churchill's paradigm for creating measures of marketing constructs, since the 1970s, marketing academics have sought to establish the reliability and validity of measures of marketing constructs. In 1979, Churchill described a paradigm that would aid researchers in the development of such measures. Churchill's (1979) paradigm involves a systematic iterative process for the development of marketing measures, while emphasizing the need for consideration of both conceptual and methodological concerns. For more than a quarter of a century, measurement of latent constructs in marketing research has relied almost exclusively on Churchill's "Paradigm for Better Measures". [2]

Churchill (1979) described the problem of developing good marketing measures and highlighted that:

> … there is no overriding framework which the marketer can embrace to help organize the many definitions and measures of reliability and validity into an integrated whole so that the decision as to which to use and when is obvious. (p. 65)

[1] It should be noted that SERVQUAL has been mentioned in 6238 citations and Gronroos' model in 5416 citations.
[2] It should be noted that Churchill's paradigm has been mentioned in 2527 citations.

He then proposed a framework involving an iterative process, whereby the researcher must first specify the domain of the construct of interest and then generate a sample of items for its measurement. Next is a process of data collection and purification of the measure based on factor analysis and the calculation of coefficient alpha. A second stage of data collection is followed by an assessment of the reliability and validity of the construct.

Concluding, based on SERVQUAL model in the area of service quality and on Churchill's paradigm for creating better measures of marketing constructs we proposed an integrated model and two instruments for assessing quality of e-government services.

1.4 Contributions of this Thesis

The contribution of the present doctoral thesis can be summarized in the construction of an integrated framework that deals with the problem of the quality evaluation of e-government sites.

More analytically the contribution of this work can be summarized in three main axes.

a) *Literature survey on the fields of quality evaluation of e-government services and website quality and conceptualization of a reliable quality model.*

Firstly, an extensive review of research efforts in the domains of e-service quality assessment and website quality and evaluation takes place. It pertains to the theoretical foundations, basic concepts and technologies used in the context of this thesis. The definition of basic concepts and perspectives regarding the quality of e-services and how it is evaluated is included. In parallel, it covers an extensive and systematic review of the state of the art regarding quality models, which define the quality aspects of e-services and portals to be evaluated. The systematic review, which originated from the need to answer the question about what should be measured as far as the quality e-government services is concerned, concluded in a suggested categorization and synthesis of the various quality models. This categorization and synthesis formed the basis for the development of an e-service quality model that addresses the aforementioned question.

b) *Development of an instrument for e-government services quality assessment with the use of questionnaires.*

Furthermore, given the constant increase of the online available governmental services, there is a need for organizations' self assessment. In order to satisfy that need we developed two instruments, each one for a different usability evaluation method.

Among usability testing methods the inquiry method was selected due to the efficiency that the end-user oriented methods provide. Of the inquiry methods we selected to use questionnaires despite their limited flexibility caused by specific questions that cannot be changed, due to the large volume of completed questionnaires that can be gathered. Moreover, due to the standardization of the questions the reaching of conclusions is easier. Finally, it requires minimum resources (cost, special equipment, qualified personnel).

Our model analyses the relationships between quality criteria and sub-criteria for assessment with a multi-attribute decision analysis method. Using the e-GovQual scale developed in Chapter 5, our statistical sample is based on citizens' preferences for the evaluation of an ideal e-government site. To accurately evaluate the influence of the evaluation criteria we used the Analytic Hierarchy Process (AHP) a multi-criteria method. Additionally, in order to test the possible existence of interrelationships among evaluation elements, we apply the Analytic Network Process (ANP) method, another multi-criteria method that does not require a uni-directional hierarchical relationship and incorporates feedback and interdependent relationships among elements to the six most popular e-government sites in Greece, as well as the AHP. Finally we compare the results of the two methods and our results show no interrelations between the evaluation criteria of the model.

c) *Development of an instrument for e-government services quality assessment with the use of heuristic evaluation.*

Heuristic evaluation is another method of usability testing for structuring the critique of a system using a set of relatively simple and general heuristics. The general idea behind heuristic evaluation is that several evaluators independently evaluate a system to come up with potential usability problems.

The heuristic evaluation method was selected because of its low cost and its simplicity.

We modified e-GovQual scale in order to use it for heuristic evaluation method. After literature research we identified the metrics that were incorporated in the instrument and defined the way of assessment and the weights for all the evaluation criteria. The resulted instrument consisted of 3 dimensions, 15 attributes and 50 metrics. This instrument was implemented on 50 websites of public authorities, which belong to 5 European countries (Greece, United Kingdom, Ireland, Malta and Finland). The websites assessed were providing the 12 basic public services to citizens as defined by European Commission (EU Commission, 2002). We classified the 5 countries according to their ratings and compared the results with Cap Gemini's results. In that way we examine the convergent validity of our scale.

Concluding, the development of the suggested model broadens the existing knowledge for the assessment of e-government services and creation of guidelines concerning the criteria that influence the quality of e-government services. Moreover, through the understanding of the impact each quality criterion has to the overall e-government service quality, organizations stand a much better chance to focus on the most important ones and consequently provide higher quality services. The two instruments developed during this doctoral thesis would be valuable to researchers and practitioners interested in designing, implementing, and managing governmental web sites and can also be used as diagnostic tools for assessing and improving quality depending on which usability testing method organizations may choose.

1.5 Structure of this Thesis

The thesis consists of 8 Chapters as can be seen in Figure 1.1. After this introductory chapter, Chapter 2 describes the theoretical foundations in the area of Quality Management, Service Management and more specifically in the areas of Website Quality and e-Government Service Quality. Theoretical definitions and perspectives about quality of service are given while a systematic review of research efforts in the area is performed.

The literature survey concludes with the categorization of the various research efforts and the discussion about the categorization results.

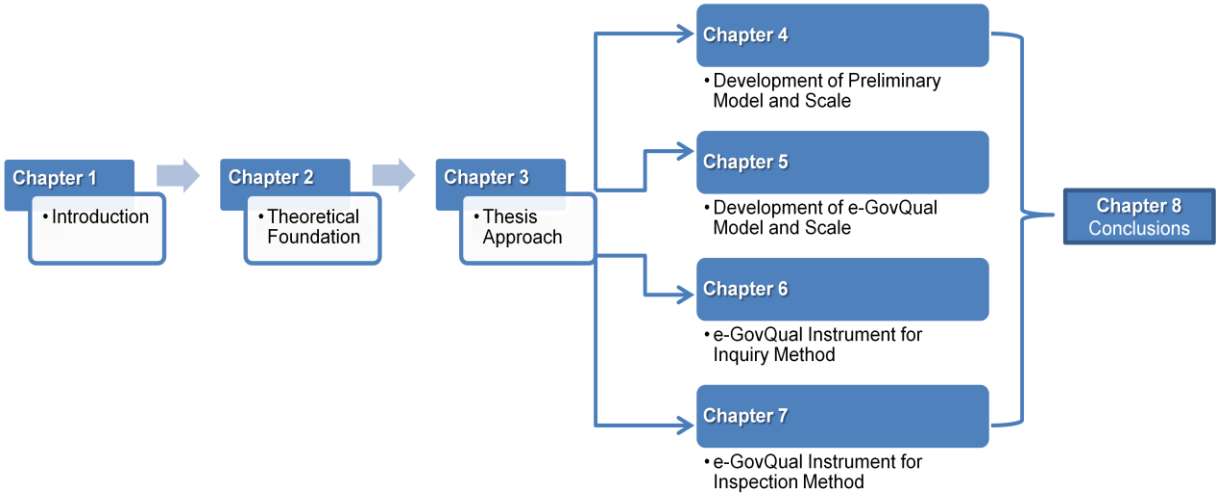

Figure 1.1. Structure of the Doctoral Thesis

In Chapter 3 the approach of this doctoral thesis on evaluation of e-government service quality is presented. The research aim of this PhD thesis is described. Furthermore, the theoretical background and the method used are presented. Finally, the chapter concludes with the results.

Chapter 4 presents the conceptualization and development of the preliminary quality model and scale. The characteristics of the e-government site and the electronic services delivered through it are defined. Focus is on construct validity and a first refining of the sample of items takes place. The remained 33 e-government quality attributes are classified under six main quality dimensions: Ease of Use, Trust, Functionality of the Interaction Environment, Reliability, Content and Appearance of Information, and finally Citizen Support. After identifying the variables that capture e-government service quality and creating the conceptual model there is a need to confirm whether the sample of items depicted, capture the construct of e-gov service quality and to decide on such operational issues as question types and question sequence. Based on the framework of SERVQUAL (Zeithaml, Parasuraman & Berry, 1990) a questionnaire based on these criteria is designed to elicit and assess information on preferences of the citizens when evaluating e-gov service and governmental web sites. The preliminary

scale is produced following guidelines for measurement development proposed by Churchill (1979).

Chapter 5 is concerned with confirming the model and normalizing the scale that have been developed in Chapter 4. It involves the important steps of subsequent independent verification and validation. In order to refine and evaluate the preliminary model and scale resulted in Chapter 4 an online survey that collected 630 responses takes place. The scale is developed, refined, evaluated psychometrically, tested as far as its reliability is concerned and reaches a stable factor structure that results in 25 quality attributes classified under 4 quality dimensions: Reliability, Efficiency, Citizen Support and Trust. A second online survey with 264 respondents takes place in order to verify, validate and finally confirm the scale. During the above process the quality attributes of the refined preliminary scale are reduced to 21 (e-GovQual model/scale). The outcome of this chapter is the e-GovQual model and scale.

Chapter 6 presents the development of the e-GovQual instrument for inquiry method. Our model analyses the relationships between quality criteria and sub-criteria for assessment with a multi-attribute decision analysis method. We use the e-GovQual scale developed in Chapter 5, to our statistical sample which is based on citizens' preferences for the evaluation of an ideal e-government site. To accurately evaluate the influence of the evaluation criteria we use the Analytic Hierarchy Process (AHP). Moreover, in order to test the possible existence of interrelationships among evaluation elements, we also apply the Analytic Network Process (ANP) method, another multi-criteria method and the AHP as well, to the evaluation of the six most popular Greek e-government sites. Finally we compare the results of the two methods as described. Our results show no interrelations between evaluation criteria of the model. The outcome of this chapter is an instrument for inquiry method that ensures that one quality criterion, sub-criterion or a set of criteria or sub-criteria, is not emphasized to the detriment of the others. Moreover, the quality indicators selected are measurable, and allow practitioners to monitor service quality.

Chapter 7 describes the development of an e-GovQual instrument for inspection method. e-GovQual scale is modified in order to be used for heuristic evaluation method. After literature research the metrics that are incorporated in the instrument are identified

and the way of assessment and the weights for all the evaluation criteria are defined. The primary outcome of this chapter is an instrument for inspection method that consists of 3 dimensions, 15 attributes and 50 metrics. Furthermore, this instrument is implemented on 50 websites of public authorities, which belong to 5 European countries (Greece, United Kingdom, Ireland, Malta and Finland). The websites assessed are providing the 12 basic public services to citizens as defined by European Commission (EU Commission, 2002). Finally with the comparison of the results with Capgemini's (2009) results, the convergent validity of the instrument was examined.

Finally in Chapter 8, conclusions and possible implications of this work are presented. Limitations of the study and possible improvements are discussed, while at the end of the chapter, issues for further research are identified.

1.6 Relation to Publications

This Thesis resulted in three (3) journal publications and five (5) international conference presentations. This section describes how the structure of the thesis is related to these publications. The list of publications can be found in Appendix VI. Although, the research contributions of a single publication may concern more than one chapter, in the following we relate each chapter to the most relative publication(s).

- The extensive and systematic review of research efforts in the domain of e-service quality models, as well as the suggested categorization and synthesis of the various quality models which are described in Chapter 2, were published in (Papadomichelaki, Magoutas, Halaris, Apostolou & Mentzas, 2006) and (Halaris, Magoutas, Papadomichelaki & Mentzas, 2007), respectively.
- Part of the literature review which is described in Chapter 2 as well as the development of the preliminary model which is described in Chapter 4 was published in (Papadomichelaki, 2006).
- The analysis of citizen attitudes in Greece which is described in Appendix I was published in (Papadomichelaki & Mentzas, 2011b) and (Papadomichelaki & Mentzas, 2008).

- The development of e-GovQual model and scale, which is described in Chapters 4 and 5, was published in (Papadomichelaki & Mentzas, 2011a) and (Papadomichelaki & Mentzas, 2009).
- Finally the development of an instrument for inquiry method that was described in Chapter 6 was published in (Papadomichelaki, Koutsiouri, Konstantinidis & Mentzas, 2011).

1.7 Relation to Research Project

It should be noted that the present doctoral thesis was partially supported by the European Commission through the Information Society Technologies (IST) project FIT (Fostering self-adaptive e-Government service improvement using semantic technologies, IST-2004-27090) [FIT Site], (Stojanovic et. al., 2006).

The overall objective of the FIT project was the development of methods and tools to publish e-government services on-line in a more efficient way in order to enable services accessibility for all users and to increase e-users satisfaction. Quality was in the heart of the approach proposed by FIT. The underlying methodology ensured that the quality of services is proactively and continually tailored to the changed preferences of e-users, which leaded to the realization of a self-adaptive e-government system.

The research reported in this thesis is related to the work we have done in the context of the FIT project regarding the review in state of art and the development of a preliminary model and tool enabling the quality evaluation of an e-government site. Particularly, our work in FIT gave input for part of the State Of Art that was presented in Chapter 2. Moreover, in FIT we developed the preliminary model and scale described in Sections 4.2 and 4.3. Furthermore, in the context of FIT we realized the first data collection presented in Section 5.2.1. Finally, some of our work in FIT is out of the context of the present doctoral thesis.

2 Quality, Service Quality, e-government Service Quality

2.1 Introduction

It has been long since Shewhart Walter (1980) described quality in terms of objective and subjective quality. Objective quality is the degree of compliance of a process or its outcome with a predetermined set of criteria, which are presumed essential to the ultimate value it provides. Subjective quality is the level of perceived value reported by the person who benefits from a process or its outcome. It may subsume various intermediate quality measures, both objective and subjective.

Kaoru Ishikawa (1991) developed an approach combining the customer's and the producer's view of quality. He named the customer's view as "true characteristics" and the producer's view as "substitute characteristics" and claimed that the degree of match between true and substitute ultimately determines customer satisfaction. This implies the need of tapping into opinions of different involved groups, achieving a 360 degree view. (like covering all possible directions of the compass).

Moreover, Parasuraman, Zeithaml and Malhotra (1988), appoint the importance of evaluating the gap between the actual and the ideal product or service.

We will be using these concepts later on in our analysis of the approaches to e-government service quality that we will be reviewing.

This PhD thesis is focused on e-government service quality. Thus the theoretical background that this PhD thesis is going to be based on is Quality Management, Service Management and Information Systems as illustrated on Figure 2.1.

More specifically we reviewed the work of Shewhart (1980), Deming (1981), Juran (1988), Crosby (1995), Feigenbaum (1961) and Ishikawa (1991) who dominate the area of quality management.

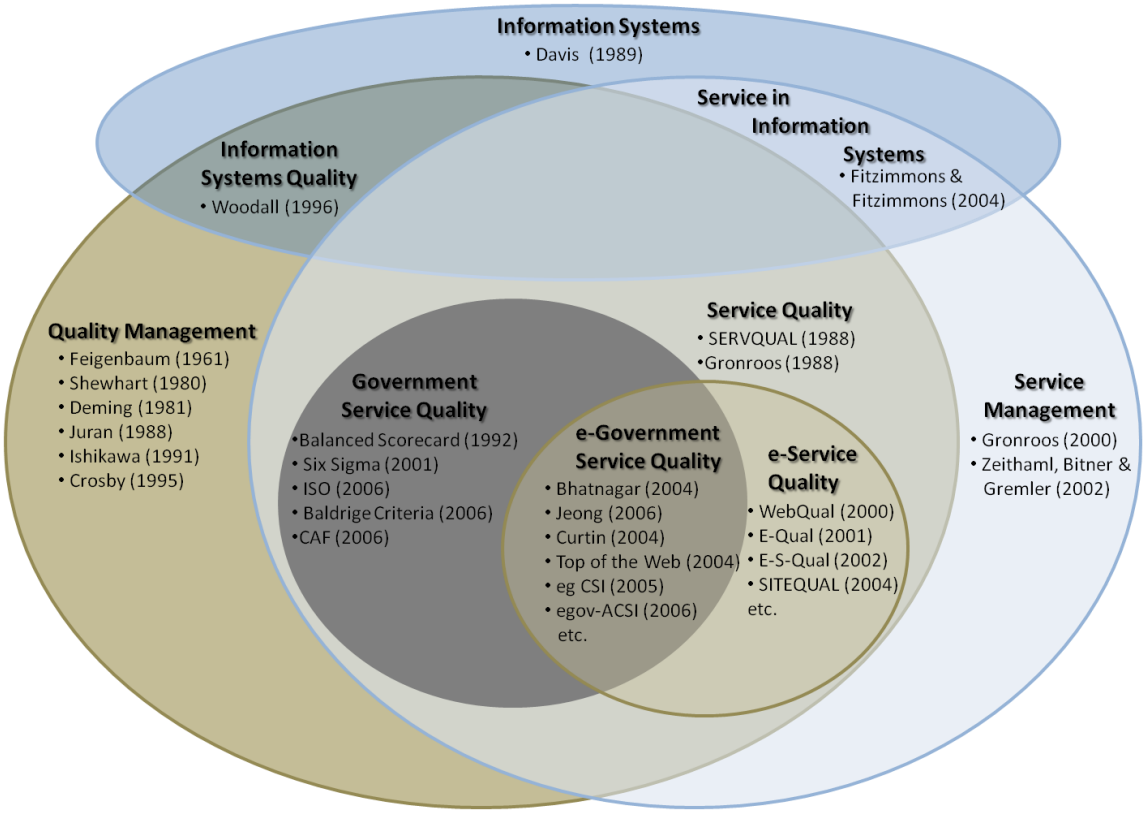

Figure 2.1. Theoretical background.

We focus on principles of quantitative and qualitative models for service management, management of service operations (Gronroos, 2000), (Zeithaml, Bitner & Gremler, 2002), quality management in services (Parasuraman, Zeithaml and Berry, 1988), total quality in information systems (Woodall, 1996) and acceptance of information systems (Davis, 1989), service management in information technology (Fitzimmons & Fitzimmons, 2004), quality used in governmental services (Balanced Scorecard, 1992; Six Sigma, 2001; ISO, 2006; Baldridge Criteria, 2006; CAF, 2006), approaches on assessing e-service quality, governance by e-government (Bhatnagar, 2004), (Jeong, 2006) and e-gov case studies from around the world (Curtin, 2004; Bhatnagar, 2004; Jeong, 2006, etc.).

2.2 Overview of Existing Approaches

By reviewing existing literature we came across an interesting but limited set of approaches concerning quality for the "e" channel of public services. Therefore we expanded our research in the relative areas of quality for government services and quality of web portals. As a result 41 approaches have been elaborated as presented in Table 2.1 that follows.

Table 2.1. Overview of relevant Approaches

Area	*Approach*	*Reference*
Service Quality	SERVQUAL	Parasuraman, Zeithaml and Berry, 1988
	Gronroos	Gronroos, 1988
Government Service Quality	Common Assessment Framework - CAF	CAF, 2006
	Balanced Scorecard	Kaplan and Norton, 1992
	Six Sigma	Motorola University, 2006a, 2006b; Process Quality Associates Inc, 2001
	ISO	ISO, 2006
	Baldrige Criteria	Baldrige National Quality Program, 2006
e-Service Quality	E-S-QUAL	Zeithaml, Parasuraman & Malhorta, 2000, 2002; Parasuraman, Zeithaml & Malhotra, 2005
	User-perceived web quality	Aladwani & Palvia, 2002
	E-Qual	Barnes, and Vidgen, 2001, 2002; Barnes Liu & Vidgen, 2001; Kelly and Vidgen, 2005
	E-Commerce Website Quality	Bessa & Belchior, 2002
	Online Service Quality	Cai & Jun , 2003
	B2C e-commerce web site quality	Cao, Zhang & Seydel 2005
	Quality Model for Portal Data	Caro, Calero, Cabalero & Piattini, 2006
	Quality factors in web sites	Cox and Dale, 2002
	Service Quality on the web	Gounaris and Dimitriadis, 2003
	E-Service Quality	Lee and Lin, 2005
	Quality aspects in design and use	Iwaarden, Wiele, Ball & Millen 2003, 2004

	of Web sites	
	Designs of Highly-Rated Web sites	Ivory and Hearst, 2002; Ivory and Megraw, 2005
	WebQual™	Loiacono, Watson & Goodhue 2000
	Web Site Quality Evaluation	Mich, Franch & Gaio, 2003
	Consumer Perspective of E-Service Quality	Zhang and Prybutok, 2005
	Web Site Quality Model	Oreste, 2005
	SITEQUAL	Webb and Webb, 2004
	Portal Usage Quality	Lin and Wu, 2002
	IP-Portals	Yang, Jun & Peterson, 2004; Yang, Cai, Zhou, & Zhou, 2005
	MAIS Approach	Cappiello, Missier, Pernici, Plebani & Batini 2004
	IBM Approach	Mani and Nagarajan , 2002
	METEOR-S Approach	Cardoso, Miller, Sheth & Arnold, 2002
	Quality of Services for Web Services (QS-WS)	Sumra and Arulazi, 2003
e-Government Service Quality	Implementation of e-government	Bhatnagar, 2004
	e-government initiatives in Korea	Jeong, 2006
	The world of e-government	Curtin, 2004
	American Customer Satisfaction Index for e-government (egov-ACSI)	American Customer Satisfaction Index, 2006
	Customer satisfaction level in e-government (eg-CSI)	Kim, Im & Park, 2005
	Quality of Norwegian public web sites	Jansen and Ølnes, 2004
	European Top of the Web	eGovernment Unit, DG Information Society, European Commission, 2004
	Interactive E-Government	Barnes and Vidgen, 2003
	User Satisfaction of E-Government Services	Horan, Tarun & Raghuvira, 2006
	e-government in Thai	Sukasame, 2004

2.3 Service Quality

Service quality involves a comparison of expectations with performance. According to Lewis and Booms (1983) service quality is a measure of how well a delivered service matches the customers' expectations.

Generally the customer is requesting a service at the service interface where the service encounter is being realized. Then the service is being provided by the provider and in the same time delivered to or consumed by the customer.

The main reason to focus on quality is to meet customer needs while remaining economically competitive in the same time. This means satisfying customer needs is very important for the enterprises survive. The outcome of using quality practices is to understand and improve operational processes, to identify problems quickly and systematically, to establish valid and reliable service performance measures and to measure customer satisfaction and other performance outcomes.

Service quality describes the degree of achievement of an ordered service. In this connection, objective and subjective service quality can be distinguished.

- Objective service quality is the concrete measurable conformity of a working result with the previous defined benefit; since the measurability is remarkable dependent on the definition's accuracy, a measurable quality criterion easily can turn out as a subjective one.
- Subjective service quality is the customers perceived conformity of the working result with the expected benefit; this perception is overlaid with the customer's original imagination of the service and the service provider's talent to present his performance as a good one.

Word-of-mouth, personal needs and past experience create an expected service (Expectation of the service). The perceived service will be compared with the expected service by the customer and lead to the perceived service quality as a result. Between the expected and the perceived service can appear a gap if the perceived service does not match with the expected service. Factors which influence the appearing of the gap were found by Parasuraman, Zeithaml and Berry in 1985.

2.3.1 SERVQUAL

Parasuraman, Zeithaml and Berry (1985) identified ten determinants of service quality that may relate to any service but later on (1988) they were reduced to five:

- Tangibles. Physical evidence of the service: appearance of physical facilities, tools and equipments used to provide the service, appearance of personnel and communication materials.
- Reliability. The ability to perform the promised service dependably and accurately: consistency of performance and dependability, service is performed right at the first time, the company keeps its promises in accuracy in billing and keeping records correctly, performing the services at the designated time.
- Responsiveness. The willingness and / or readiness of employees to help customers and to provide prompt service, timeliness of service: mailing a transaction slip immediately, setting up appointments quickly.
- Assurance. The knowledge and courtesy of employees and their ability to convey trust and confidence: competence (possession of the required skills and knowledge to perform the service), courtesy (consideration for the customer's property, clean and neat appearance of public contact personnel), trustworthiness, security (safety and confidentiality).
- Empathy. The provision of caring, individualized attention to customers: informing the customers in a language they can understand, Understanding customer's specific needs, providing individualized attention.

SERVQUAL model says that the expected service is influenced by the word-of-mouth, the personal needs, past experience and also by the external communication to customers. A perception gap can appear between the expected service and the perceived service. This gap is called the service quality gap and it occurs if the customer is not satisfied and depends on the other gaps of the model.

The perceived quality depends on the external communication to customers and the service delivery. The communication gap is appearing between the external communication to customers and the service delivery. It appears when promises do not match the delivery.

The service delivery depends on the service quality specifications. If they are not matching each other the service performance gap appears.

The service quality specifications depend on the management perceptions of customer expectations, where the management perceptions of customer expectations influence the external communication to customers. The standards gap occurs between the management perceptions of customer expectations and the service quality specifications if the wrong quality standards were consulted.

The biggest gap, the marketing information gap occurs between the management perceptions of customer expectations and the expected service. It appears because the service provider does not know what the customer expects.

2.3.2 Gronroos (1988)

Grönroos says that the expectations of the customer depend on the 5 determinants market communication, image, word of mouth, customer needs and customer learning (Figure 2.2).

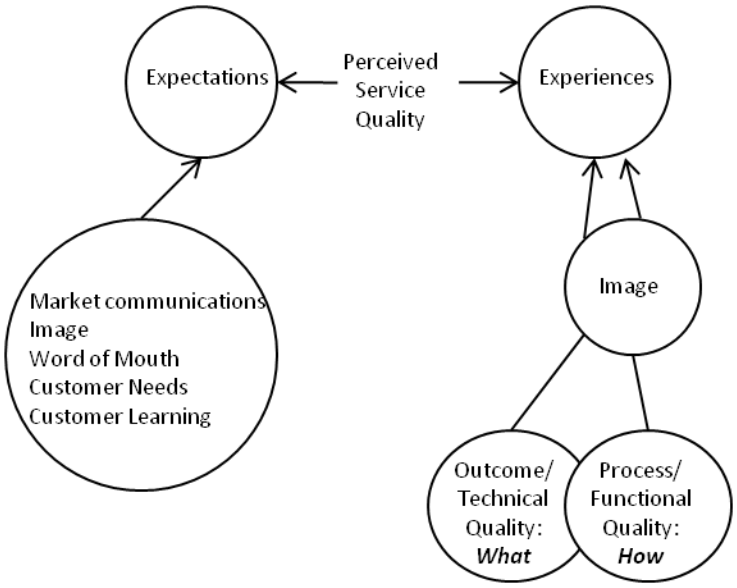

Figure 2.2. Grönroos' Perceived Service Quality model

Experiences depend on the technical quality (what/ outcome) and the functional quality (how/process), which are filtered through the image (who). Both expectations and experiences can create a perception gap.

Grönroos more clearly shows the existence of a perception gap, although there is no suggestion of "delighting" only of narrowing the gap. However the model has more practical application as it shows factors that contribute to each side of the gap. It demonstrates that the supplier can affect both sides of the gap – most notably by managing customer expectations. In addition it illustrates that the customer experience is a product of the image of supplier quality, not just the actuality. Clearly marketing as well as process and technical quality has an effect on the perception gap.

2.3.3 Synthesis of service quality approaches

As we already mentioned service quality involves a comparison of expectations with performance. Both models incorporated a Gap between expectations and experiences or perceptions of the receiver of the service. They both agree with Lewis and Booms (1983) who claims that service quality is a measure of how well a delivered service matches the customers' expectations. In order to have a quantitative measure of quality they both ask the customers to rate the perceived service as well as to state their expectations; but for estimating the Gaps of the models, the points of view of the organizations' employees and managers are also needed.

In table 2.2 the criteria/perspectives/principles of each process oriented approach are presented. For each approach of this category we have marked the criteria that are used for assessment. Furthermore we have identified whether each criterion is being assessed by the customer's/citizen's or the service provider's point of view. For a specific approach and a specific criterion, if the assessment is performed by the organization that provides the public service, then the corresponding cell of the matrix is filled with the S symbol (Substitute characteristic). On the other hand if citizens assess the service delivered to them, then the T symbol is used (T stands for True characteristic).

Table 2.2. Review Table for Process Oriented Approaches (T = True, S = Substitute)

Criteria	*SERVQUAL*	*Gronroos*
Tangibles	T	
Reliability	T	
Responsiveness	T	
Assurance	T	
Empathy	T	T
Technical Quality		T
Functional Quality		T

2.4 Government Service Quality

The approaches in the area of traditional public services address quality as the result of effective management of various parameters (eg. back office procedures, leadership of the organization, management's dedication to quality etc.) within the organization. Although the citizen is not ignored, assessment and continuous monitoring of the above mentioned parameters is in focus, as an indication of the overall quality of services delivered. The field from which it borrows the elements to measure and assess is the organization itself. It includes all the levels of management in addition to the employees.

Emphasis is put on the internal attributes of the organization both for assessment and for improvement – although most of them have feedback from the results.

Although, some of the approaches of this section were originally introduced as a tool intended for commercial organizations on the long run have been used in the public sector as well.

2.4.1 CAF

CAF (CAF Resource Center, 2006) is a common European quality framework developed by EFQM that gradually would be used across the public sector as a tool for organizational self assessment. The model identifies for consideration 9 main quality

aspects (boxes), grouped into 2 categories (enablers and results). More specific, "enablers" are operations evaluation areas and examine how an organization functions. According CAF quality enablers are Leadership, Human resource Management, Strategy and Planning, Partnership and resources, Process and change Management. The "results" evaluation areas, in turn, assess what the organization has achieved and include Customer/citizens results, people (employee) results, society results and key performance results.

2.4.2 The Balanced Scorecard

The Balanced scorecard is mainly a strategic management system for measuring an organization's activities in terms of its vision and strategies. Originally introduced as a tool intended for commercial organizations (which are focused on financial performance), the Balanced Scorecard has found considerable support and is widely used in the public sector. It is particularly popular as a public sector performance management tool in the USA, UK, Australia and Scandinavia. Main focus is on the important performance metrics that drive success. The system consists of four processes: 1. Translating the vision into operational goals; 2. Communicating the vision and link it to individual performance; 3. Business planning; 4. Feedback and learning and adjusting the strategy accordingly. Assessment of an organization's current status is the first step for building a Balanced Scorecard. The Balanced Scorecard uses assessment data to determine what improvements and breakthroughs in performance are most needed, so that strategies can be crafted to meet these needs.

2.4.3 Six Sigma

Six Sigma is a methodology to manage process variations that cause defects, defined as unacceptable deviation from the mean or target; and to systematically work towards managing variation to eliminate those defects. The objective of Six Sigma is to deliver high performance, reliability, and value to the end customer.

2.4.4 ISO 9000

The ISO 9000 series of five international standards are used by organizations to determine what is needed to maintain an efficient quality conformance system. Parameters of the quality conformance system are grouped into general requirements, management responsibility, resource management, product realization and measurement, analysis and improvement. ISO 9000 registration determines whether an organization complies with its own quality system.

2.4.5 Baldrige Criteria

Finally, the Baldrige Criteria is a framework that focuses on results and continuous improvement. The criteria are designed to help organizations use an aligned approach to organizational performance management that results in delivery of ever-improving value to customers, improvement in overall organizational effectiveness and capabilities, and organizational and personal learning. Seven categories of the criteria are used; Leadership, Strategic Planning, Customer & Market Focus, Measurement, Analysis and Knowledge Management, Human Resource Focus, Process Management and Results. Together with CAF, the Baldrige criteria are the main examples of organizational assessment tools. They provide a framework for designing, implementing, and assessing a process for managing all business operations. Overall, ISO 9000 registration covers fewer criteria than Baldrige. So a quality management system established during ISO 9000 implementation efforts can easily be expanded to support the addition of key processes based on the Baldrige criteria.

2.4.6 Synthesis of government service quality approaches

In table 2.3 the criteria/perspectives/principles of each process oriented approach are presented. For each approach of this category we have marked the criteria that are used for assessment. Furthermore we have identified whether each criterion is being assessed by the customer's/citizen's or the service provider's point of view. For a specific approach and a specific criterion, if the assessment is performed by the organization that

provides the public service, then the corresponding cell of the matrix is filled with the S symbol (Substitute characteristic). On the other hand if citizens assess the service delivered to them, then the T symbol is used (T stands for True characteristic):

Table 2.3. Review Table for Process Oriented Approaches (T = True, S = Substitute)

Criteria	*CAF*	*Balanced Scorecard*	*Six Sigma*	*ISO*	*Baldrige Criteria*
Leadership	S			S	S
Strategy & Planning					S
Human Resources	S	S		S	S
Business & Process Management	S	S	S	S	S
Customer Perspective	S,T	T	S	T	S
Key Performance Results	S	S		S,T	S

The main conclusion is that Human Resources, Process Management and Customer Focus are domains that almost all the models stress as very critical for the assessment and improvement of an organization.

2.5 e-Service Quality

Quality of e-services approaches focus on the quality of the service delivered itself. Emphasis is put on the way the client receives the services from the front office-web site. It is a customer/citizen -oriented approach since it is motivated by the customer's needs. Quality dimensions of this approaches are related to the delivered service (availability, usability, security etc. of the service) and/or input from the receivers of the service (customers' priorities and needs).

A common characteristic of the models and approaches of e-service category is that they are primarily focused on quality characteristics of the service delivered, on what kind of information is presented and on how it is presented and on some system characteristics. Another characteristic of this category of models is that most of the studies result from composition, adaptation and extension of existing models. The

constitutive studies for the models presented here are SERVQUAL (Parasuraman et. al, 1988) from service quality literature and Wang and Strong's (1996) study and TAM (Davis, 1989) from the data quality literature. For example SITEQUAL (Section 2.5.17) combines SERVQUAL with Wang's work, Portal Usage Quality (Section 2.5.18), combines SERVQUAL with TAM, while IP-Portals (Section 2.5.19) is based on TAM model.

The e-service category of approaches includes also some technical approaches that examine quality of service for web services. Web services are used widely as the underlying technology for service provision and thus their technical characteristics influence the qualitative result of the service delivered to customers.

2.5.1 E-S-QUAL

Parasuraman, Zeithaml & Malhotra (2005) and Zeithaml, Parasuraman & Malhorta (2000, 2002) use the means-end framework as a theoretical foundation and conceptualize, construct, refine, and test a multiple-item scale named E-S-QUAL for measuring the service quality delivered by Web sites on which customers shop online. Two stages of empirical data collection revealed that two different scales were necessary for capturing electronic service quality:

- the basic E-S-QUAL scale, a 22-item scale of four dimensions: efficiency, fulfillment, system availability, and privacy.
- the second scale, E-RecS-QUAL, salient only to customers who had non-routine encounters with the sites, contains 11 items in three dimensions: responsiveness, compensation, and contact.

2.5.2 User-Perceived Web Quality

In Aladwani's and Palvia's (2002) user-perceived web quality we find the development of an instrument that captures key characteristics of web site quality from the user's perspective. The 25-item instrument measures four factors of web quality: specific content, content quality, appearance and technical adequacy.

2.5.3 E-Qual

Kelly and Vidgen (2005), conducted a series of studies to develop an effective instrument, in the beginning named Webqual and then renamed as E-Qual, to measure the quality of various websites (Barnes and Vidgen, 2001, 2002; Barnes, Liu & Vidgen, 2001). Their instrument was originally developed based on user evaluations of four university websites rather than retail sites. It was later tested and revised for online auction sites, wireless news sites and bookstores. When applied to three online auction sites, the instrument incorporated three quality factors: information quality, interaction quality and site-design quality (Barnes and Vidgen, 2001). In testing the instrument for online bookstores (Barnes and Vidgen, 2002), the researchers replaced site-design quality with usability because the latter kept 'the emphasis on the user and their perceptions rather than on the designer and the site as simply a context-free software artifact'. Usability was defined as a measure of how a user perceives and interacts with a website.

2.5.4 E-Commerce Website Quality

E-Commerce website quality (Bessa and Belchior, 2002) defines a relevant set of website quality attributes based on a software quality evaluation model. Quality factors that were used in this research include usability, conceptual reliability and reliability of the representation. Usability is a quality objective that refers to the characteristics that allow use of an e-commerce site in the most diverse situations. Conceptual Reliability concerns the ecommerce site's capacity to implement, satisfactorily, what was specified and designed. The Reliability of the Representation refers to the e-commerce site's representation characteristics that affect its understanding and manipulation along its life cycle.

2.5.5 Online Service Quality

Online service quality approach (Cai & Jun, 2003) identifies four key factors of online service quality as perceived by two groups of Internet users, online buyers and information searchers. The derived factors were: Web site design/content,

trustworthiness, prompt/reliable service, and communication. It also reveals that there are significant differences between these two Internet user groups regarding their perceptions on the identified dimensions. Furthermore, this research reveals that all of the four dimensions significantly influence online buyers' evaluation of overall online service quality, while only three factors, Web site design/content, trustworthiness, and communication, have a significant impact on information searchers' assessment of overall online service quality.

2.5.6 B2C e-Commerce Web Site Quality

B2C e-commerce web site quality (Mei, Zhang & Seydel, 2005) examines and integrates four sets of factors that capture e-commerce web site quality using an IS success model: system quality, information quality, service quality, and attractiveness. A questionnaire survey was conducted to verify the measures of web site quality. A framework is also developed relating web site quality to customers' beliefs (perceived usefulness and ease of use), attitudes (preferences for the site), and intentions (to revisit the site). A set of instruments of web site quality has been developed and empirically validated by factor analysis.

2.5.7 Quality Model for Portal Data

In quality model for portal data (Caro, Calero, Cabalero & Piattini, 2006) a preliminary version of a data quality model for Web portals that consider the data consumers' point of view is presented. It has been built on three key elements: a set of web data quality attributes set out in the relevant literature, data quality expectations of data consumers on the Internet, and the functionalities which a Web portal may offer its users.

2.5.8 Quality Factors in Web Sites

Quality factors in web sites (Cox & Dale, 2002) identify the key quality factors in web site design and use. From the factors identified, a conceptual model has been developed

to assess how a web site can deliver what its users expect. The model is based on: ease of use, customer confidence, on-line resources, and relationship services.

2.5.9 Service Quality on the Web

Service quality on the web (Gounaris & Dimitriadis, 2003) explores the quality dimensions that the visitors of national and foreign business to consumer portals use to assess the performance of their service offering. Based on SERVQUAL model (Parasuraman et. al., 1988) and previous research on web site evaluation and quality, it identifies three quality factors: Customer care and risk-reduction benefit, information benefit and interaction facilitation benefit

2.5.10 E-Service Quality

E-Service quality (Lee & Lin, 2005) examines the relationship among e-service quality dimensions and overall service quality, customer satisfaction and purchase intentions. Data from online consumers were used to test the research model. The analytical results showed that the dimensions of web site design, reliability, responsiveness, and trust affect overall service quality and customer satisfaction, while personalization is not significantly related. Moreover, service quality and customer satisfaction are significantly related to customer purchase intentions.

2.5.11 Quality aspects in Design and Use of Web Sites

Quality aspects in design and use of web sites approach, (Iwaarden, Wiele, Ball & Millen, 2003; 2004) expands and adjusts the SERVQUAL instrument from the traditional service evaluation to web site quality evaluation. The items that have been identified as most important in relation to the quality of Web sites are tangibles (the appearance of the Web site, navigation, search options, and structure), reliability (the ability to judge the trustworthiness of the offered service and the organization performing the service), responsiveness (the willingness to help customers and provide prompt service), assurance

(the ability of the Web site to convey trust and confidence in the organization behind it with respect to security and privacy), and empathy (the provision of caring, individualized attention to customers, including user recognition and customization).

2.5.12 Designs of Highly-Rated Web Sites

Ivory and Megraw (2005) after examining the characteristics of highly rated sites from 2000 to 2003, they identified an exhaustive set of quantitative measures to assess as many aspects of web interfaces as possible. As the result of this effort they developed 157 page- and site-level measures. These measures are part of a conceptual model of web interfaces. The quality aspects examined by the conceptual model are information, navigation, graphic design, page performance and overall site architecture.

2.5.13 WebQual™

WebQual™ (Loiacono, Watson & Goodhue, 2000) uses the general theoretical frames of the Theory of Reasoned Action (Fishbein and Ajzen, 1975) and the Technology Acceptance Model (Davis, 1989) as starting points to develop a measure of Web site quality that predicts consumer reuse of the site. The development and validation process of a Web site quality measure is presented, with 12 core dimensions: informational fit-to-task; tailored communications; trust; response time; ease of understanding; intuitive operations; visual appeal; innovativeness; emotional appeal; consistent image; on-line completeness; and relative advantage.

2.5.14 Web Site Quality Evaluation

Web site quality evaluation (Mich, Franch & Gaio, 2003) helps developers evaluate Web site quality from both owner and user viewpoints. It highlights elements that, when suitably combined, permit thorough site assessment and guide development. The respective dimensions used are identity, content, services, location, management, usability and feasibility.

2.5.15 Consumer Perspective of E-Service Quality

Consumer perspective of e-service quality (Zhang & Prybutok, 2005) develops an e-service model. Specifically this model consists of such constructs as individual differences, e-service convenience, web site service quality, risk, e-satisfaction and intention. An e-service quality survey instrument was developed and validated.

2.5.16 Web Site Quality Model

Web site quality model (Oreste, 2005) aims at defining a quality model and a set of characteristics relating internal and external quality factors and giving clues about potential problems, which can be measured by automated tools. Correctness, presentation, content, navigation and interaction are the five dimensions considered by the quality model. The model has been designed to cover a possible automated process for the quality evaluation, using pages and page components as elements to evaluate. The first step in the quality assessment process is an automatic check of the source code, followed by manual evaluation, possibly supported by an appropriate user panel.

2.5.17 SITEQUAL

SITEQUAL (Webb & Webb, 2004) provides us with guidelines and an instrument to measure the quality of a Web site over time. Using previous research in information quality and service quality as a springboard, a conceptual model and an instrument to measure Web site quality were developed. A factor analysis was conducted which suggested that four minimum Web site quality factors and seven desired Web site quality factors are important to consumers in the retail music industry. The use of Web site quality factors for measurement of consumer expectations and perceptions, determining Web site requirements, and guiding the testing process was suggested.

2.5.18 Portal Usage Quality

The approach of Lin and Wu (2002) provides general hints on the construction of a portal in order to keep people continuing to visit the portal site and the aim of this work is to explore users' intention and behavior of the portal site.

2.5.19 IP-Portals

IP-Portals approach (Yang, Jun & Peterson, 2004) is based on a broad conceptual framework which integrates theory and conceptualization in customer service quality, information systems quality, and product portfolio management, into online service quality. An ethnographic content analysis customer review of online banking services was employed to identify salient online service quality dimensions. The most frequently cited online service quality attributes, along with literature review and personal interview results were utilized to develop the survey questionnaire. Subsequent to the pre-test, a Web-based survey was undertaken to verify and test the online service quality model. A confirmatory factor analysis produced six key online service quality dimensions: reliability, responsiveness, competence, ease of use, security, and product portfolio. Moreover in a second study Yang , Cai,, Zhou and Zhou (2005) developed and validated an instrument to measure user perceived service quality of portals. Based upon conceptual models in the areas of IS and technology adoption, and using responses from users, they validated a five-dimension service quality instrument involving: usability, usefulness of content, adequacy of information, accessibility, and interaction.

2.5.20 MAIS Approach

An example of such a technical approach is the work done by the MAIS project team. They proposed a general framework for the definition of quality of service dimensions (Cappiello, Missier, Pernici, Plebani & Batini, 2004). The most relevant quality dimensions are service and data reliability, robustness and security of the application. Service security and availability, as well as time performance are considered important quality dimensions of the model.

2.5.21 IBM Approach

IBM (Mani & Nagarajan, 2002) addresses the subject of quality of service delivered through web services in seven aspects. Although these aspects refer to web services, they can be easily generalized for e-services. Availability is the quality aspect of whether the service is present or ready for immediate use. Accessibility represents the degree that the service is capable of serving requests, while integrity is related with the way that the service maintains the correctness of the interaction in respect to the source. Performance is the quality aspect related with throughput and latency and reliability represents the degree of being capable to maintain the service and service quality. Regulatory is the quality aspect of the service in conformance with the rules, the law, compliance with standards, and the established service level agreement. Finally IBM approach includes some security related dimensions like authentication, access control and encryption of messages.

2.5.22 METEOS-S Approach

Cardoso, Miller, Sheth, & Arnold, (2002) present, as part of METEOR-S project, a comprehensive model for the specification of workflow QoS as well as methods to compute and predict QoS.

2.5.23 Quality of Services for Web Services (QS-WS)

Sumra and Arulazi (2003) propose seven dimensions that contribute to service quality. Performance, reliability, integrity, accessibility, availability and security quality dimensions cover the same aspects as the IBM approach, while the interoperability dimensions is related with the ability of a service to operate with different systems.

Finally some other domain specific approaches examine the quality of web sites and more specifically of banking portals (Bauer et. al., 2005), health web sites (Provost et. al., 2006), nursing websites (Tsai and Chai, 2005), or of sites used in higher open distance education courses (Xenos et. al., 2004).

2.5.23 Synthesis of the e-service quality approaches

In Table 2.4 the criteria/perspectives/principles of each model are presented. There are some technical approaches of the e-service category which focus at technical web services characteristics that influence quality.

Table 2.4: Review Table for e-service Approaches (T = True, S = Substitute)

	E-S-Qual	*User-perceived web quality*	*E-Qual*	*E-Commerce Website Quality*	*Online Service Quality*	*B2C e-commerce website quality*	*Quality Model for Portal Data*	*Quality factors in web sites*	*Service quality on the web*	*E-Service Quality*	*Quality aspects in design and use of Web sites*	*Designs of Highly-Rated Web sites*	*WebQual*	*Web Site Quality Evaluation*	*Consumer Perspective of E-Service Quality*	*Web Site Quality Model*	*SITEQUAL*	*Portal usage quality*	*IP-Portals*	*MAIS approach*	*IBM approach*	*Meteor-S approach*	*QoS for WS*
Service Reliability	T	T	T	T,S	T	T	T	S	T	T	T		T		T		T	T		T,S	S	S	S
Personalization	T	T		T,S			T			T			T	T,S			T	T	T				
Information/ Content		T	T	T,S	T	T	T	S	T			S	T	T,S	T	T,S	T	T	T				
Navigation/ Accessibility	T	T	T	T,S	T	T	T	S		T	T		T	T,S	T	T,S	T		T		S		
Security	T	T	T	T,S	T	T	T	S	T	T	T		T	T,S	T		T	T	T	T,S	S		S
System Performance	T	T		T,S		T		S	T	T	T	S		T,S		T,S				T,S	S	S	S

We consider the assessment of quality characteristics performed by these approaches, as objective assessment, because specific metrics are used (like service reliability measures and service performance measures). The evaluation of these metrics calls for special knowledge that usually managers of the public organization don't have. Thus the evaluation is performed by experts that have the appropriate knowledge and ability for this task. But experts' evaluation has been considered as substitute evaluation

for Table 2.3, because experts are usually employed by the service provider, i.e. the public organization. The same consideration is used here as well. An exception to this methodology is the MAIS approach where quality of service is a fundamental element of the service selection and the subsequent negotiation between service provider and service consumer. This means that both provider and consumer are involved in evaluation and thus both T and S symbols have been used for this approach.

By reviewing the table, it is apparent that models presented value mostly the dimension of security (confidentiality, non reputation, encrypting). Also important seems to be the quality of information presented on the site/portal and its characteristics as relevancy, accuracy, completeness, understandability, together with the way this information is presented i.e. appearance, navigability etc. Great importance is also given to the service dimension of a site such as reliable delivery of service, personalized services etc.

On the other hand more technical approaches like IBM, Meteor-S etc, consider the performance dimension (related with the response and provision time) the most important one. The availability dimension (whether the system is ready for immediate use) follow, together with reliability (the degree the system is capable of maintaining service quality) and security (confidentiality, non reputation, encrypting).

2.6 E-government service quality

Approaches of this area focus on the quality of the portal and the overall customer satisfaction. Customer satisfaction is affected both from perceived by citizens quality and from their expectations about the service. Many factors compose perceived quality and are taken into account for the satisfaction measurement, aiming at the calculation of indexes describing the customer/citizen satisfaction for a service.

2.6.1 Implementation of e-government

In his study Bhatnagar (2004) intended to provide practical guidelines on selection of application areas, project design, strategy and implementation. Analysis of existing

applications provide useful insights into the trends of e-government in the developing world.

2.6.2 e-government initiatives in Korea

The Korean experience and strategies in driving e-government initiatives, lessons, and policy issues for the direction of e-government implementation is described by Jeong (2006) who was responsible for vision, strategy, direction, and oversight for e-government as Director General in charge of e-government initiatives in Korea.

2.6.3 The World of e-government

In the world of e-government Curtin (2004) investigates how electronic communication is helping to revolutionize democracies across the globe. Using case studies, cutting-edge research, and commentary from some of the field's foremost researchers, practitioners, and industry leaders, this first-of-its-kind volume explores the enormous future potential of e-government as it links all world citizens locally, regionally, nationally, and internationally. This pioneering text offers the experiences of many leading countries using electronic government, showing you what mistakes they made, the benefits they've reaped, and the impact of e-government to democracy, traditional government, and international commerce.

2.6.4 ACSI E-Government Satisfaction Index

The American Customer Satisfaction Index (ACSI) model is a cause-and-effect model with indices for drivers of satisfaction on the left side, satisfaction (ACSI) in the center, and outcomes of satisfaction on the right side. Customer Satisfaction Index methodologies identify key drivers of satisfaction and quantify their relationship to overall customer satisfaction, i.e. they calculate the impact of the different drivers of satisfaction based on direct "voice of the customer" feedback for each measured site. As seen in Figure 2.3 the ACSI government model (used for most agencies) is identical to

the private-sector model with a key modification in the "outcomes" component. Specifically, the outcome of citizen trust replaces the price-related outcomes found in the private-sector model (repurchase intention and price tolerance).

Because agencies provide services with little or no direct charge to the user, perceived value is not part of the government model. The drivers of expectations and perceived quality, satisfaction, and the outcome of customer complaints appear in both the government and private-sector models.

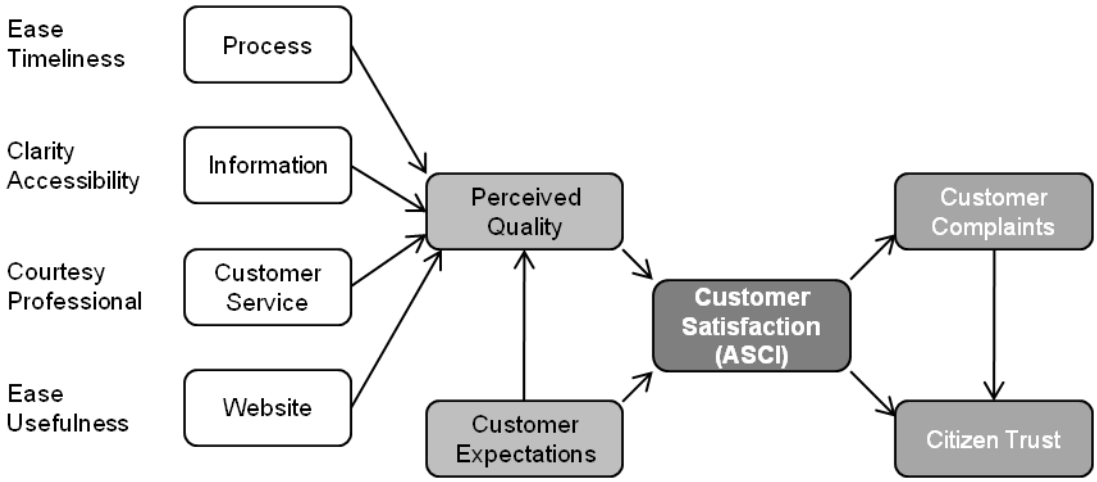

Figure 2.3. The American Customer Satisfaction Index (ACSI) model

For government organizations, indicators of satisfaction are grouped into four broad categories that are used as input to measure quality (process, information, customer service, and website).

For the outcome of citizen trust, indicators are (1) the degree to which the user/customer would recommend the agency's services to others (recommend) and (2) the extent to which the user has confidence in relying on the agency in the future (confidence).

The American Customer Satisfaction Index uses two interrelated methods to measure and analyze customer satisfaction: customer questionnaires and econometric modeling. The idea of the Customer Satisfaction Index has been introduced in the traditional off-line world and then migrated to the online world. Satisfaction with an

online service is a complex issue with multiple elements determining how well the online experience meets the needs of site visitors.

The American egov-ACSI is the more established model of this category. It evaluates quarterly more than 90 online e-government sites grouped into four categories (ecommerce/transactions, news/ information, portal/dept. main sites, recruitments/ careers).

2.6.5 g-CSI

The second model of this group, the Korean g-CSI, has been based on the ASCI model and therefore has many resemblances. Quality aspects addressed by these models consist of information, process, and service. Accessibility and accuracy of information easiness and costs of the service as well as expertness and kindness concerning customer service, are some of the quality dimensions included.

The cause-and-effect nature of these methodologies enables an agency or department to predict the impact of website enhancements in a particular area, (e.g., navigation) on overall satisfaction. Going further, such a methodology predicts how increases in satisfaction affect desired future behaviors of site visitors, such as return visits and referrals to the site. Typically, an area with a low satisfaction score and a high impact score is considered high priority. The identification of high priority satisfaction drivers provides valuable insight into how an agency or department should prioritize website improvements based on where they will have the greatest impact on citizen satisfaction.

A key common feature is that they are based on a ‘model’. This model consists of a number of latent variables (such as ‘quality’) and the cause and effect relationships between them. Each of these latent variables includes several manifest variables that act as concrete proxies for the latent variable. Consumer satisfaction is the latent variable that is at the centre of the model; it is encased within a system of variables relating to causes and effects.

2.6.6 EUSI

A similar approach; the European User Satisfaction Index (EUSI) is under development by the European Public Administration Network (2005). The future existence of such an index in America, Asia and Europe implies that both local and global comparisons can be realized, using a single number. The importance of such a comparison is very high, because it has as consequence improvement efforts between competitors. The final result of these efforts will be the improvement of customer satisfaction.

2.6.7 Norwegian public web sites

The Western Norway Research Institute initiated a project that uses a set of 25 indicators and a set of quality criteria for evaluating public websites in Norway (Jansen and Ølnes, 2004). The quality of web sites is defined as "that public information and services on the Internet must meet a predefined standard or level that can satisfy some central user needs". Three main quality criteria are identified; accessibility, user orientation and useful services and for each specific indexes are introduced. An interesting point is that the evaluation is not performed neither from the real users nor the system's administrators. For the evaluation a group of well trained evaluators is used.

2.6.8 European Top of the Web

The European Top of the Web approach focuses on the benefits gained by end users. The approach combines the gathering of information from service providers on the extent to which public services are being used via on-line channels compared to traditional channels and the use on online questionnaires addressing users of the online services. User satisfaction and perceived quality of an on-line service is measured combining:

- Usability dimensions (about whether users have experienced any problems using the service),
- Benefits experienced by the users (save time, gain flexibility, etc)

- Overall evaluation, i.e. user's overall satisfaction with the service and whether the users' expectations are met or not.

2.6.9 Interactive E-Government

The interactive E-Government (Barnes & Vidgen, 2003) examines the results of a survey of the quality of a Web site provided by the UK Government. The site is that of the Inland Revenue. The survey was administered directly after the launch of a new system to enable online submission of self-assessed tax returns. The instrument, E-Qual, draws on previous work in Web site usability, information quality, and service interaction quality to provide a rounded framework for assessing e-government offerings. The metrics and qualitative comments provided some detailed insights into the perceptions of users who attempted to interact with the online taxation system. The research findings suggest that usability has been a major issue that requires attention and that there is a great need for empathy and personalization in the delivery of services.

2.6.10 User Satisfaction of E-Government Services

User Satisfaction of E-Government Services (Horan, Tarun & Raghuvira, 2006) focuses on evaluating a citizen-centric approach in the Advanced Travel Information Systems (ATIS) domain, a form of government-citizen information service. It first details the structure and results of a preliminary study of usability that was conducted in two major metropolitan areas – Los Angeles and Minneapolis. Based on findings from the first phase a more comprehensive concept of overall satisfaction with these services has been developed.

2.6.11 e-government in Thai

Finally the approach used by e-government sites in Thailand (Sukasame, 2004) focus on the development of a conceptual framework and on the elicitation of factors such as reliability, linkage, content, ease of use and self-service that affect the e-Service provided

on the Web portal of Thailand's government. Content refers to concise, useful, and current information moreover to the presentation and layout of factual information and functions on the web site, linkage refers to the number and quality of links that a web site offers targeting to the integration of relevant information at the site and at other sites. Reliability is related with the technical functioning of the site, particularly the extent to which it is available and functioning properly, while ease of use reflects the usability of the web site during customer navigation and aims to reduce customer frustration. Finally, self-service refers to formats, which enable customers to perform services for themselves quickly and conveniently.

2.6.12 Synthesis of the e-government service quality approaches

In Table 2.5 the criteria/perspectives/principles of each model are presented. Regarding the meaning of T and S symbols the same description that was provided for Tables 2.3 and 2.4 applies here as well. Furthermore for the "Norwegian public web sites" approach the evaluation is performed by experts. We consider experts evaluation as a substitute perspective, since experts are employed by the public organization to perform the assessment for them.

Table 2.5: Review Table for e-government Approaches (T = True, S = Substitute)

	American Customer Satisfaction Index	*Korean g-CSI*	*Norwegian public web sites*	*European Top of the Web*	*Interactive E-Government*	*User Satisfaction of E-Government Services*	*e-government in Thai*
Service Reliability						T	T
Personalization			S		T	T	
Information/ Content	T	T		T	T	T	T
Navigation/ Accessibility	T	T	S	T	T	T	T
Customer service	T	T			T		
Overall evaluation				T	T	T	

The first three approaches of this category were not included in the Table 2.5 since they are more descriptive.

2.7 Synthesis and Classification of Quality approaches.

Based on the analysis of the previous section we identify four layers of quality assessment for e-government services summing up the main quality factors described on existing literature, as follows:

- Back office process performance layer, addressing factors mainly found in quality models for traditional government services,
- Site technical performance layer, addressing the factors of the technical performance of the site , i.e. site reliability, security etc. ,
- Site Quality layer, addressing the factors of the site usability, and interface
- Customer's overall satisfaction addressing the overall level of quality perceived by the user against user's expectations

Quality aspects and factors of each layer can be evaluated by both the public organization (self-evaluation) and citizens who benefit from the online delivery of public services..

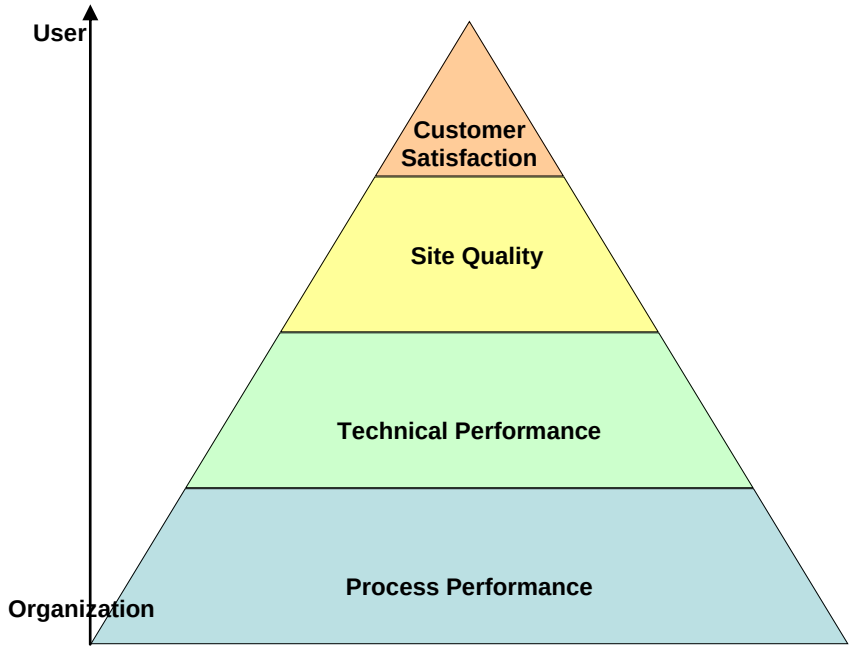

Figure 2.4: Layers of quality assessment

Despite this fact, the process performance and technical performance layers focus on organization's self assessment, while site interface and customer satisfaction layers put emphasis on citizens' evaluation, as depicted in Figure 2.4

Many of the literature quality approaches reviewed include quality aspects and factors that are relevant for more than one quality layers. The four layers identified are used as the first axis for the classification of approaches reviewed. Two more axes are used for the classification, the objective/subjective and the true/substitute ones.

The objective/subjective axis is the second axis of the classification and represents whether each approach contains objective or subjective assessment of the quality. The idea of distinguishing quality to objective and subjective was adopted by Shewhart (1980), but we have changed and adapted the original definition to e-government domain. Objective is an assessment that is based upon specific metrics and measures, like page download speed, the number of images in a page, image sizes, number and type of links etc. Performance metrics like service time and reliability are also considered as objective measures. Finally metrics that calculate the degree of conformance to standards [i.e. W3C's Web content accessibility guidelines (W3C, 1999), or Validity of HTML Coding (Ivory and Megraw, 2005)] is another source of objective web site assessment. On the other hand, subjective quality is considered the citizens', organizations' or experts' opinion regarding the quality of public services delivered through an e-government portal.

The third axis of the classification is the true/substitute one. Adopting the theoretical idea of Ishikawa (1991), true quality is the citizens'/customers' point of view, while substitute quality is the service provider's perspective. As already noted the evaluation performed by experts is considered as substitute evaluation, because experts are employed by the public organization and are its representatives in the evaluation process.

The result of the three dimensional classification is depicted in Table 2.6.

By reviewing the table, it is apparent that there are specific groups of models. Some of these groups are identical to the four groups that were initially used for the presentation of literature in groups, i.e. service quality approaches, traditional public services approaches, e-government services and e-services approaches, others are subsets

of these initial groups and some others are new categories consisting of approaches belonging to two or more initial groups. Table 2.7 depicts the categories identified after the three dimensional classification.

Table 2.6: Classification of literature approaches (T=True, S=Substitute)

	Objective Characteristics				*Subjective Characteristics*			
Approach	*Processes Performance*	*System Performance*	*Site Quality*	*Customer Satisfaction*	*Processes Performance*	*System Performance*	*Site Quality*	*Customer Satisfaction*
SERVQUAL					T			T
Gronroos					T			T
CAF					S			S
Balanced Scorecard	S			S	S			T
Six Sigma	S			S				
ISO	S			S	S			T
Baldrige Criteria	S			S				
American Customer Satisfaction Index							T	T
Korean g-CSI							T	T
Norwegian public web sites			S					
European Top of the Web							T	T
Interactive E-Gov							T	T
User Satisfaction of E-Gov Services						T	T	T
e-government in Thai						T	T	
E-S-Qual						T	T	
User-perceived web quality						T	T	
E-Qual						T	T	
E-Commerce Website Quality						T,S	T,S	
Online Service Quality						T	T	
B2C e-commerce website quality						T	T	
Quality Model for Portal Data						T	T	
Quality factors in web sites		S	S					
Service quality on the web						T	T	
E-Service Quality						T	T	
Quality aspects in design and use of Web						T	T	
Designs of Highly-Rated Web sites		S	S					
WebQual						T	T	
Web Site Quality Evaluation						T,S	T,S	
Consumer Perspective of E-Service Quality						T	T	
Web Site Quality Model		S	S			T	T	
SITEQUAL						T	T	

	Objective Characteristics				*Subjective Characteristics*			
Approach	*Processes Performance*	*System Performance*	*Site Quality*	*Customer Satisfaction*	*Processes Performance*	*System Performance*	*Site Quality*	*Customer Satisfaction*
Portal usage quality						T	T	
IP-Portals						T	T	
MAIS approach		S						
IBM approach		S						
Meteor-S approach		S						
QoS for WS		S						

The traditional category includes all the models that have been categorized as service quality models as well as traditional at the initial categorization of state of the art models. Approaches of this category focus on process performance and customer satisfaction concerning the four quality layers and on true and substitute assessment along the true/substitute axis. Quality and performance is assessed both objectively and subjectively and thus both sides of the second axis are covered.

Citizen satisfaction category includes models from the initial e-government services group. Approaches classified as citizen's satisfaction, focus on site quality and customer satisfaction layers. Furthermore for these approaches the assessment is performed subjectively (second axis), by taking into account the citizens' perspective (third axis).

Web site quality category includes models from both e-government services and e-services initial groups. The common characteristic of these models is that the emphasis is put on the system performance and site quality. Furthermore all these models are placed at the subjective side of the second axis. As far as the true/substitute axis is concerned, citizens' point of view is examined by all approaches of web site quality category. There are finally two approaches that examine the subjective opinion of the e-service producer as well.

E-government services and e-services are the two initial groups from where the web site quality factors category borrows the approaches it includes. In contrast to the web site quality category, approaches of this one examine objectively the system's and

Table 2.7: Identified Categories

Category	*Approach*
Traditional	SERVQUAL
	Gronroos
	CAF
	Balanced Scorecard
	Six Sigma
	ISO
	Baldrige Criteria
Citizen Satisfaction	American Customer Satisfaction Index
	Korean g-CSI
	European Top of the Web
	Interactive E-Gov
Web site quality	User Satisfaction of E-Gov Services
	e-government in Thai
	E-S-Qual
	User-perceived web quality
	E-Qual
	E-Commerce Website Quality
	Online Service Quality
	B2C e-commerce website quality
	Quality Model for Portal Data
	Service quality on the web
	E-Service Quality
	Quality aspects in design and use of Web
	WebQual
	Web Site Quality Evaluation
	Consumer Perspective of E-Service Quality
	SITEQUAL
	Portal usage quality
	IP-Portals
Web site quality factors	Web Site Quality Model
	Quality factors in web sites
	Designs of Highly-Rated Web sites
	Norwegian public web sites
Technical Approaches	MAIS approach
	IBM approach
	Meteor-S approach
	QoS for WS

site's quality aspects. The assessment is substitute, as it is performed by the public organization. An exception to this is the "web site quality model" approach where there is also true and subjective assessment by citizens.

Finally the technical approaches category is a subset of the initial e-services category that focuses on the assessment of technical characteristics of web services. These approaches reside on the objective side of the second axis and on the substitute one of the third axis.

By reviewing the table, another important note is that the objective side of the second axis doesn't include true assessment. This means that there are no objective quality measures that can be used for the qualitative assessment of public e-services by users/citizens. This observation is very reasonable, because the average citizen doesn't have the necessary knowledge and skills in order to evaluate specific quality metrics, which usually are technical.

The quality layers that our model uses are the site technical performance layer, the site quality layer and the customer's overall satisfaction layer. Back office process performance layer although is very critical to the final service delivered in front desk, is beyond the scope of this PhD thesis.

Furthermore, both objective and subjective characteristics are going to be evaluated. As we present in Chapter 4 and 5 in this thesis we focus on the e-government service delivery from the citizens' point of view. We build, refine and validate our scale measuring the perceived quality by the citizens. From that point of view all the criteria assessed are True and subjective characteristics are going to be evaluated. The same stands for Chapter 6 where we develop an instrument for inquiry method.

In Chapter 7 though, where we develop the instrument for inspection method the criteria assessed are Substitute and the evaluated characteristics are objective since an expert evaluates each element of the interface against a list of commonly accepted principles.

2.8 Conclusions

As most of the public administrations in Europe and developed countries recognized the need of e-government services the number of online Government to citizen (G2C) and Government to Business (G2B) services has substantially increased. Despite the large number of already existing e-government services, users face significant problems concerning the level of their quality. To overcome quality problems management needs to periodically measure the quality of existing e-government services, as the basis of a continuous improvement process.

In this PhD thesis we develop a quality model that will help the public organizations measure and monitor the quality of public e-services. The quality model will be responsible for providing answers to questions such as: what to assess? who will perform the assessment? how the assessment will be done? etc.

The first step for the development of the quality model is a critical review of state of the art approaches and an appropriate synthesis and classification of them. This first step has been presented in this chapter. These approaches focus on different aspects of quality and on a different level of detail. Some of them deal with major quality areas such as information, while others examine in more detail these quality areas. A detailed examination of quality of information for example, is provided by considering information freshness, completeness and ease of understanding. Another differentiation point between literature approaches is the meaning that each one gives to a quality factor. Some approaches use a quality factor's name with different meaning than others or refer to the same quality aspect with different names.

The amalgamated review tables presented are the result of our effort to correlate the meaning each researcher gives to each dimension with the corresponding dimensions of other models. This correlation was not always feasible on a detailed level, so we have used a higher view of quality factors in order to achieve it. For example for an approach that deals with information freshness, we have ticked the relevant quality factor which includes information freshness, i.e. information/content, in the review table. The result of the correlation of quality aspects' meaning was the identification of four layers of quality assessment:

- Back office Process Performance layer
- Site Technical Performance layer
- Site Quality layer
- Customer's overall satisfaction

This categorization enables a composite, multi-faceted view of the literature and helps us answer the question about what should be assessed for the evaluation of e-government services. For the other two questions that must be addressed for the development of a quality model for public e-services and namely for the questions about who will perform the assessment and how the assessment will be done, we will use the results of Table 2.6. This table contains the information about who performs the assessment (true/substitute axis) and how the assessment will be done (objective/subjective axis). Thus the results of the work presented in this chapter form the basis for the development of a quality model for e-government services.

The quality model that we develop in the next chapters will measure and monitor all quality aspects and dimensions identified by the present state of the art review, using appropriate quality tools such as surveys and objective metrics and by taking into account different perspectives.

3 Thesis Approach

This chapter describes the approach of this thesis. First, the research aim of this thesis is presented in Section 3.1 and then the theoretical background is described in Section 3.2. Section 3.3 describes the method used in the thesis while the chapter concludes with the results.

3.1 Research Aim

The research aim of this PhD thesis is to:

- Develop a new quality model of e-government services which will be grounded in the existing literature.
- Develop an instrument for measuring of the quality of the service provided
- Test, refine and validate the model and the instrument through the use of the quality instruments in real world cases
- Develop an instrument for assessing e-government service quality through inquiry method
- Develop an instrument for assessing e-government service quality through inspection method
- Assign weights to the quality indicators of the model and instruments in order to study the impact they have to the overall e-government service quallity according to citizens

3.2 Theoretical Background

The theoretical background that this PhD thesis is going to be based on is Quality Management, Service Management, Information Systems and e-government as illustrated on Figure 3.1.

More specifically we reviewed the work of quality "gurus" such as Shewhart (1980), Deming (1981), Juran (1988), Crosby (1995), Feigenbaum (1961) and Ishikawa (1991) who dominate the area of quality management.

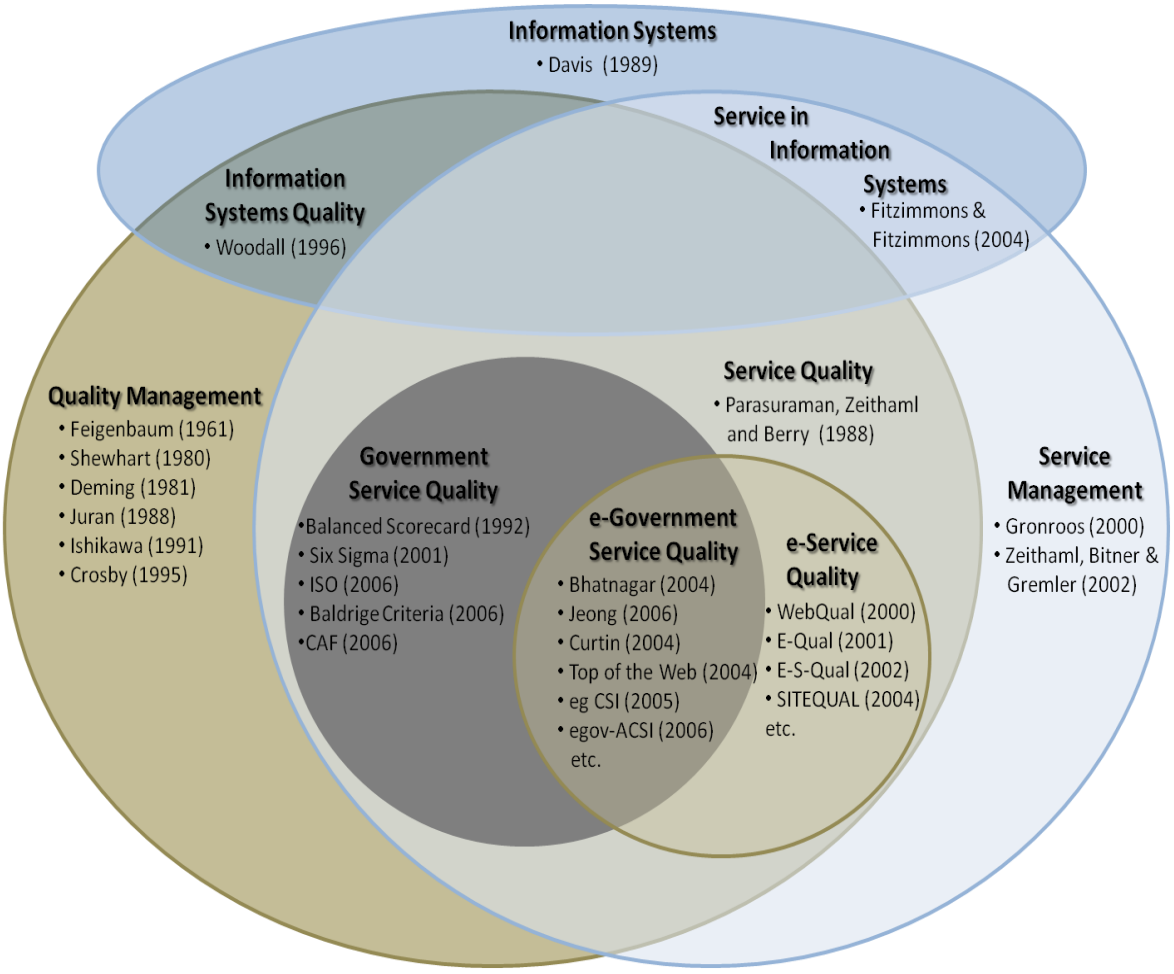

Figure 3.1. Theoretical background.

We focus on principles of quantitative and qualitative models for service management, management of service operations (Gronroos, 2000), (Zeithaml, Bitner & Gremler, 2002), quality management in services (Parasuraman, Zeithaml and Berry, 1988), quality (Woodall, 1996) and acceptance of information systems (Davis, 1989; Fitzimmons & Fitzimmons, 2004), quality in governmental services (Balanced Scorecard, 1992; Six Sigma, 2001; ISO, 2006; Baldridge Criteria, 2006; CAF, 2006), approaches on assessing e-service quality, governance by e-government (Bhatnagar, 2004), (Jeong, 2006) and e-gov case studies from around the world (Curtin, 2004) (more analytically presented in Chapter 2).

3.3 Method

To establish an e-government service quality performance evaluation model and scale, we followed the next three-step procedure: building preliminary model/scale; modifying preliminary model and scale; building final scales for inquiry and inspection methods which include the weights of the evaluation criteria. In this last step the development of the methodology for assessing e-government service quality is also included (Fig. 3.2).

Step 1. Building the preliminary model/scale. In this step, this study refers to the literature reviewed in Chapter 2. We reviewed all the relative approaches to quality of e-government services, models, cases and national initiatives. Then in order to regenerate a quality model we grouped all the existing criteria of the literature. After two evaluation rounds, as described in Chapter 4, 33 e-government quality sub-criteria remained in the list classified under six main criteria: Ease of Use (navigation personalization, technical efficiency), Trust (privacy, security), Functionality of the Interaction Environment (support in completing forms), Reliability (accessibility, availability), Contents and Appearance of Information and Citizen Support (Interactivity).

Step 2. Modifying the preliminary model. In order to validate, refine, purify, evaluate the model and the scale and also test the model's and the scale's factorability two rounds of data

collection and analysis took place. This process resulted in the reduction of the criteria from 6 to 4 and in the drop of 12 sub-criteria as illustrated in Chapter 5.

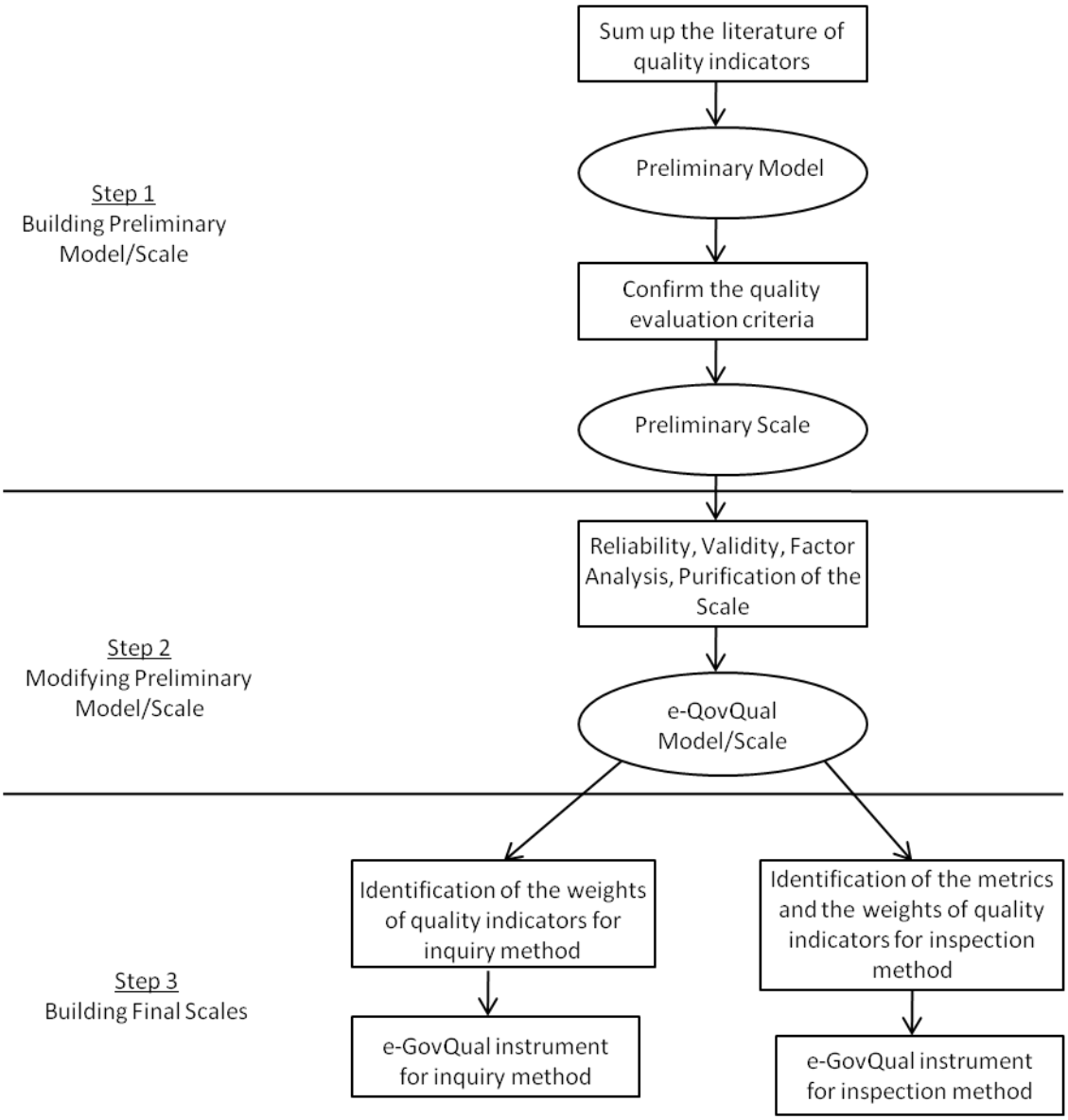

Figure 3.2. The procedure of building quality evaluation model.

Step 3. Building the evaluation Model/Scale. After identifying the quality evaluation criteria for assessing e-government service quality performance we developed two instruments

for assessing e-government quality service; one for inquiry method and the other for inspection method. For the first we identified the relationships between quality dimensions and attributes as well as the weights of each dimension and each attribute by the AHP multi criteria method as described in Chapter 6. For the second we assigned weights for the existing evaluation criteria as well as for some new - more technical ones - that can be measured by inspection and tested our results with some real cases (Chapter 7).

3.4 Results

Prior to any data collection, the accuracy and validity of the instrument capturing that data must be demonstrated. It is for this reason that the suggested eight-step procedure for developing better measures by Churchill (1979) is followed.

1. Specify Domain of Construct (Chapter 2).

2. Generate Sample of Items: The purpose of this step is to take the information gathered in the initial exploration of the construct and develop a sample of items (Churchill 1979). The items generated from the initial explorative research tap into the nuances of e-government service quality. The items will then be further edited to fully capture the essence of e-government service quality (Chapter 4).

3. Collect Data: Data will be collected using the sample of items generated in step two. E-government users will be polled to ensure generalizability to the larger population (Chapter 5).

4. Purify Measure: During this step, the initial sample of items are purified and refined. Two statistical methods are performed at this stage of instrument development: coefficient alpha and factor analysis. Since the sample items are drawn from the domain of a single construct, they should be highly correlated. Coefficient alpha, which measures the internal consistency of a set of items, is the most appropriate means of determining the quality of an instrument (Churchill 1979). Factor analysis, which determines the number of dimensions underlying a construct, is used to confirm or refute components (Chapter 5).

5. Collect Data: Data will be collected from e-government users using the final purified sample of items generated in step four (Chapter 5).

6. Assess Reliability: If an instrument is not reliable, one cannot have confidence in the relation between variables (Kerlinger 1986). Cronbach's alpha is the most commonly used measure of reliability (Churchill 1979; Goodhue 1998). Low alphas (generally below .50 or .60), the sample of items does not truly capture the construct for which it was meant to measure and thus is not a quality measure (Chapter 5).

7. Assess Validity (Chapter 5).

8. Develop Norms: The final step in the e-GovQual development will be to develop norms. The raw score on a measuring instrument is not particularly informative (Churchill 1979). Without an understanding of what the actual "norm" is, incorrect conclusions might be drawn. Thus, after e-GovQual is developed, the average scores for e-government service quality in different countries and sites and an overall e-government site rating will be determined through further testing. Even before the setting of norms is complete, e-GovQual can be used to compare governmental sites.

Figure 3.3 depicts the approach of this thesis.

3.4.1 Literature Survey

By reviewing existing literature we came across an interesting but limited set of approaches concerning quality for the "e" channel of public services. Therefore we expanded our research in the relative areas of e-commerce quality, site quality and quality of web portals as described more analytically in Chapter 2 and depicted in Figure 3.1.

As already mentioned quality of e-services approaches focus on the quality of the service delivered. Emphasis is put on the way the client receives the services from the front office - web site. It is a customer oriented approach since it is motivated by the customer's needs. Quality dimensions of these approaches depend on the attributes of the delivered service such as availability, usability, security etc. and the receivers' of the service priorities and needs. In this group outstanding work is that of Parasuraman, Zeithaml, and Malhotra (2005) and Zeithaml, Parasuraman, and Malhotra (2000, 2002), Aladwani's and Palvia's (2002) study, Kelly and Vidgen's E-Qual (2005). Also there is much work done on E-Commerce website quality, online service quality approaches, B2C e-commerce web site quality.

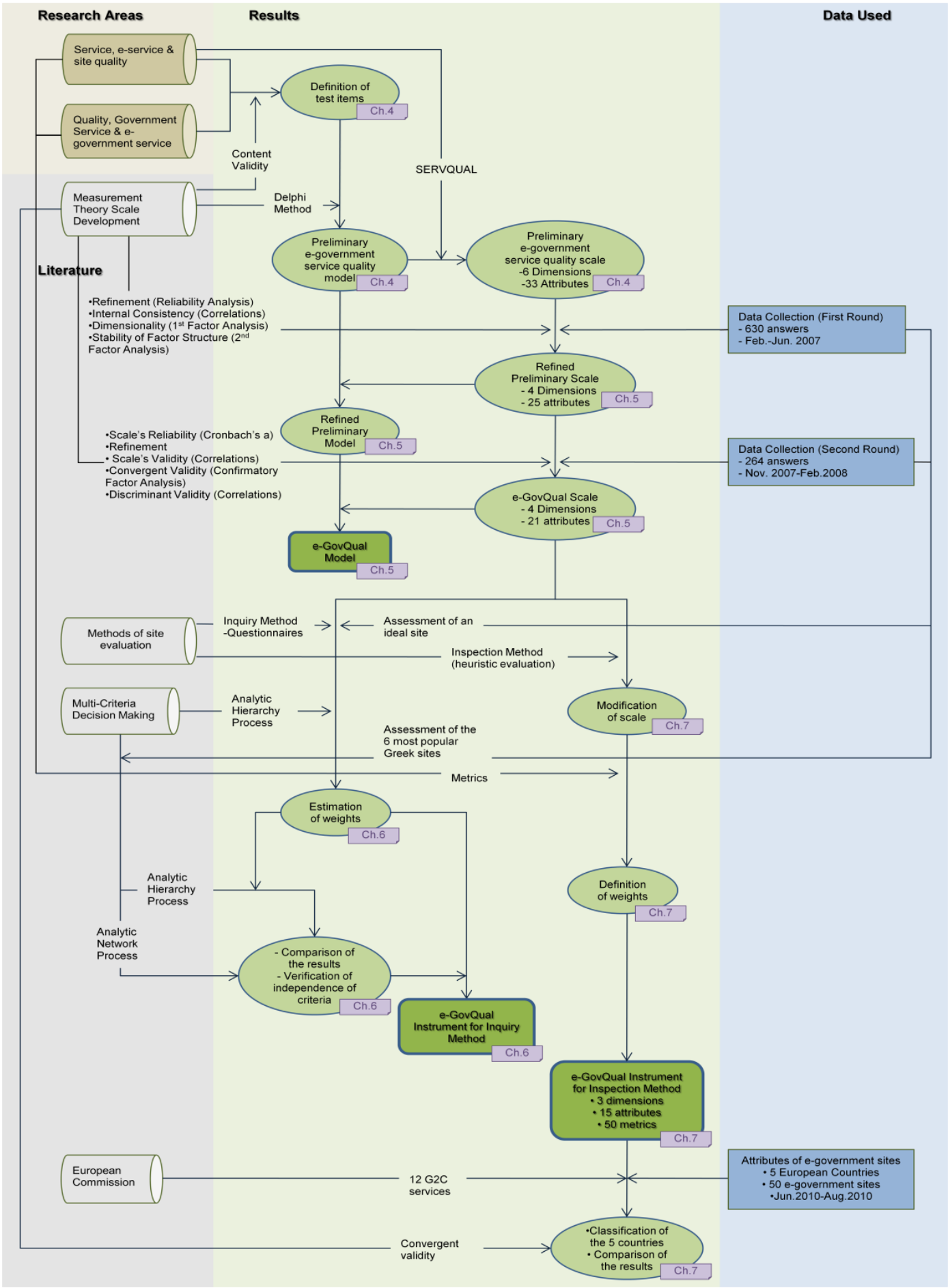

Figure 3.3. Thesis Approach

Approaches like WebQual™ (Loiacono, Watson, & Goodhue, 2000), SITEQUAL (Webb & Webb, 2004) and some others as well also give a good insight on the subject.

Previous studies on Web site quality have focused on different niches of the e-commerce market such as e-banking (Bauer, Hammerschmidt, & Falk, 2005; Miranda, Cortes, & Barriuso, 2006; Pikkarainen, Pikkarainen, Karjaluoto, & Pahnila, 2006), lodging industry (Chung & Law, 2003; Jeong & Gregoire, 2003) as well as in e-travel industry (Ho & Lee, 2007; Shchiglik & Barnes, 2004).

It also seems that the area of quality of Web sites is so broad that some researchers decided to work on a specific quality dimension. Some work has been done in evaluation of information quality (Eschenfelder, 2004; Herrera-Vieldma, Pasi, Lopez-Herrera, & Porcel, 2006; Katerattanakul & Siau, 1999), while others' efforts deal with the quantity of content (Kang & Kim, 2006) and the information architecture (Gullikson et al., 1999). Moreover, researchers have also been occupied with handling accessibility as a quality dimension (Brebner & Parkinson, 2006; W3C, 2007). Furthermore, research has been conducted in examining tangibility as a quality factor (Alzola & Robaina, 2006) and navigation structures' impacts on Web site usability (Fang & Holsapple, 2007).

Turning to the study of e-government service quality, we note that although some of the quality evaluation criteria will be generic in nature (i.e. may be suitable for either e-commerce or e-government sites), others may apply only to e-commerce and some may apply only to e-government (Barzilai-Nahon & Scholl, 2007). In order to further examine these differences and set up a measurement scale targeting e-government, we also examined the literature that focuses on e-government quality.

Research addressing e-government service quality has examined users' opinions about the factors that characterize the quality of an e-government web page (Eschenfelder, 2004, Brebner & Parkinson, 2005) or has tried to benchmark the actual status of e-government implementation (Kaylor, Deshazo, & Van Eck, 2001).

3.4.2 Preliminary e-government service quality model

Our goal was to develop a measure which has desirable reliability and validity properties. First we defined the universe of content and then we wanted to show that the test items are a sample of that universe. Content validity is ordinarily to be established deductively since we sampled systematically within that universe to establish the test (Cronbach, 1971). In other words after an extensive literature survey and critical screening of the existing approaches on Web site quality, portal quality, e-service quality, e-government and quality measurements (previously validated scales), the boundaries of the research or the construct of interest was defined and we identified an exhaustive candidate list of items from the domain of all possible items consisting the quality construct of e-government service. Thus, a multitude of quality attributes of different approaches was identified.

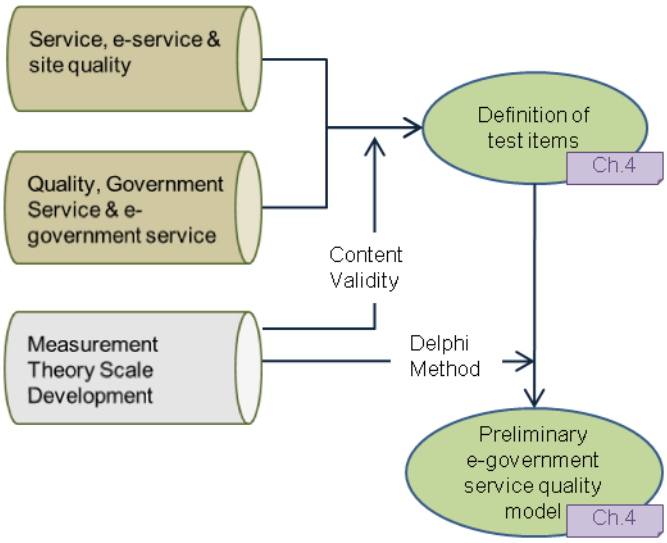

Figure 3.4. Development of preliminary e-government service quality model

For a better insight at the phenomenon, Delphi method was used to initially assess sample items in order to provide input for developing a conceptual model of e-government service quality. After two evaluation rounds 33 e-government quality attributes remained in the list classified under six main criteria determined as the e-government service quality dimensions: Ease of Use (navigation, personalization, technical efficiency), Trust (privacy, security), Functionality of the Interaction Environment (support in completing forms), Reliability

(accessibility, availability), Content and Appearance of Information and Citizen Support (Interactivity) as depicted in Figure 3.5. The development of the preliminary e-government service quality model is described in Chapter 4 and illustrated in Figure 3.4.

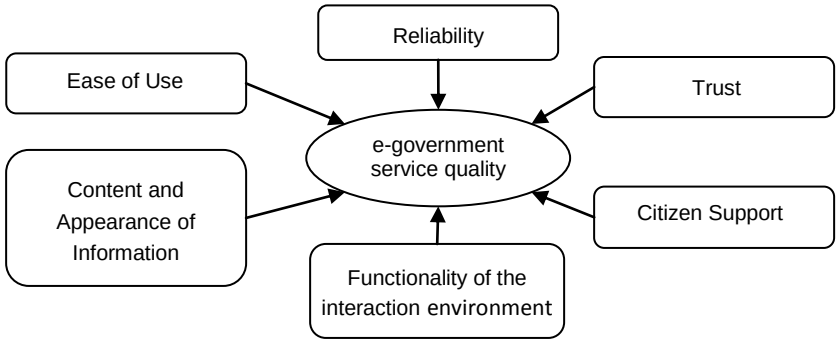

Figure 3.5. Preliminary e-government service quality model

3.4.3 Preliminary e-government service quality scale

After creating the conceptual model there was a need to confirm whether the sample of items depicted there, capture the construct of e-government service quality. As a next step, a questionnaire based on these criteria has been designed to elicit and assess information on preferences of the citizens when evaluating e-government service and governmental Web sites (Fig. 3.6).

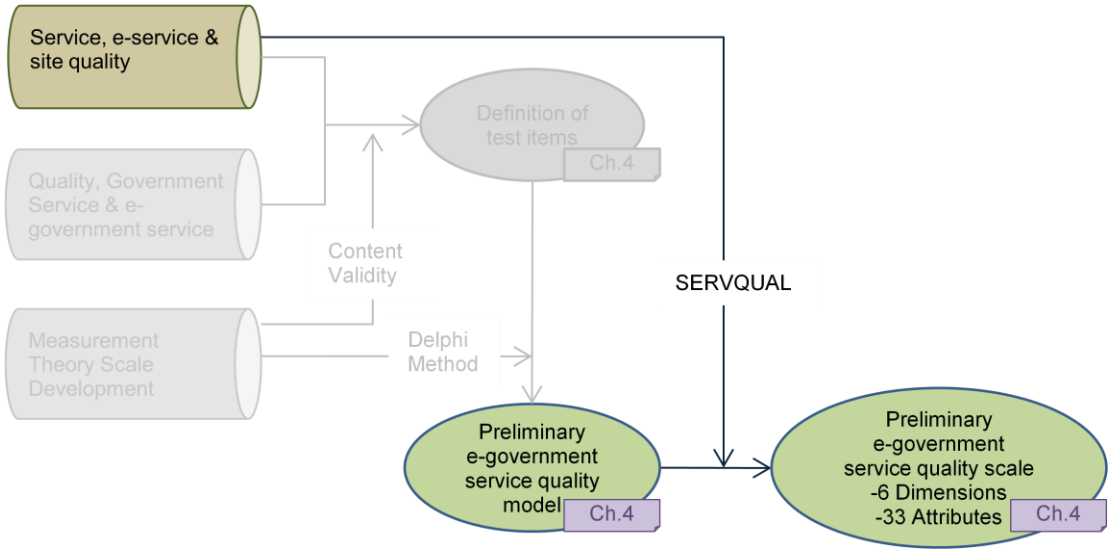

Figure 3.6. Development of preliminary e-government service quality scale

The attributes chosen for the preliminary conceptual model were arranged in a questionnaire phrased in SERVQUAL's format (Zeithaml, Parasuraman, & Berry, 1990). The development of preliminary e-government service quality scale is described in Chapter 4.

3.4.4 e-GovQual model and scale

In order to refine and evaluate the preliminary scale to measure e-GovQual, two online surveys took place collecting in total 894 answers. Data collection was web-based. During data analysis and purification we conducted reliability analysis and we refined the instrument (reduced the list of attributes within each dimension). Items were purified as recommended by Churchill (1979). Furthermore, in an attempt to identify internal consistency problems and improve reliability levels, all items were screened along Churchill's recommendations (1979). Factor analysis was used to examine the dimensionality of the scale and confirm whether the number of dimensions conceptualized can be verified empirically. Moreover, in our quest for a stable factor structure, we used principal components analysis (Costello & Osborne, 2005). Discriminant validity of the questionnaire was assessed using exploratory factor analysis, ensuring that each sub-criterion loads on separate criterion. The outcome of the above process (Fig. 3.7) was the modified e-GovQual model (Fig. 3.8) and scale (Table 5.12), consisting of 21 sub-criteria, loading strongly on four main criteria.

The following are the four criteria and the 21 sub-criteria in the modified model:

Efficiency: The ease of using the site and the quality of information it provides have also been noted by other researchers (Gefen, Karahanna & Straub, 2003; Santos, 2003) (7 evaluation sub-criteria). More analytical this criterion takes into account the clear and easy to follow structure of the site (Structur), the effectiveness of the site's search engine (SearchEng), how well the site's map is organized (SiteMap), how well the site can be customized to individual user's needs (Customiz), whether the information displayed in the site is appropriate detailed (INDetail), whether the information provided by the site is 'fresh' (InUp2Dat) and finally whether there is enough information about the site's fields' completition (FRpreFil).

Trust: The degree to which the citizen believes the site is safe from intrusion and protects personal information (4 evaluation sub-criteria). The importance of trust as a critical aspect of e-service has already been stressed in other studies (Gefen, Karahanna & Straub, 2003; Zhao & Zhao, 2010).

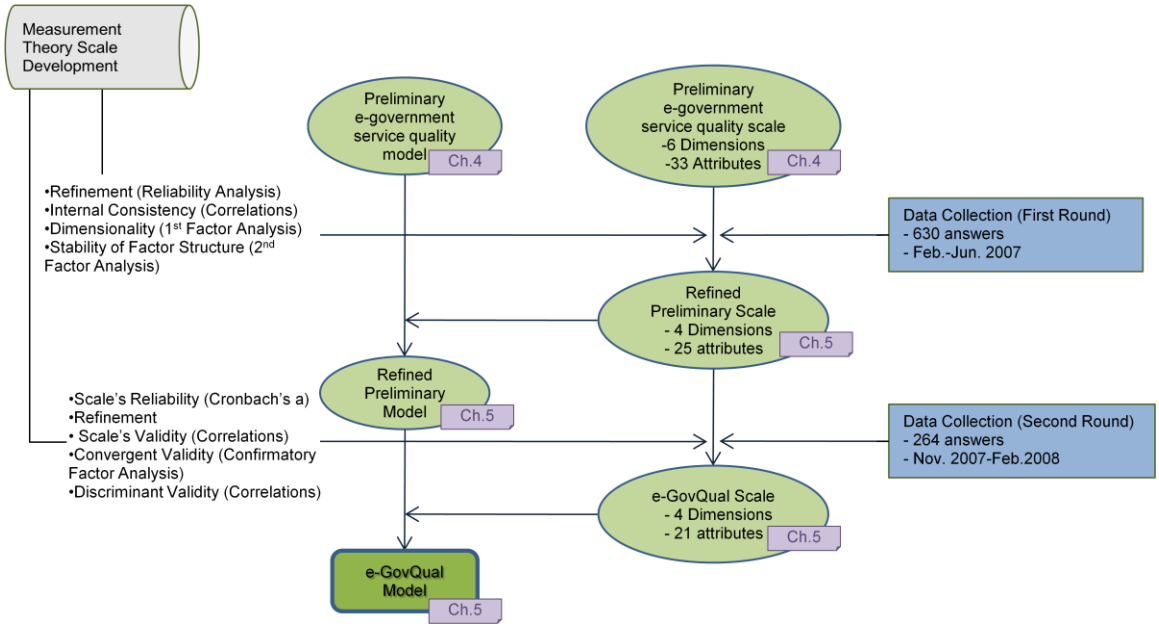

Figure 3.7. Development of e-GovQual model and scale

This criterion refers to the degree that the acquisition of username and password in the site is secure ((SafeCode), the amount of personal data required for authentication on the e-government site (PDMinim), whether data provided by users in the site are archived securely (PDSafety) and whether data provided by the citizens are used only for the reason they were submitted on the first place (PDUse).

Reliability: The feasibility and speed of accessing, using and receiving services of the site (6 evaluation sub-criteria). Reliability as a critical aspect of e-service has already been stressed in other studies (Anbazhagan & Nagarajan, 2002; Sukasame, 2004; Sumra & Arulazi, 2003; Webb & Webb, 2004). More detailed this criterion is comprised of the speed of downloading forms from the e-government site (FRFasrAp), whether the site is available and accessible whenever

the citizen needs it (SiteAvai), the extent to which the site performs the service successfully upon first request (SRSucces), whether the services provided by the site are in time (SRInTime), how fast the site's pages are downloaded (FastDown) and finally whether the e-government site works properly with any default browser (BrowsCom).

Citizen Support: The ability to get help when needed (4 evaluation sub-criteria). This final criterion deals with the interaction of the citizen with the employees of the site's Help Desk while experiencing some difficulties in their interaction with the e-government site. It refers to the interest shown by the employees in solving the citizen's problem (HDIntere), whether the employees give prompt replies to users' inquiries (HDAnswer), whether the employees have the knowledge to answer the users' questions (HDKnowle) and finally to the ability the employees have to convey trust and confidence (HDTrust).

Nevertheless as stressed by Zeithaml, Parasuraman, and Malhorta in 2002 the Citizen Support dimension applies only when citizens experience problems.

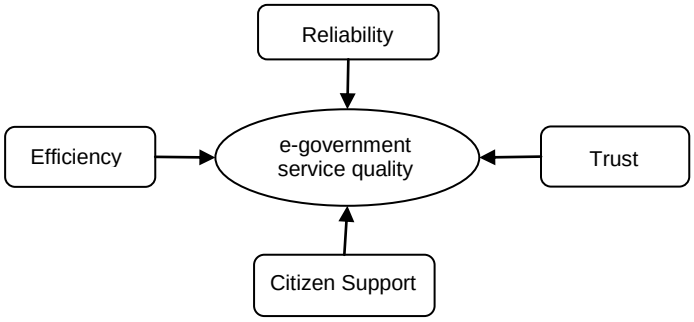

Figure 3.8. e-GovQual model

3.4.5 e-GovQual instruments for usability testing

After having concluded to an e-government service quality model and all the evaluation criteria that affect the service delivered we wanted to provide IT managers and practitioners with a instruments that can serve as useful diagnostic tools in order to measure and improve service delivery.

As described in the literature in order to evaluate a product, usability testing is a technique used to do so. Usability testing focuses on measuring a human-made product's capacity to meet its intended purpose. Usability testing can be divided into three categories: inquiry, inspection, and formal usability testing. While the first and last involve real users, the second does not.

In the context of Web site and interface assessment, inquiry involves requesting information about a particular site from the users. Methods of inquiry include focus groups, interviews, questionnaires, and surveys. Questionnaires are written lists of questions that you distribute to your users.

With inspection methods like heuristic evaluation and cognitive walkthrough, a site's designers and information specialists serve as testers and subjects, often putting themselves in the place of the user to perform various tasks using the site. Heuristic evaluation involves usability experts checking elements of an interface against a checklist of heuristics, or design principles (Nielsen, 1993; Nielsen & Mack, 1994).

In formal usability testing, users are observed using a site, or prototype, to perform given tasks or achieve a set of defined goals.

In the methodology proposed in this thesis we employ inquiry and inspection methods since they are more flexible and less cost demanding methods than formal usability testing method. More precisely we propose the use of questionnaires as far as the inquiry methods are concerned and heuristic evaluation as far as inspection methods are concerned.

e-GovQual instrument for inquiry method - Questionnaire

Of the inquiry method as already mentioned we are going to use the questionnaires. The questionnaires are written lists of questions that you distribute to your users. We have already formulated questions about the quality of e-government sites based on the type of information we want to know in the modified e-GovQual scale (Table 5.12). e-GovQual model and scale encompasses several quality criteria, and each criterion is further split into numerous sub-criteria. However, how to best balance these indicators is an important issue. An incomplete measurement model can result in inappropriate actions that may harm organizations' e-

government service delivery. When choosing an appropriate range of service quality measures, it is necessary to balance these measures, to ensure that one quality criterion, sub-criterion or a set of criteria or sub-criteria, is not emphasized to the detriment of the others.

Therefore, in this work we use AHP in order to study the importance of the evaluation criteria involved and develop our proposed quality assessment model. AHP is a flexible multi-criteria decision-making method used to effectively synthesize the judgments given by a team of experts in order to make better decisions in complex settings where both tangible and intangible criteria are considered (Saaty, 1990).

After constructing the AHP framework and applying the AHP method as analytically described in Chapter 5 the weights of each criterion and each sub-criterion detected in the e-government service quality model are determined. The citizens' preferences for an ideal e-government site were adopted in the establishment of estimation of criteria and sub-criteria weights. These weights show the impact of each criterion and sub-criterion to the overall e-government service quality according to citizens.

Moreover, in order to test the possible existence of interrelationships among evaluation elements, we also apply the AHP method, and the ANP method (another multi-criteria criteria decision-making method) to the six most popular e-government sites in Greece. Our results show that the order of the criteria and the ranking of the six e-government sites came up for both methods the same something that proves that there aren't any relationships among the elements examined that could cause deviation of the analytical results. The results do not vary depending on weather criteria interrelationships are taken into account or not. However, this independence of the elements could not be assumed before the analysis. The application of both methods was necessary in order to arrive to that conclusion.

We also found that all of the four criteria Efficiency, Trust, Reliability and Citizen Support significantly influence citizens' evaluation of site quality. Nevertheless users of e-government considered Reliability as the most important criterion, while Citizen Support Trust and Efficiency follow in importance. The most important sub-criterion concerning Reliability was the extend that the site is available and accessible whenever the citizen needs it, while for the Citizen Support criterion the most important sub-criterion was the extend that the employees

have the knowledge to answer the users' questions. In the case of Trust criterion, was whether the data provided by users in the site is used only for the reason they were submitted on the first place, whereas for Efficiency it was the extent that a site can be customized to individual user's needs.

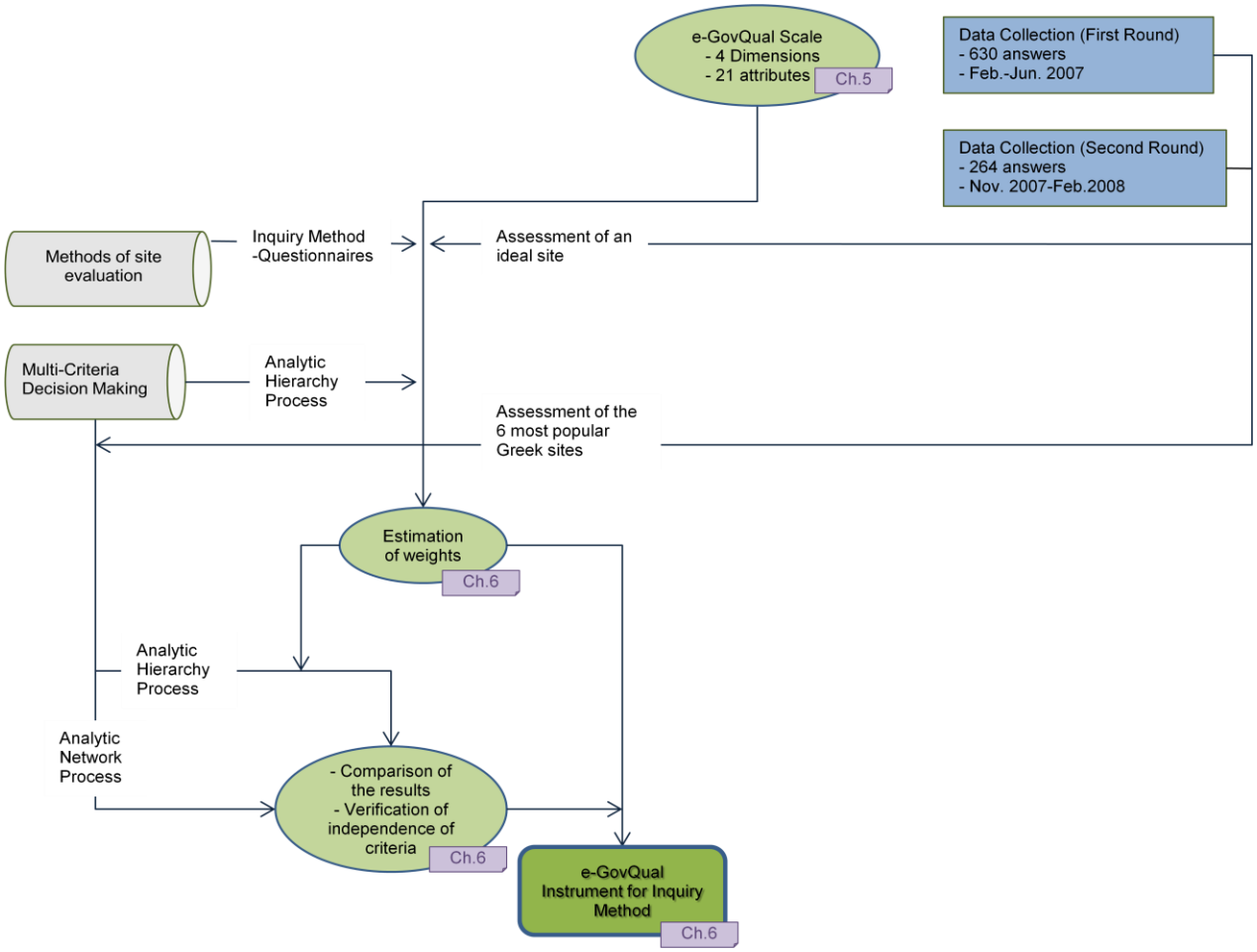

Figure 3.9. Development of final e-GovQual instrument for inquiry method

The development of the instrument for inquiry method is depicted in Figure 3.9 and analytically described in Chapter 6.

e-GovQual instrument for inspection method – Heuristic Evaluation

As already noted in this thesis in Chapter 7 we are providing a methodology for evaluating the quality of an e-government site by inspection method and more precisely by heuristic evaluation (Fig. 3.10).

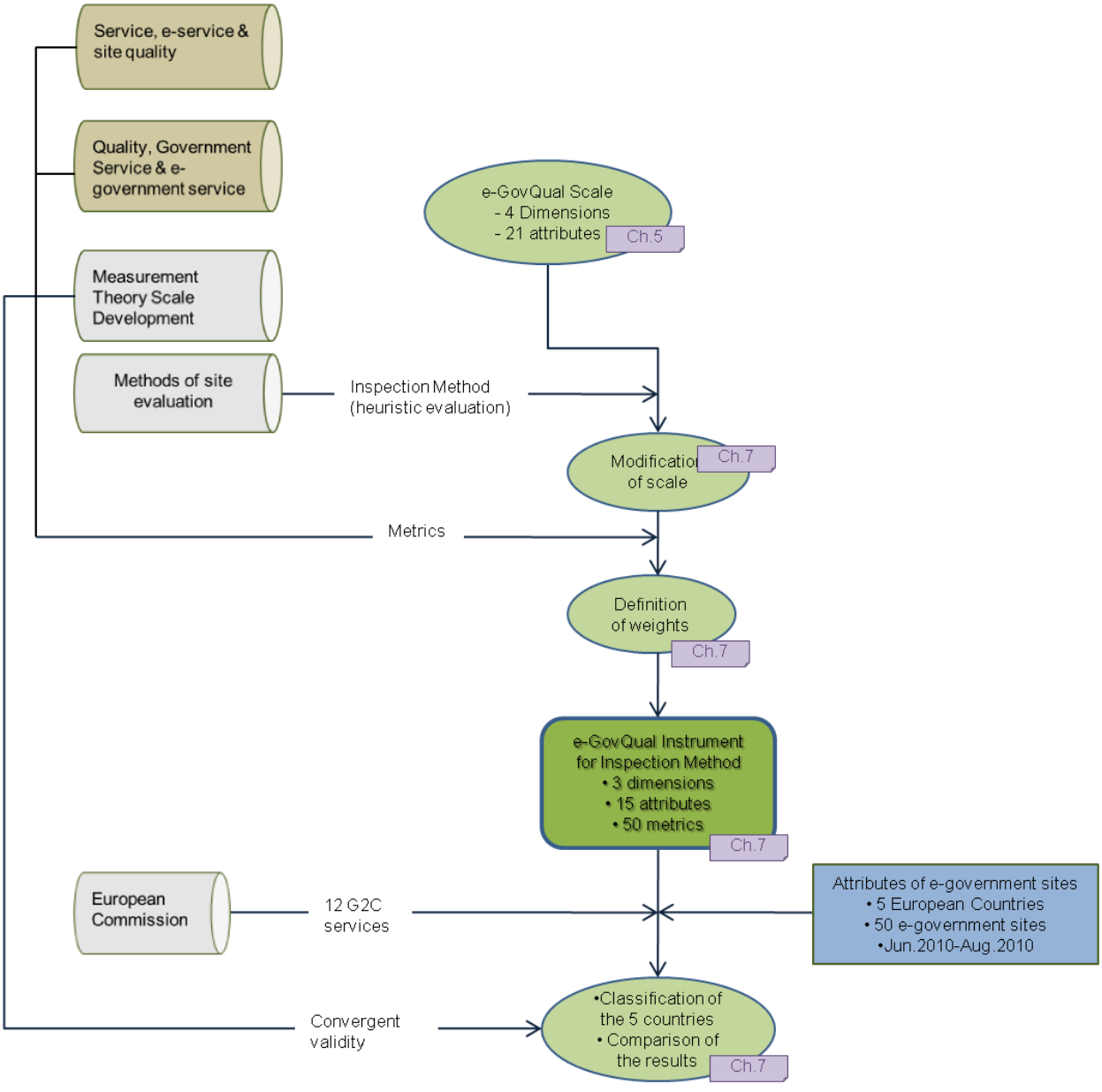

Figure 3.10. Development of final e-GovQual instrument for inspection method

A heuristic evaluation is a discount usability inspection method for computer software that helps to identify usability problems in the user interface (UI) design. It specifically involves evaluators examining the interface and judging its compliance with recognized usability principles (the "heuristics"). These evaluation methods are now widely taught and practiced in the sectors, where UIs are often designed in a short space of time on a budget that may restrict the amount of money available to provide for other types of interface testing.

The main goal of heuristic evaluations is to identify any problems associated with the design of user interfaces.

Jakob Nielsen's heuristics are probably the most-used usability heuristics for user interface design. Nielsen developed the heuristics based on work together with Rolf Molich in 1990 (Nielsen & Molich, 1990; Molich & Nielsen, 1990). The final set of heuristics that are still used today were released by Nielsen in 1993.

By taking into account Nielsen's heuristics we adjusted each quality evaluation criterion of the scale, to the requirements of the method. After an extensive literature research we identified the metrics that were incorporated in the instrument and defined the way of assessment and the weights for all the evaluation criteria. Our effort was to form the criteria in such a way that the evaluator would be as objective as possible. We tried to form the evaluator's answers in a YES/NO way so as to eliminate biased data. Some criteria were inspected in multiple ways. It should also be noted that for obtaining the results to some questions we utilized 5 web diagnostic tools.

The resulted instrument consisted of 3 dimensions, 15 attributes and 50 metrics. This instrument was implemented on 50 websites of public authorities, which belong to 5 European countries (Greece, United Kingdom, Ireland, Malta and Finland). The selection of the above mentioned countries was because they are all members of the European Union and follow the same directives in relation to e-government but also was based on the criterion of availability of the sites in English language. The websites assessed were providing the 12 basic public services to citizens as defined by European Commission (EU Commission, 2002). The questionnaire was employed by one experienced evaluator from June till August of 2010.

Our results awarded Great Britain's sites with the highest score, then Malta, Ireland and Finland follow while Greece comes last with the lowest score. The ranking of the countries concerning e-government service quality came up the same with the ranking of Capgemini (2010) for the online availability of citizen services. Capgemini does not assess service quality as eGovQual does; however it shows a trend that e-GovQual's results follow.

Moreover, in Efficiency dimension Finland scores much higher than the other countries at the same time as in Reliability and Trust Great Britain comes first. Our results indicate that in Finland websites at all government services place emphasis mainly on the content, navigation and citizen friendliness of the site while in Great Britain most websites at all government services place emphasis firstly on technical characteristics such as accessibility and privacy and secondly on general characteristics such as navigation, content etc.

4 Development of Preliminary e-government Model and Scale

4.1 Introduction

From the perspective of interactions e-Government may be divided into four categories (Evans & Yen, 2006; Siau & Long, 2005): Government to Government (G2G), Government to Business (G2B), Government to Employees (G2E) and Government to Citizens (G2C). Though e-government has clear benefits for governments themselves, businesses and employees, it is citizens that actually receive the widest array of benefits (Jaeger, 2003) and this research is focused on.

In many ways, the new technology does provide greater opportunities for access, for example by people in remote locations, those who work un-social hours, or those who are immobile and thus cannot attend offices in person. However, there are important problems in determining precisely what citizens want and need, and how to provide e-government in a user-friendly and effective way. User needs are always conditioned by what they already get, or imagine they can get.

In our effort to define the parameters that influence the service quality perceived by the citizens we describe throughout this chapter the conceptualization of a model and then the development of a multiple-item instrument for measuring e-government service quality of governmental sites, where citizens seek either information or service.

First, the model is conceptualized after an extensive literature survey as illustrated on Figure 4.1.

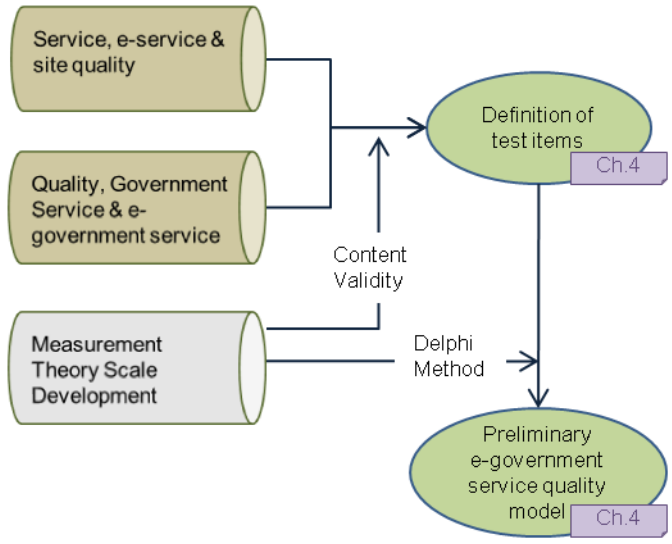

Figure 4.1. Development of preliminary e-government service quality model

After having reviewed prior research related to e-government, e-service quality, Web site quality, portal quality, and service quality measurements as presented in Chapter 2, we focused on construct validity and a first refining of the sample of items took place. We classified the 33 e-government quality attributes remained under six main quality dimensions: Ease of Use, Trust, Functionality of the Interaction Environment, Reliability, Content and Appearance of Information, and finally Citizen Support. After identifying the variables that capture e-government service quality and creating the conceptual model there was a need to confirm whether the sample of items depicted, capture the construct of e-gov service quality and to decide on such operational issues as question types and question sequence.

Based on the framework of SERVQUAL (Zeithaml, Parasuraman & Berry, 1990) a questionnaire based on these criteria was designed to elicit and assess information on preferences of the citizens when evaluating e-gov service and governmental web sites. The scale was produced following guidelines for measurement development proposed by Churchill (1979).

4.2 Development of the Model

Since our goal was to develop a measure which has desirable reliability and validity properties we firstly defined the universe of content and then we wanted to show that the test items are a sample of that universe. Content validity is ordinarily to be established deductively since we sampled systematically within that universe to establish the test (Cronbach, 1971). In other words as already described after an extensive literature survey and critical screening of the existing approaches on Web site quality, portal quality, e-service quality, e-government and quality measurements (previously validated scales), the boundaries of the research or the construct of interest was defined and we identified an exhaustive candidate list of items from the domain of all possible items consisting the quality construct of e-government service. Thus, a multitude of quality attributes of different approaches was identified and the nomological validity of the scale is guaranteed.

For a better insight at the phenomenon, Delphi method was used to initially assess sample items in order to provide input for developing a conceptual model of e-government service quality. The Delphi method is a structured communication technique, originally developed as a systematic, interactive forecasting method which relies on a panel of experts as described by Linstone and Turoff in 1975 (Fig. 4.2).

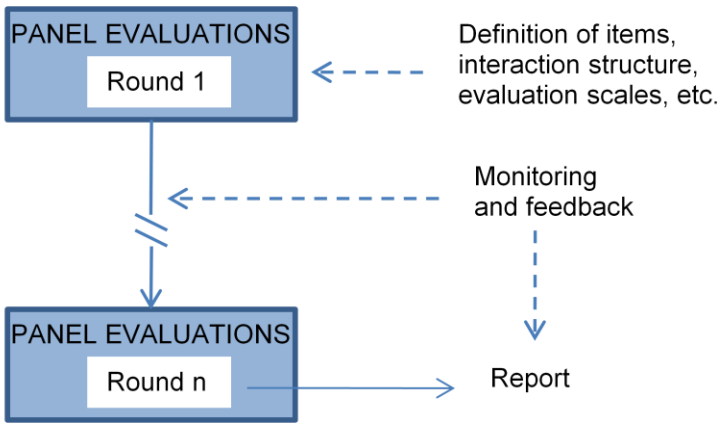

Figure 4.2. Delphi method

The Delphi method has been an anticipatory thinking technique aimed at building an agreement, or consensus about an opinion or view, without necessarily having people meet face to face. This group dynamics technique, if used effectively, can be highly efficient and generate new knowledge. To build interdisciplinary consensus, the Delphi method often uses the Hegelian dialectic process of thesis (establishing an opinion or view), antithesis (conflicting opinion or view) and finally synthesis (a new agreement or consensus), with synthesis becoming the new thesis. All participants in this organizational learning process shall then either change their views to align with the new thesis, or support the new thesis, to establish a new common view. The involution goal is a continual evolution towards 'oneness of mind' or consensus on the opinion or view. Delphi is based on the principle that forecasts (or decisions) from a structured group of individuals are more accurate than those from unstructured groups (Rowe & Wright, 2001).

According to Delphi method an information systems research professor, an information systems research unit senior researcher and an information systems scholar were asked to evaluate the items reword them if necessary and make changes so that repetitive items and higher level and more general items were removed. After two evaluation rounds 33 e-government quality attributes remained in the list classified under six main criteria determined as the e-government service quality dimensions: Ease of Use (navigation, personalization, technical efficiency), Trust (privacy, security), Functionality of the Interaction Environment (support in completing forms), Reliability (accessibility, availability), Content and Appearance of Information and Citizen Support (Interactivity). The six quality dimensions together with the respective attributes are summarized in Table 4.1.

The dimensions are discussed below:

Ease of Use (navigation, personalization, technical efficiency).

Ease of use is defined as how easy the Web site is for citizens to interact with. The attributes of the this dimension are extensively referred to in the literature (Bauer and Scharl, 2000; Smith, 2001; Olsina, Godoy, Lafuente & Rossi, 2008; Santos, 2003; Gefen, Karahanna & Straub, 2003) as they directly connect to a web site’s functionality and ease

of use. Factors such as web interface and search functionality have been identified as key measurements that define web success (Rose, Khoo & Straub, 1999). The literature suggests that without efficient and user-friendly navigation, the user is likely to get confused, lost, or frustrated and finally leave the site (Gehrke and Turban, 1999).

Table 4.1: e-Government service quality model's dimensions and attributes

Ease of Use *(navigation, personalisation, technical efficiency)* • Web site's structure • Customized search functions • Site-map • Set up links with search engines • Easy to remember URL • Personalization of information • Ability of customization	*Trust* *(privacy, security)* • Not sharing personal information with others • Protecting anonymity • Secure archiving of personal data • Providing informed consent • Use of personal data • Non repudiation by authenticating the parties involved • Procedure of acquiring username and password • Correct transaction • Encrypting messages • Digital Signatures • Access control
Functionality of the interaction environment *(support in completing forms)* • Existence of on-line help in forms • Reuse of citizen info to facilitate future interaction • Automatic calculation of forms • Adequate response format	*Reliability* • Ability to perform the promised service accurately • In time service delivery • Accessibility of site • Browser-system compatibility • Loading/transaction speed
Content & Appearance of Information • Data completeness • Data accuracy and conciseness • Data relevancy • Updated information • Linkage • Ease of understanding/ Interpretable Data • Colours • Graphics • Animation • Size of Web pages	*Citizen Support (Interactivity)* • User friendly guidelines • Help pages • Frequently Asked Questions • Transaction tracking facility • The existence of contact information • Problem solving • Prompt reply to customer inquiries • Knowledge of employees • Courtesy of employees • Ability of employees to convey trust and confidence

In fact, Basu (2002) suggests that users should be able to find what they are looking for in three clicks or less. In e-commerce, if the customer cannot find a product, then he or she will not buy it (Nielsen, 2000) and will probably refer to another online supplier. However, in e-government the citizen does not have the luxury of "buying"

from somewhere else; if the citizen cannot find something online, they will have to do it over the phone or by their physical presence at the public authority offices.

The use of set-up links with major search engines and an easy to remember and concise URL can facilitate citizens in finding the Web site on the worldwide Web.

One useful navigational feature of web sites is internal search engines. The popularity and importance of search engines, where the citizens are allowed to search within the site by transactions, by public agencies or by keywords (with just google receiving over 250 million search requests per day) indicates that people extensively use search engines as a reference point (Intdev, 2007; Fallows, Rainie & Mudd, 2004). Correspondingly, internal search engines emerge as a useful navigational aid for sites that contain large amounts of information (Alexander and Tate, 1999; Gehrke and Turban, 1999), as they provide an easy and quick way for locating information. Moreover, internal navigation can be greatly assisted by a consistent web site structure, by including a site map or an alphabetical index (Gehrke and Turban, 1999; Basu, 2002) that allows users to skip sessions that are of no interest; these provide a quick overview of the pages contained within the entire web site, and each can be an important tool in determining the coverage of the site (Alexander & Tate, 1999). However, it should be noted that the full functionality of site maps and indices is achieved when their contents are simultaneously active links to the appropriate web pages (Alexander and Tate, 1999). Other supplementary tools for navigation include menus, directories, buttons, subject trees, image maps, and colors (Clyde, 2000).

Navigational evaluation items are extensively referred to in the literature (Bauer & Scharl, 2000; Merwe & Bekker, 2003; Smith, 2001; Olsina Godoy, Lafuente & Rossi, 2008) as they directly connect to a web site's functionality and ease of use. Factors such as web interface and search functionality have been identified as key measurements that define web success (Rose, Khoo & Straub, 1999). The literature suggests that without efficient and user-friendly navigation, the user is likely to get confused, lost, or frustrated and finally leave the site (Gehrke and Turban, 1999). In fact, Basu (2002) suggests that users should be able to find what they are looking for in three clicks or less. In e-commerce, if the customer cannot find a product, then he or she will not buy it (Nielsen, 2000) and will probably refer to another online supplier. However, in e-government the

citizen does not have the luxury of "buying" from somewhere else; if the citizen cannot find something online, they will have to do it over the phone or by their physical presence at the public authority offices. Zhang & Von Drun (2001) found out in their research that for the governmental domain "easy to navigate" is the most important feature with "clear layout of info", "up-to-date info", "search tool" and "accuracy of info" following.

Furthermore, personalization of information - how much and how easily the site can be tailored to individual customers' preferences, for example communicating with the citizens in language they can understand and offering choices of languages other than the official language of the country. Current literature on web site evaluation includes limited references to multilingualism (Bauer & Scharl, 2000; Durrant, 2005). Of course, a public authority web site should be primarily available in the national language(s). However, multilingualism does not only refer to countries with more than one official language. Nowadays, financial and technological circumstances facilitate large population shifts and hence multilingualism is an issue that more or less all countries will have to deal with.

Personalization also applies in providing choices that aid people with disabilities to use the site, can improve the easiness of use of a governmental site. Easiness of use for the disabled that will encompass all different disability types (associated with aging, visual, auditory, speech, motor and cognitive deficiencies; Nielsen, 2000) is a very important aspect in e-government. In the race for more content, colors, graphics, motion pictures, audio, video and other dynamic elements it is becoming increasingly difficult for disabled individuals to access web sites (Huang, 2002). A study of 19 USA and Japanese web sites that observed 84 users with visual and motor disabilities concluded that web site usability is three times better for non-disabled users, commenting also on the necessity for the disabled not only to be able to perform a certain task, but also to perform it easily and quickly (Nielsen, 2001). What is more, in contrast to commercial web sites that regard accessibility as a competitive advantage (Huang, 2002) accessibility of government web sites emerges not as an advantage rather as an obligation towards citizens. To avoid digital exclusion, e-government web sites should aim to facilitate usage by all citizens and businesses independent of circumstances, such as age, origin,

disability and social status. Thus, for e-government web site accessibility becomes an important consideration.

Finally, the ability of customization - so that the system recognizes the user and displays in the first page links that the user frequently uses or remembers the settings concerning the preferred language and display – can aid citizens that repeatedly use the Web site. Previous research has shown that the governmental Web sites are well designed and easy to use (Santos, 2003).

Trust (Privacy/Security).

Trust consists of privacy and security and is defined as the citizen's confidence towards the Web site concerning freedom of danger risk or doubt during the e-service process. Privacy consists of the protection of personal information, not sharing personal information with others, protecting anonymity, secure archiving of personal data and providing informed consent. Finally, security is defined mainly as protecting users from the risk of fraud and financial loss from the use of their credit card or other financial information but also by ensuring that the whole transaction is carried on the way it was supposed to.

The latest technological advances that enable personalized services and full online transactions have raised public awareness of security and privacy issues. In fact, recent research findings indicate that "citizens place security and a desire for greater accountability above convenience or the expansion of services and information" (Moon & Welch, 2005, p. 256). The same research concludes that, due to limited knowledge of e-government management processes and limited confidence in government, citizens expect government agencies to clearly demonstrate attention to these issues. In addition, a recent survey indicates that 85 per cent of users of online government services believe that their local authority's IT systems have probably already suffered a security breach at the hands of cyber criminals, and, in such circumstances, 86 per cent of users would hold the local authority itself responsible, rather than the hackers (PublicTechnology.net, 2007). To overcome privacy issues, literature suggests the use of secure, encrypted connections for the transmission of personal information and transaction data, by access control, by digital signatures, by having procedures of acquiring username and password

and an evident link to a security statement that explicitly explains the way in which citizen data is protected and how it will be used (Smith, 2001; Gehrke and Turban, 1999). The importance of trust as a critical aspect of e-service has already been stressed in other studies (Gefen, 2003; Zhao and Zhao, 2010).

Functionality of the interaction environment (support in completing forms).

Forms play an integral role on e-government in allowing users to communicate and interact with the public administrations, allowing the collection of required information. Especially for e-government services of maturity level 3 or greater, forms are used as the major medium for submitting information online. Thus, quality characteristics of online forms are of high importance for citizens during their interaction with e-government portal and influence significantly the qualitative result of the delivered service.

During the on-line filling of forms the ability of the system to recall previously submitted information, the ability of the system to fill certain fields as a result of internal calculations on other fields or previously submitted information, the ability of the system to provide several alternative choices to the user concerning what he can do with a form he has filled in (submit, print, save, e.t.c.), or finally the automatic presentation of help text in form fields which aids users to fill in the form, facilitates the on-line interaction of the citizen with the public sector.

Reliability.

Reliability is defined as the citizen's confidence towards the e-government site concerning correct and in time delivery of the service. Reliability refers to the ability to perform the promised service accurately, consistently and in time. The term includes correct technical functioning (accessibility and availability) and accuracy of service promises. Accessibility is a general term used to describe the degree to which a system is usable by as many people as possible without modification. It is not to be confused with usability which is used to describe how easily a thing can be used by any type of user.

Nowadays, the web is widely regarded as a convenient, low cost and easily accessible by every medium. However, this is not exactly the case. There are still a large number of citizens that, albeit frequent internet users, may not be able to afford the latest

hardware equipment and software applications or to subscribe to fast, high-bandwidth internet connections; data confirms that only 30 per cent of EU households had a broadband connection in 2006 (Eurostat, 2007). In fact, download delays have been identified as the most critical factor for the development of e-commerce (Rose, Khoo & Straub, 1999; Gehrke and Turban, 1999). Additionally, time response to citizen's requests has been measured as a heuristic for the evaluation of Brazilian e-government web sites (Garcia et al., 2005).

Also, the capability of the system to be displayed and used independently of the web browser used enhances its accessibility. Availability refers to the degree to which a system suffers degradation or interruption in its service to the citizen as a consequence of failures of one or more of its parts. It represents the probability that a service is available. The availability of a site can also be enhanced by ensuring the 24/7 accessibility to it, and a high loading and transaction speed.

*Content & Appearance of Information***.**

This dimension refers to the quality of the information itself as well as to the presentation and layout of it i.e. proper use of color, graphics and size of web pages.

As far as the quality of information is concerned characteristics as completeness, accuracy, conciseness and relevancy are considered as positive while too much or too little information are both considered to be negative elements. Self-evidently, thorough, precise and current content is an indispensable part of a successful web site. Almost all literature references on web site evaluation refer to some degree to content and width of offered information (e.g. Smith, 2001; Henriksson, Frost & Middleton, 2006; Gehrke & Turban, 1999). Some sources stress the importance of clear, concise, error-free information that is limited to the absolutely necessary and useful, so that it does not weary the reader (Smith, 2001; Gehrke & Turban, 1999). Other sources refer also to the currency of information, meaning that content should be regularly reviewed and updated (Alexander & Tate, 1999; Smith, 2001) especially since previous work has shown that governmental Web sites are not updated regularly (Santos, 2003).

Linkage is defined as the number and quality of hyperlinks a site offers. The correct links supplement the information a site offers so it is important to select and

maintain the proper links. Moreover, avoiding broken links by regular checking is essential. The easiness of understanding and information that is interpretable is crucial since especially in governmental documents where there is too much terminology and the language used is too formal. Last but not least is the site aesthetics with characteristics such as the colors used, the graphics, the animation and the size of web pages. The visual impact of a web page can have a significant influence on user experience and has important implications for effective communication (Hoffman and Krauss, 2004) and, in particular, the interaction users have with a site (Schenkman and Johnsson, 2000).

Citizen Support (Interactivity).

Citizen Support refers to the help provided by the organization to assist citizens in their quest of information or during their transactions.

This help may consist of user friendly guidelines, help pages and Frequently Asked Questions in site as well as tailored communication availability. For occasions that the above are insufficient the existence of contact information - so that personal advice can be offered either through e-mail or through a traditional channel such as the telephone, fax or postal mail - is required. Typically, a web site user should be able to perform all actions online without the need for further contact through telephone or post. However, in the case of public authority web sites it is important that further contact options are provided and contact with key personnel is encouraged; in this way it is possible to help citizens overcome problems, such as limited technological competencies.

In cases of interaction between the citizen and the organization's employees, quality dimensions of service quality literature (Parasuraman, 1988) may apply - such as prompt reply to customer inquiries, knowledge of the employees, courtesy of the employees, ability of employees to convey trust and confidence and problem solving. The latter attributes suggest the need for interaction and not only visiting a Web site. Finally the ability to track the progress and the status of a transaction is considered positive. Nevertheless as mentioned in the literature the Citizen Support dimension applies only when citizens experience problems (Zeithaml, Parasuraman & Malhorta, 2002).

Table 4.2 summarizes the quality dimensions of the preliminary e-government service quality model in relation with other studies of the literature.

Table 4.2: Dimensions of e-government service quality model and support references

Dimensions	*Support References*
Ease of Use	Parasuraman, Zeithaml & Malhotra, 2005; Bessa & Belchior, 2002; Cox & Dale, 2002; Loiacono, Watson & Goodhue 2000; Yang, Jun & Peterson, 2004; Cappiello, Missier, Pernici, Plebani & Batini, 2004
Functionality of the interaction environment	
Content & Appearance of Information	Aladwani's & Palvia, 2002; Mei, Zhang & Seydel, 2005; Gounaris & Dimitriadis, 2003; Cappiello, Missier, Pernici, Plebani & Batini, 2004
Reliability	Bessa & Belchior, 2002; Cai & Jun, 2003; Lee & Lin, 2005; Iwaarden, Wiele, Ball & Millen, 2003; 2004; Webb & Webb, 2004; Lin & Wu, 2002; Yang, Jun & Peterson, 2004; Cappiello, Missier, Pernici, Plebani & Batini, 2004; Mani & Nagarajan, 2002; Sumra & Arulazi, 2003; Sukasame, 2004
Trust	Parasuraman, Zeithaml & Malhotra, 2005; Aladwani's & Palvia, 2002; Mei, Zhang & Seydel, 2005; Lee & Lin, 2005; Loiacono, Watson & Goodhue 2000; Webb & Webb, 2004; Yang, Jun & Peterson, 2004; Cappiello, Missier, Pernici, Plebani & Batini, 2004; Sumra & Arulazi, 2003
Citizen Support (Interactivity)	Parasuraman, Zeithaml & Malhotra, 2005; Cai & Jun, 2003; Yang, Jun & Peterson, 2004

It is worth mentioning that the dimension "Functionality of the Interaction Environment" refers to completion of forms. We believe that this dimension is important in the interaction of citizens with government through an electronic channel therefore we included it in our model although there were no support references for it.

The above discussed are reflected in the model Figure 4.3, which outlines how the e-gov service quality is defined by Reliability, Ease of Use, Trust, Content & Appearance of Information and by Citizen Support.

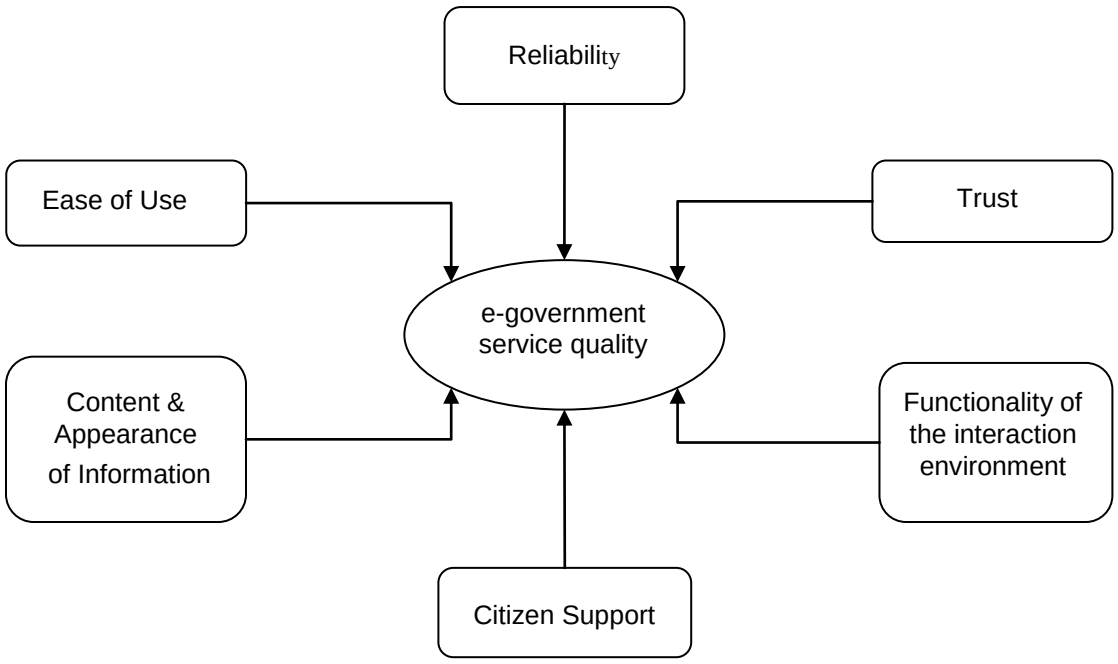

Figure 4.3. Preliminary model for e-government service quality

4.3 Development of the Scale

After creating the conceptual model there was a need to confirm whether the sample of items depicted there, capture the construct of e-government service quality. As a next step, a questionnaire based on these criteria has been designed to elicit and assess information on preferences of the citizens when evaluating e-gov service and governmental Web sites.

Table 4.3 depicts the quality attributes of the e-government service quality scale and the support references of the literature reviewed.

Table 4.3: Attributes of e-government service quality scale and support references

Attributes	*Support References*
This portal's structure is clear and easy to follow	Parasuraman, Zeithaml & Malhotra, 2005; Aladwani's & Palvia, 2002; Cai & Jun, 2003; Mei, Zhang & Seydel, 2005; Iwaarden, Wiele, Ball & Millen, 2003; 2004; Loiacono, Watson & Goodhue 2000; Zhang & Prybutok, 2005; Yang, Jun & Peterson, 2004; American Customer Satisfaction Index, 2006; eGovernment Unit, DG Information Society, European Commission, 2004; Barnes & Vidgen, 2003; Horan, Tarun & Raghuvira, 2006; Sukasame, 2004

This portal's layout is pleasant, clean and functional	Aladwani's & Palvia, 2002; Bessa & Belchior, 2002; Cai & Jun, 2003; Mei, Zhang & Seydel, 2005; Cox & Dale, 2002; Gounaris & Dimitriadis, 2003; Lee & Lin, 2005; Ivory & Megraw, 2005; Loiacono, Watson & Goodhue 2000; Mich, Franch & Gaio, 2003; Zhang & Prybutok, 2005; Oreste, 2005; Webb & Webb, 2004; Cappiello, Missier, Pernici, Plebani & Batini, 2004; American Customer Satisfaction Index, 2006; Barnes & Vidgen, 2003; Barnes & Vidgen, 2003
This portal's URL is easy to remember	Aladwani's & Palvia, 2002; Mich, Franch & Gaio, 2003
This portal's search engine is effective	Aladwani's & Palvia, 2002; Cox & Dale, 2002; Iwaarden, Wiele, Ball & Millen, 2003; 2004; Webb & Webb, 2004; American Customer Satisfaction Index, 2006
This portal's site map is well organised	Aladwani's & Palvia, 2002; Cox & Dale, 2002; Webb & Webb, 2004; American Customer Satisfaction Index, 2006
This portal is well customized to individual users' needs	Aladwani's & Palvia, 2002; Bessa & Belchior, 2002; Mei, Zhang & Seydel, 2005; Gounaris & Dimitriadis, 2003; Lee & Lin, 2005; Ivory & Megraw, 2005; Mich, Franch & Gaio, 2003; Webb & Webb, 2004
The information displayed in this portal is appropriate detailed	Aladwani's & Palvia, 2002; Bessa & Belchior, 2002; Gounaris & Dimitriadis, 2003; Loiacono, Watson & Goodhue 2000; Zhang & Prybutok, 2005; Webb & Webb, 2004; Cappiello, Missier, Pernici, Plebani & Batini, 2004; Barnes & Vidgen, 2003
The information displayed in this portal is accurate	Aladwani's & Palvia, 2002; Bessa & Belchior, 2002; Mei, Zhang & Seydel, 2005; Gounaris & Dimitriadis, 2003; Mich, Franch & Gaio, 2003; Webb & Webb, 2004; Cappiello, Missier, Pernici, Plebani & Batini, 2004; American Customer Satisfaction Index, 2006; Barnes & Vidgen, 2003; Horan, Tarun & Raghuvira, 2006
The information displayed in this portal is fresh	Aladwani's & Palvia, 2002; Bessa & Belchior, 2002; Mei, Zhang & Seydel, 2005; Gounaris & Dimitriadis, 2003; Mich, Franch & Gaio, 2003; Yang, Jun & Peterson, 2004; Cappiello, Missier, Pernici, Plebani & Batini, 2004; American Customer Satisfaction Index, 2006; Barnes & Vidgen, 2003
The information displayed in this portal is easy to understand (it does not use formal language)	Aladwani's & Palvia, 2002; Cai & Jun, 2003; Loiacono, Watson & Goodhue 2000; eGovernment Unit, DG Information Society, European Commission, 2004; Barnes & Vidgen, 2003
The information displayed in this portal is relevant	Mei, Zhang & Seydel, 2005; Loiacono, Watson & Goodhue 2000; Webb & Webb, 2004; Barnes & Vidgen, 2003
This portal offers enough and of high quality hyperlinks	Aladwani's & Palvia, 2002; Bessa & Belchior, 2002; Mei, Zhang & Seydel, 2005; Cox & Dale, 2002; Iwaarden, Wiele, Ball & Millen, 2003; 2004; Ivory & Megraw, 2005; Oreste, 2005; Sukasame, 2004
Forms in this portal are downloaded in short time	
Automatic recalling of user's personal data within portal's forms is satisfactory	
The level of automatic calculation within portal's forms is satisfactory	
Information about field's completion in this portal is enough	Bessa & Belchior, 2002; Cox & Dale, 2002; Oreste, 2005

Submitted requests or results of the elaboration are easy to stored locally or printed	Bessa & Belchior, 2002; Iwaarden, Wiele, Ball & Millen, 2003; 2004; Horan, Tarun & Raghuvira, 2006
This portal is available and accessible whenever you need it	Parasuraman, Zeithaml & Malhotra, 2005; Aladwani's & Palvia, 2002; Bessa & Belchior, 2002; Iwaarden, Wiele, Ball & Millen, 2003; 2004; Ivory & Megraw, 2005; Yang, Jun & Peterson, 2004; Cappiello, Missier, Pernici, Plebani & Batini, 2004; Mani & Nagarajan, 2002; Sumra & Arulazi, 2003; Horan, Tarun & Raghuvira, 2006
This portal performs the service successfully upon first request	Parasuraman, Zeithaml & Malhotra, 2005; Lee & Lin, 2005; Mich, Franch & Gaio, 2003; Webb & Webb, 2004; Yang, Jun & Peterson, 2004; Mani & Nagarajan, 2002; Sumra & Arulazi, 2003; Barnes & Vidgen, 2003
This portal provides services in time	Parasuraman, Zeithaml & Malhotra, 2005; Iwaarden, Wiele, Ball & Millen, 2003; 2004; Mich, Franch & Gaio, 2003; Zhang & Prybutok, 2005; Webb & Webb, 2004; Cappiello, Missier, Pernici, Plebani & Batini, 2004; Mani & Nagarajan, 2002; Sumra & Arulazi, 2003; Barnes & Vidgen, 2003
Portal's pages are downloaded quickly enough	Parasuraman, Zeithaml & Malhotra, 2005; Aladwani's & Palvia, 2002; Bessa & Belchior, 2002; Mei, Zhang & Seydel, 2005; Gounaris & Dimitriadis, 2003; Iwaarden, Wiele, Ball & Millen, 2003; 2004; Ivory & Megraw, 2005; Loiacono, Watson & Goodhue 2000; Mich, Franch & Gaio, 2003; American Customer Satisfaction Index, 2006; eGovernment Unit, DG Information Society, European Commission, 2004
This portal works properly with your default browser	Bessa & Belchior, 2002
This portal provides contact information	Parasuraman, Zeithaml & Malhotra, 2005; Aladwani's & Palvia, 2002; Bessa & Belchior, 2002; Cai & Jun, 2003; Gounaris & Dimitriadis, 2003; Iwaarden, Wiele, Ball & Millen, 2003; 2004; Loiacono, Watson & Goodhue 2000; Mich, Franch & Gaio, 2003; Barnes & Vidgen, 2003
Employees showed a sincere interest in solving users' problem	Parasuraman, Zeithaml & Berry, 1988; Cai & Jun, 2003; Mei, Zhang & Seydel, 2005; Gounaris & Dimitriadis, 2003; Lee & Lin, 2005
Employees give prompt replies to users' inquiries	Parasuraman, Zeithaml & Berry, 1988; Cai & Jun, 2003; Gounaris & Dimitriadis, 2003; Lee & Lin, 2005; Iwaarden, Wiele, Ball & Millen, 2003; 2004; Yang, Jun & Peterson, 2004
Employees have the knowledge to answer users' questions	Parasuraman, Zeithaml & Berry, 1988; Yang, Jun & Peterson, 2004
Employees are courteous	Parasuraman, Zeithaml & Berry, 1988; Webb & Webb, 2004
Employees have the ability to convey trust and confidence	Parasuraman, Zeithaml & Berry, 1988; Cai & Jun, 2003
The FAQ section of this portal covered completely the topic that you were interested in	Bessa & Belchior, 2002; Cai & Jun, 2003; Iwaarden, Wiele, Ball & Millen, 2003; 2004
Acquisition of username and password in this portal is secure	Bessa & Belchior, 2002; Mich, Franch & Gaio, 2003; Cappiello, Missier, Pernici, Plebani & Batini, 2004; Mani & Nagarajan, 2002; Sumra & Arulazi, 2003; American Customer Satisfaction Index, 2006
Only necessary personal data are provided for authentication on this portal	Sumra & Arulazi, 2003; American Customer Satisfaction Index, 2006

Data provided by users in this portal are archived securely	Parasuraman, Zeithaml & Malhotra, 2005; Aladwani's & Palvia, 2002; Bessa & Belchior, 2002; Cai & Jun, 2003; Gounaris & Dimitriadis, 2003; Lee & Lin, 2005; Loiacono, Watson & Goodhue 2000; Mich, Franch & Gaio, 2003; Zhang & Prybutok, 2005; Webb & Webb, 2004; Yang, Jun & Peterson, 2004; Cappiello, Missier, Pernici, Plebani & Batini, 2004; Mani & Nagarajan, 2002; Sumra & Arulazi, 2003; American Customer Satisfaction Index, 2006; Barnes & Vidgen, 2003
Data provided in this portal are used only for the reason submitted	Parasuraman, Zeithaml & Malhotra, 2005; Bessa & Belchior, 2002; Mei, Zhang & Seydel, 2005; Gounaris & Dimitriadis, 2003; Loiacono, Watson & Goodhue 2000; Zhang & Prybutok, 2005; Webb & Webb, 2004; Yang, Jun & Peterson, 2004; Cappiello, Missier, Pernici, Plebani & Batini, 2004; Mani & Nagarajan, 2002; Sumra & Arulazi, 2003; American Customer Satisfaction Index, 2006; Barnes & Vidgen, 2003

At this point we have to note that although the attributes referring to forms completion do not have support references in the literature we included them in our scale since we believe that these attributes are important in the interaction of citizens with government through an electronic channel. These attributes will lie under the following validation and refinement of the scale.

Next we arranged the attributes chosen (Table 4.4) in a questionnaire phrased in SERVQUAL's format (Zeithaml, Parasuraman & Berry, 1990). Each statement was reviewed so that its wording would be as precise as possible. Each item was measured using a five point Likert scale relating to the citizen's feelings about the site under assessment. The extent to which the citizen believed the site had the feature described by the statement was ranging from (1) "strongly disagree" that the portal has the feature to (5) "strongly agree". There were also two more general sets of questions, with each statement inspecting the citizen's feelings for the six constructs, once for the site under examination and once for an ideal site. Another question asked the citizens a total rate of the site under evaluation and of course some demographic questions. The scale items of the above described questionnaire are depicted on Appendix II.

Table 4.4: Preliminary e-government service quality scale

Ease of Use	This portal's structure is clear and easy to follow
	This portal's layout is pleasant, clean and functional
	This portal's URL is easy to remember
	This portal's search engine is effective

	This portal's site map is well organised
	This portal is well customized to individual users' needs
Content & Appearance of Information	The information displayed in this portal is appropriate detailed
	The information displayed in this portal is accurate
	The information displayed in this portal is fresh
	The information displayed in this portal is easy to understand (it does not use formal language)
	The information displayed in this portal is relevant
	This portal offers enough and of high quality hyperlinks
Functionality of the interaction environment	Forms in this portal are downloaded in short time
	Automatic recalling of user's personal data within portal's forms is satisfactory
	The level of automatic calculation within portal's forms is satisfactory
	Information about field's completion in this portal is enough
	Submitted requests or results of the elaboration are easy to stored locally or printed
Reliability	This portal is available and accessible whenever you need it
	This portal performs the service successfully upon first request
	This portal provides services in time
	Portal's pages are downloaded quickly enough
	This portal works properly with your default browser
Citizen Support	This portal provides contact information
	Employees showed a sincere interest in solving users' problem
	Employees give prompt replies to users' inquiries
	Employees have the knowledge to answer users' questions
	Employees are courteous
	Employees have the ability to convey trust and confidence
	The FAQ section of this portal covered completely the topic that you were interested in
Trust	Acquisition of username and password in this portal is secure
	Only necessary personal data are provided for authentication on this portal
	Data provided by users in this portal are archived securely
	Data provided in this portal are used only for the reason submitted

5 Development of e-GovQual Model and Scale

5.1 Introduction

This stage of our research concerns the effort to confirm the model and normalize the scale that have been developed in Chapter 4. It involves the important steps of subsequent independent verification and validation.

In order to refine and evaluate the preliminary model and scale resulted from the previous chapter an online survey that collected 630 responses took place. The scale was developed, refined, evaluated psychometrically, tested as far as its reliability was concerned and reached a stable factor structure that resulted in 25 quality attributes classified under 4 quality dimensions: Reliability, Efficiency, Citizen Support and Trust.

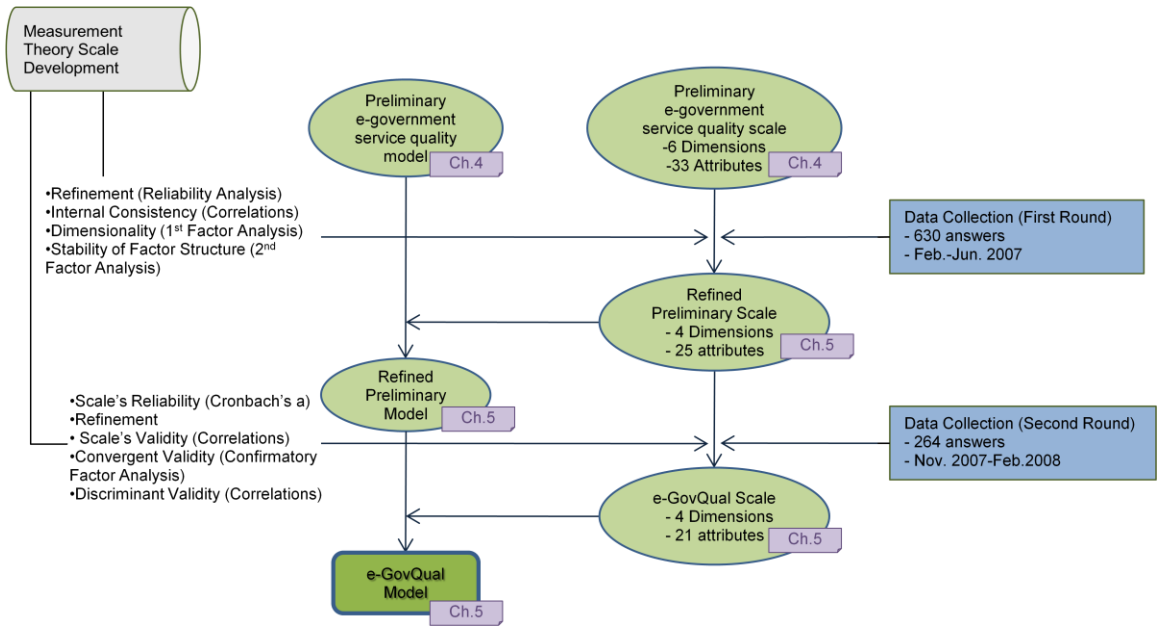

Figure 5.1. Development of e-GovQual model and scale

A second online survey with 264 respondents took place in order to verify, validate and finally to confirm the scale. During the above process the quality attributes of the refined preliminary scale were reduced to 21 (e-GovQual model/scale) as illustrated on Figure 5.1. The instrument developed under the above process would be valuable to researchers and practitioners interested in designing, implementing, and managing governmental web sites.

5.2 Refinement and Validation of the Preliminary Scale

5.2.1 Data collection (first round)

In order to refine and evaluate the scale to measure e-GovQual, an online survey took place. Data collection was web-based and respondents were notified about the survey along with the link to the Web site from KEP's home-page (www.kep.gov.gr). KEP is a governmental site which has been designed and developed for citizens' electronic information and service as well as for facilitating KEP's employees in their every-day work by seeking information on their work or even submitting an online application on behalf of a citizen. The site's information covers the entire scope of the Public Sector and dealings with Public Administration. In addition, it gives the ability to submit electronic applications to KEP for a series of administrative documents, implementing a substantial step toward electronic management in Greece. A total of 630 respondents that comprised of citizens along with KEP's employees, answered the online survey between 6th of February 2007 and 19th of June 2007. The demographic profile of survey respondents indicated a mature group of Internet users who were very familiar with both web-usage and e-government transactions. Among the 630 respondents 77.8% was working for KEP and public sector. Ages of respondents varied, but were generally older than student-based surveys with 8.1% of the respondents being under the age of 25, 57.9% ranging from 26 to 35; 28.3% were ages 36-45 and 5.6% were over age 46. A large portion, 70.1% of the respondents had at least college education. Use of the Internet was rather heavy among the participants with 60.7% of the respondents surfing in Internet more than 10 hours per week; while the high familiarity of the sample with KEP's site (71.5% had

daily usage) was considered very positive in our research. The characteristics of the respondents were similar to Internet user profiles gathered in other studies (Kehoe, Pitkow, Sutton, Aggarwal & Rogers, 1999). Finally no monetary or bonus was given to the respondents, while the responses were purely voluntary. Table 5.1 summarizes some of the demographic information collected.

Table 5.1. Demographic Information

Please indicate the highest level of education completed		How frequently do you visit KEP's site?	
PhD Degree	1.1%	Every day	70.3%
Bachelors Degree	68.9%	Once a week	15.6%
High School Diploma	23.2%	Once per month	10.8%
Gymnasium Diploma	6.7%	Less than once per year	1.7%
Which of the following categories best describes your professional status?		Which of the following categories best describes the duration you access the web within a week?	
Pupil	0.5%	More than 10 hours	60.6%
University/College Student	2.5%	6-10 hours	22.1%
Academic Faculty	1.0%	1-5 hours	16.3%
KEP's employee	66.7%	Less than an hour	0.8%
Government Employee	11.1%	What is your age?	
Private Sector Employee	7.5%	Less than 16	0.3%
Free Lancer	8.3%	16-25	7.8%
Unemployed	1.7%	26-35	57.9%
Retired	0.3%	36-45	28.3%
		46-55	4.6%
		56-65	1.0%

5.2.2 Data analysis-Scale reduction (first round)

During data analysis we observed a pattern of a high proportion of missing data on most of the attributes of certain dimensions. After further investigation we arrived at the conclusion that the two main groups of missing values are the 'Trust' dimension, which deals with security and privacy and the group of questions concerned with support in filling forms, belonging to the 'Functionality of the interaction environment' dimension.

Furthermore, there was an overlap of the 'Support in filling forms' questions to the 'Security and Privacy' questions. Almost all of the samples that did not answer the questions concerned with 'Support in filling forms' did not also answer the 'Security and Privacy' questions, most probably because they are the information seekers (Barnes and Vidgen, 2004) who do not attempt an on-line submission (interactors) but instead they are largely concerned with finding certain information and as a consequence, security is not a concern for them. The interactors seemed more satisfied with the quality of the site and with lower variation in their answers than the Information Seekers. Table 5.2 depicts their perceptions on quality on the six dimensions of the conceptual model.

Table 5.2. Comparison of quality perceptions of Information Seekers and Interactors

	Ease of Use	*Content and Appearance of Information*	*Functionality of the interaction environment*	*Reliability*	*Citizen Support*	*Trust*
Information Seekers (337)						
Mean	3.94	3.91		3.72	3.66	
Std. Deviation	1.004	0.893		1.134	1.055	
Variance	1.008	0.797		1.286	1.113	
Interactors (269)						
Mean	4.16	4.13	3.93	3.88	3.94	4.03
Std. Deviation	0.954	0.898	0.964	0.930	1.008	0.954
Variance	0.911	0.806	0.928	0.864	1.015	0.910

During data analysis and purification we conducted reliability analysis by grouping the items to the six conceptual dimensions from which they were derived. The most widely used reliability coefficient is Cronbach's coefficient alpha with acceptance level at least 0.7 (Nunnally & Bernstein, 1994). Coefficient alpha is estimated as an indication of how the sample of items performs in capturing the construct.

Cronbach's α (alpha) has an important use as a measure of the reliability of a psychometric instrument. It indicates the extent to which a set of test items can be treated as measuring a single latent variable. It was first named as alpha by Cronbach (1951), as he had intended to continue with further instruments. It is the extension of an earlier

version, the Kuder-Richardson Formula 20 (often shortened to KR-20) (Kuder & Richardon, 1937), which is the equivalent for dichotomous items, and Guttman (1945) developed the same quantity under the name lambda-2.

Cronbach's α is defined as:

$$\frac{N}{N-1}\left(\frac{\sigma_X^2 - \sum_{i=1}^{N}\sigma_{Y_i}^2}{\sigma_X^2}\right),$$

where N is the number of components (items or testlets), σ_X^2 is the variance of the observed total test scores, and $\sigma_{Y_i}^2$ is the variance of component i.

Alpha is an unbiased estimator of reliability when the components are all parallel. α can take values between negative infinity and 1 (although only positive values make sense). Some professionals, as a rule of thumb, require a reliability of 0.70 or higher (obtained on a substantial sample) before they will use an instrument. Obviously, this rule should be applied with caution when α has been computed from items that systematically violate its assumptions. Further, the appropriate degree of reliability depends upon the use of the instrument.

Cronbach's α is related conceptually to the Spearman-Brown prediction formula (Spearman, 1910). Both arise from the basic classical test theory result that the reliability of test scores can be expressed as the ratio of the true score and total score (error and true score) variances:

$$\rho_{XX} = \frac{\sigma_T^2}{\sigma_X^2}$$

Alpha is most appropriately used when the items measure different substantive areas within a single construct. Conversely, alpha (and other internal consistency estimates of reliability) are inappropriate for estimating the reliability of an intentionally hetrogeneous instrument. Also, α can be artificially inflated by making scales which consist of superficial changes to the wording within a set of items.

Although this description of the use of α is given in terms of psychology, the statistic can be used in any discipline.

The coefficient alpha values ranged from 0.84 to 0.92, exceeding the conventional minimum of 0.7 and demonstrating high internal consistency and hence reliability of each dimension. Table 5.3 shows coefficient alpha values for all the dimensions.

Table 5.3. Constructs' Cronbach's Alpha values

Constructs	*Coefficient Alphas*
Ease of Use	0.840
Functionality of the interaction environment	0.869
Content & Appearance of Information	0.849
Reliability	0.868
Trust	0.887
Citizen Support	0.919

We refined the instrument (reduced the list of attributes within each dimension) by examining its reliability. Items were purified as recommended by Churchill (1979) by examining corrected item to total correlations with respect to its specific component in the construct and discarding items whose elimination improved reliability or in other words Cronbach's coefficient alpha, until no item's removal increased a construct's overall alpha. The result was the removal of two attributes (the items concerning the politeness of the help desk employees and the easiness to remember the URL of the site). Prior to any removal we ensured that the particular attribute could not be viewed as representing a distinct additional dimension.

In an attempt to identify internal consistency problems and improve reliability levels, all items were screened along Churchill's recommendations (1979) to make sure that no items possess low correlations (less than 0.4) with similar traits, as also described by Goodhue (1998).

Factor analysis can now be used to examine the dimensionality of the scale and confirm whether the number of dimensions conceptualized can be verified empirically.

With 55 questions in the initial questionnaire and a rule of thumb for factor analysis of at least five times as many observations as there are variables to be analyzed (Hair, Anderson, Tatham & Black, 1998; Stevens, 1996), at least 275 subjects were required. The 630 respondents of our survey quite exceeded the mentioned limit.

In our quest for a stable factor structure, we used principal components analysis as the extraction method and Promax rotation method with Kaiser normalization (Costello and Osborne, 2005). The criterion to determine the initial number of factors to retain was that the eigenvalues be greater than 1, but also taking the scree plot under consideration. In order to make the final results more efficient, factor cross-loadings below 0.3 were not reported (Table 5.4). The correspondence of the scale attributes and the items depicted on the statistical analysis is illustrated on Appendix III.

Table 5.4. Principal Components Analysis (First Study)

Factor Analysis' Items' Loadings				
	Factor 1	*Factor 2*	*Factor 3*	*Factor 4*
Ease of Use				
Structur	.775			
Aestheti	.466	.418		-.412
SearchEn	.644			
SiteMap	.752			
Customiz	.879			
Content & Appearance of Information				
INDetail	.876			
INPrecis	.759			
INUp2Dat	.603			
INUnders	.496			
INReleva	.725			
Hyperlin	.432	.445		
Functionality of the interaction environment				
FRFastAp		.643		
FRPreFil	.634			
FRAutoFil	.658			
FRHelp	.633			.303
FRSave	.353			
Reliability				
SiteAvai		.631		

SRSucces		.643			
SRInTime		.557			
FastDown		.850			
BrowsCom		.764			
Citizen Support					
HDInform	.581	.356			
HDIntere			.832		
HDAnswer			.889		
HDKnowle			.979		
HDTrust			.898		
FreqUseP	.429				
Trust					
SafeCode					.713
PDMinim					.853
PDSafety					.798
PDUse					.714

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.
Rotation converged in 7 iterations.
Total variance explained by the four factors: 66.733%
Loadings<.30 not shown
The above results derived by SPSS software package

The initial factor analysis extracted four factors that were evident on the scree plot and had an eigenvalue grater than one. Then we eliminated ‘crossloading’ items (items that load at 0.32 or higher on two or more factors). In this step three items were deleted. The attributes that were eliminated in this step were the attributes concerning how pleasant the portal’s layout is, the number and the quality of the portal’s hyperlinks and the provision of contact information.

Hair, Anderson, Tatham and Black (1992) suggest that item loadings >0.3 are considered significant, item loadings >0.4 are more important and item loadings >0.5 are considered very significant. There are no accepted absolute standards for the cut-offs while the choice is based on judgment, purpose of the study and prior studies. Our goal is to examine the most significant loadings in interpreting the factor solution so we decided

to eliminate attributes with loadings smaller than 0.5. Under these criteria three attributes were eliminated (the attribute concerning whether the site uses formal language, the attribute concerning whether the submitted requests or the results of the elaboration are easy to store locally or print and the attribute concerning whether the FAQ section of the portal covered completely the topic the citizen was interested in) while another one attribute revealed its connection to a different dimension than the one it was appointed to, in the first place. This attribute concerned the speed that the forms are downloaded which shifted from the dimension of 'Functionality of the interaction environment' to 'Reliability'. Before any attribute was deleted it was screened to make sure it could not be viewed as representing a possible additional dimension, while the attribute that was moved from its intended dimension to a different dimension it correlated more highly, was screened in order to ensure that it has conceptual relation with its new dimension. It seems that the speed that the forms are downloaded from the site is closer related to Reliability than to Efficiency as far as the citizens are concerned. We then resubmitted the remaining items to a second round of factor analysis where we reached a meaningful factor structure where each item was found to load strongly on only one factor (Table 5.5).

Table 5.5. Principal Components Analysis (Second Study)

Factor Analysis' Items' Loadings				
	Components			
	Factor 1 - Efficiency	*Factor 2 - Reliability*	*Factor 3 - Citizen Support*	*Factor 4 – Trust*
Ease of Use				
Structur	.768			
SearchEn	.721			
SiteMap	.777			
Customiz	.883			
Content & Appearance of Information				
INDetail	.873			
INPrecis	.744			
INUp2Dat	.543			
INReleva	.729			

Functionality of the interaction environment				
FRFastAp		.687		
FRPreFil	.616			
FRAutoFil	.648			
FRHelp	.669			
Reliability				
SiteAvai		.683		
SRSucces		.699		
SRInTime		.595		
FastDown		.909		
BrowsCom		.783		
Citizen Support				
HDIntere			.830	
HDAnswer			.888	
HDKnowle			.972	
HDTrust			.873	
Trust				
SafeCode				.760
PDMinim				.892
PDSafety				.782
PDUse				.788

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.
Rotation converged in 6 iterations.
Total variance explained by the four factors: 69.066%
Loadings<.30 not shown
The above results derived by SPSS software package

The factor analysis revealed four factors with eigenvalues >1, while the scree test concurred with a four factor solution, not six as proposed initially by the authors. The cumulative variance explained by all four factors account for 70% of the variance with most factor loadings above 0.60.

It seems that 'Ease of Use', 'Content and Appearance of Information' and 'Functionality of the Interaction Environment' are closely related to citizens. Attributes derived from the dimensions 'Ease of Use', 'Functionality of the interaction environment' and 'Content & Appearance of Information' loaded on the same dimension - which was renamed 'Efficiency' - reflecting the ease of using the site and the quality of information it provides. After reviewing the remaining dimensions we made certain that they all consist of more than 3 attributes as suggested by Cronbach and Mehl (1955) and

recommended by Kim and Mueller (1978) - the shortest dimension had four attributes and we checked for discriminant validity problems by making sure that there are no attributes that correlate more highly with attributes measuring different dimensions than they do with items in their intended dimension (Campbell et al., 1959; Goodhue, 1998).

Table 5.6. Refined Preliminary Scale

Efficiency	This portal's structure is clear and easy to follow
	This portal's search engine is effective
	This portal's site map is well organized
	This portal is well customized to individual users' needs
	The information displayed in this portal is appropriate detailed
	The information displayed in this portal is accurate
	The information displayed in this portal is fresh
	The information displayed in this portal is relevant
	Automatic recalling of user's personal data within portal's forms is satisfactory
	The level of automatic calculation within portal's forms is satisfactory
	Information about field's completion in this portal is enough
Reliability	Forms in this portal are downloaded in short time
	This portal is available and accessible whenever you need it
	This portal performs the service successfully upon first request
	This portal provides services in time
	Portal's pages are downloaded quickly enough
	This portal works properly with your default browser
Citizen Support	Employees showed a sincere interest in solving users' problem
	Employees give prompt replies to users' inquiries
	Employees have the knowledge to answer users' questions
	Employees have the ability to convey trust and confidence
Trust	Acquisition of username and password in this portal is secure
	Only necessary personal data are provided for authentication on this portal
	Data provided by users in this portal are archived securely
	Data provided in this portal are used only for the reason submitted

Discriminant validity of the questionnaire was assessed using exploratory factor analysis, ensuring that each dimension loads on separate factor.

The outcome of the above process was an instrument consisting of 25 attributes, loading strongly on four dimensions (Table 5.6).

5.2.3 Data collection (second round)

Another round of data collection allowed further assessment of the factor structure and the measurement validity of the final version of the instrument. Specifically in this part of research we reconfirmed the refined scale's reliability and validity by using the 25-item questionnaire derived from the first round.

In this stage we administered the revised questionnaire to a random sample of Internet users through an online survey. A total of 1365 Internet users were contacted but only the ones who had previous experience with e-government sites, were considered as qualified respondents. The rest were encouraged not to take the survey. Qualified respondents were asked to list the three e-government sites with which they were most familiar with and then to evaluate the one they use the most. By that way we collected evaluations of sites with high popularity - they were the most visited e-government sites - and at the same time very different in terms of types, variety and quality of services they provide.

For the second round of data collection we used the refined preliminary scale Table 5.6). Apart of the 25 attributes of the questionnaire loading on to 4 dimensions there was also a more general set of four questions, with each statement inspecting the citizen's feelings concerning every dimension of the site under examination. An additional question asked the citizens for an overall rate of the site under evaluation. Two more questions checked the citizens' intentions to reuse the site for collecting information and for on-line submission. Finally another question asked the respondents to rank the four dimensions of the refined preliminary scale as general characteristics related with e-government sites and the services they provide and in the end of course some demographic and usage questions. Appendix IV contains the above described questionnaire.

To collect the data, respondents were directed to a Web site containing the revised questionnaire, which they then self administered. This process yielded a total of 264 completed questionnaires. This sample size exceeded the conventional requirement that about five observations per scale item are needed for conducting factor analyses (Hair, Anderson, Tatham & Black, 1998; Stevens, 1996).

Table 5.7. Demographic Information (second data collection)

What is your gender?	
Male	52.7%
Female	47.3%
What is your age?	
Less than 16	0.4%
16-25	9.6%
26-35	54.4%
36-45	28.4%
46-55	6.1%
56-65	0.8%
More than 65	0.4%
Please indicate the highest level of education completed	
PhD Degree	14.1%
Masters Degree	32.4%
Bachelors Degree	40.5%
High School Diploma	12.2%
Gymnasium Diploma	0.8%
Which of the following categories best describes your professional status?	
Pupil	0.4%
University/College Student	10.7%
Academic Faculty	1.1%
Government Employee	29.5%
Private Sector Employee	25.7%
Free Lancer	29.9%
Unemployed	2.7%
Retired	0.0%

Which of the following categories best describes the duration you access the web within a week?	
More than 20	46.9%
11-20 hours	17.2%
6-10 hours	17.2%
1-5 hours	15.6%
Less than an hour	3.1%
How frequently do you visit an e-government site?	
Daily	11.5%
At least once a week	26.1%
At least once a month	44.4%
At least once per year	18.0%
List the three e-government sites with which you are most familiar with*	
Internal Revenue Service	67.2%
Ministries/General Secretariats	67.2%
Citizen Service Center	38.8%
Social Security Institute	17.2%
Municipalities	10.8%
Supreme Council for Civil Personnel Selection	9.6%
National Printery	6.8%
Prefectures	3.6%
Other	21.2%
What were you primarily looking for on this portal?*	
Information	70.5%
On-line submission	52.9%

* Multiple Response Questions (percent of cases)

Respondents that comprised of citizens that had visited at least an e-government site, answered the online survey between 19th of November 2007 and 28th of February 2008. The demographic profile of survey respondents indicated a mature group of Internet users who were very familiar with both web-usage and e-government transactions. Among the 264 respondents 52.7 % were male while 47.3% were female. Ages of respondents varied, but were much older than student-based surveys with 10 % of the respondents being under the age of 25, 54.4% ranging from 26 to 35; 28.4% were ages 36-45 and 6.1% ranging from 46 to 55 and 1.2% were over age 56. A very large portion, 87 % of the respondents had at least college education while 46.6% had at least Masters Degree; 29.9% was working as free lancers, 29,5% was working for public sector and 25.7% was working as private sector employees. Use of the Internet was heavy among the participants with 46.9% of the respondents surfing in Internet more than 20 hours per week. The 82% of the survey respondents visit an e-government site at least once a month, while the e-government sites mostly visited are the Internal Revenue Site together with Ministries/General Secretariats sites; 70.5% of the respondents visit an e-government site looking for information, while 52.9% for conducting an on-line submission. The characteristics of the respondents also for the second survey were similar to Internet user profiles gathered in other studies (Kehoe, Pitkow, Sutton, Aggarwal & Rogers, 1999). In this survey just like in the first one no monetary or bonus was given to the respondents, while the responses were purely voluntary. Table 5.7 summarizes some of the demographic information collected.

5.2.4 Data analysis-Scale reduction (second round)

The reliability of the final questionnaire was calculated using Cronbach's alpha (Cronbach, 1951). As presented on Table 5.8 reliability scores were 0.880, 0.855, 0.938 and 0.804, for efficiency, reliability, citizen support and trust respectively. The overall reliability of the e-GovQual scale was 0.97. The coefficient alpha values exceed the minimum standard of 0.7 suggested by Nunnally & Bernstein (1994), suggesting that the measures are reliable. Also coefficient alpha is estimated as an indication of how the sample of items performs in capturing the construct.

Table 5.8. Constructs' Cronbach's Alpha values

Constructs	*Coefficient Alphas*
Efficiency	0.880
Reliability	0.855
Citizen Support	0.938
Trust	0.804
Overall (25 item scale)	0.970

As further evidence of the validity of the e-GovQual construct, its four dimensions and their 25 attributes, we examined the relationship 1) between the dimensions' scale ratings and the ratings of their respective attributes and 2) between the citizens' overall quality ratings for the e-government site and the dimensions' scale ratings. The former is on Appendix V while Table 5.9 summarizes the results of the latter, reporting the correlation matrix along with variables' means and standard deviations.

Table 5.9. Correlations among items and among constructs and descriptive statistics

	Site Efficiency	*Site Reliability*	*Site Citizen Support*	*Site Trust*	*Site Evaluation*	*Service ReuseInt*	*Info ReuseInt*
SiteEfficiency							
SiteReliability	0.564						
SiteCitizenSupport	0.451	0.402					
SiteTrust	0.440	0.505	0.470				
SiteEvaluation	0.514	0.547	0.405	0.473			
ServiceReuseInt	0.438	0.475	0.235	0.432	0.293		
InfoReuseInt	0.505	0.321	0.392	0.333	0.245	0.501	
Mean	3.48	3.57	3.12	3.62	2.93	4.06	4.03
St. Deviation	0.858	0.859	1.071	0.955	0.989	1.075	0.963

We next conducted confirmatory factor analysis to examine whether the second data set supports the construct extracted from the study of the first data set as well as to fine tune the final questionnaire. In confirmatory factor analysis (CFA), a finding that indicators have high loadings on the predicted factors indicates convergent validity. In an

oblique rotation, discriminant validity is demonstrated if the correlation between factors is not so high (ex., > 0.85) as to lead one to think the two factors overlap conceptually. With 31 questions in the initial questionnaire and a rule of thumb for factor analysis of at least five times as many observations as there are variables to be analyzed (Hair, Anderson, Tatham & Black, 1998; Stevens, 1996), at least 155 subjects were required. The 264 respondents of our survey quite exceeded the mentioned limit.

We used principal components analysis as the extraction method and Promax rotation method with Kaiser normalization (Costello and Osborne, 2005) (Table 5.10).

The factor analysis of the second data set supports the construct extracted from the study of the first data set. The four factors account for 54.667% of the variance with most factor loadings above 0.7. The strong loadings of the scale items on their corresponding factors together with the values of the coefficient alpha support the convergent validity of each scale's construct. All the attributes loaded on the same dimensions as they did with the first data set. Each attribute was found to load to only one dimension and there were no 'crossloading' items. Since we are examining the most significant loadings we may as well eliminate four attributes with loadings <0.5 from the Efficiency construct. These attributes concern the precision and the relevancy of the information provided, the automatic recalling of users' personal data and the level of automatic calculation within e-government site's forms.

Discriminant validity assesses the degree that two measures designed to measure conceptually different constructs are related. A low to moderate correlation is considered evidence of discriminant validity. Also, if some items correlate more highly with items measuring different constructs than they do with items in their intended construct (Goodhue, 1998) is evidence of discriminant validity problems. As a final check on discriminant validity we tested all possible pairs of the 4 constructs during confirmatory factor analysis to see if fit was improved when any pair collapsed into a single construct.

Convergent validity refers to the degree to which two measures designed to measure the same construct are related. Convergence is found if two measures designed to assess the same construct are highly correlated. If a measure of a concept is valid, then correlations between that measure and a second measure of the same construct must be

Table 5.10. Principal Components Analysis (Scale Verification)

Factor Analysis' Items' Loadings				
	Components			
	Factor 1 - Efficiency	*Factor 2 - Reliability*	*Factor 3 - Citizen Support*	*Factor 4 – Trust*
Efficiency				
Structur	.579			
SearchEn	.791			
SiteMap	.712			
Customiz	.815			
INDetail	.688			
INPrecis	.454			
INUp2Dat	.570			
INReleva				
FRPreFil				
FRAutoFil				
FRHelp	.537			
Reliability				
FRFastAp		.765		
SiteAvai		.804		
SRSucces		.588		
SRInTime		.614		
FastDown		.876		
BrowsCom		.730		
Citizen Support				
HDIntere			.768	
HDAnswer			.906	
HDKnowle			.890	
HDTrust			.902	
Trust				
SafeCode				.711
PDMinim				.754
PDSafety				.772
PDUse				.782

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.
Rotation converged in 5 iterations.
Total variance explained by the four factors: 54.667%
Loadings<.40 not shown
The above results derived by SPSS software package

significantly different from zero and sufficient large (Hinkin, 1998). Also a finding that indicators have high loadings on the predicted factors indicates convergent validity.

Predictive validity is demonstrated by testing the ability of the instrument to accurately predict a Web's visitor intention to revisit the e-gov site. E-GovQual was also tested both for convergent and predictive validity.

5.3 e-GovQual model and Scale

The various statistical analyses described on the previous section, revealed considerable correlation among items representing several of the original six dimensions of the preliminary model. In particular, the correlations suggested consolidation of three dimensions into one broader dimension labeled *efficiency*. The remaining dimensions – *reliability, trust* and *citizen support* – remained intact throughout the scale development and refinement process. Table 5.11 shows the correspondence between the original six dimensions and e-GovQual's four dimensions.

Table 5.11: Correspondence between e-GovQual's dimensions and original six dimensions of the preliminary model for evaluating e-government service quality

	e-GovQual's Dimensions			
Original six dimensions for evaluating e-government service quality	*Efficiency*	*Reliability*	*Trust*	*Citizen Support*
Ease of Use *Content & Appearance of Information* *Functionality of the interaction environment*	▨			
Reliability		▨		
Trust			▨	
Citizen Support				▨

The outcome of the above process was the e-GovQual model (Fig. 5.2) and scale (Table 5.12), consisting of 21 attributes, loading strongly on four dimensions.

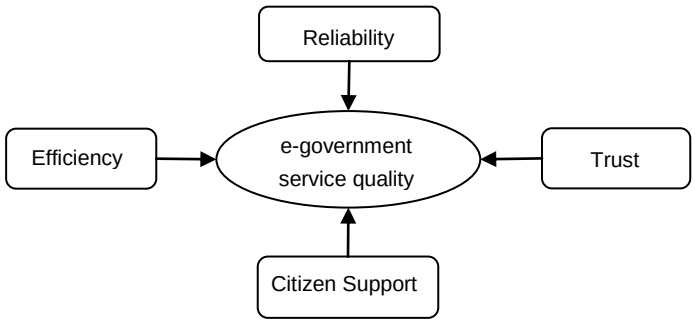

Figure 5.2. e-GovQual model

Efficiency: The ease of using the site and the quality of information it provides (7 items). More analytical this dimension takes into account the clear and easy to follow structure of the site (ClearStructure), the effectiveness of the site's search engine (SearchEngine), how well the site's map is organized (SiteMap), how well the site can be customized to individual user's needs (Customization), whether the information displayed in the site is appropriate detailed (InfoDetail), whether the information provided by the site is 'fresh' (InfoUpToDate) and finally whether there is enough information about the site's fields' completition (FormHelpInformation).

Trust: The degree to which the citizen believes the site is safe from intrusion and protects personal information (4 items). This dimension refers to the degree that the acquisition of username and password in the site is secure (SecureUsername-Password), the amount of personal data required for authentication on the e-gov site (PersonalDataMinimumProvision), whether data provided by users in the site are archived securely (DataProvidedSafety) and whether data provided by the citizens are used only for the reason they were submitted on the first place (DataProvidedUse).

Reliability: The feasibility and speed of accessing, using and receiving services of the site (6 items). More detailed this dimension is comprised of the speed of downloading

forms from the e-gov site (FormFastDownload), whether the site is available and accessible whenever the citizen needs it (SiteAvailability), the extent to which the site performs the service successfully upon first request (ServiceSuccessful), whether the services provided by the site are in time (PerformServiceInTime), how fast the site's pages are downloaded (SiteFastDownload) and finally whether the e-gov site works properly with any default browser (BrowserCompatibility).

Citizen Support: The ability to get help when needed (4 items). This final dimension deals with the interaction of the citizen with the employees of the site's Help Desk while experiencing some difficulties in their interaction with the e-gov site. It refers to the interest shown by the employees in solving the citizen's problem (HelpDeskInterest), whether the employees give prompt replies to users' inquiries (HelpDeskPromtReply), whether the employees have the knowledge to answer the users' questions (HelpDeskKnowledge) and finally to the ability the employees have to convey trust and confidence (HelpDeskTrust).

The scale items of the e-GovQual scale are depicted in Table 5.12.

Table 5.12: e-GovQual Scale

Efficiency
1. This e-government site's structure is clear and easy to follow.
2. This e-government site's search engine is effective.
3. This e-government site's site map is well organized.
4. This e-government site is well customized to individual users' needs.
5. The information displayed in this e-government site is appropriate detailed.
6. The information displayed in this e-government site is fresh.
7. Information about field's completion in this e-government site is enough..
Trust
1. Acquisition of username and password in this e-government site is secure.
2. Only necessary personal data are provided for authentication on this e-government site.
3. Data provided by users in this e-government site are archived securely.
4. Data provided in this e-government site are used only for the reason submitted.

Reliability
1. Forms in this e-government site are downloaded in short time.
2. This e-government site is available and accessible whenever you need it.
3. This e-government site performs the service successfully upon first request.
4. This e-government site provides services in time.
5. E-government site's pages are downloaded quickly enough.
6. This e-government site works properly with your default browser.
Citizen Support
1. Employees showed a sincere interest in solving users' problem.
2. Employees give prompt replies to users' inquiries.
3. Employees have the knowledge to answer users' questions.
4. Employees have the ability to convey trust and confidence.

5.4 Conclusions

Informed by insights from the extant literature, we set out to conceptualize, construct, refine, and test a multiple-item scale (e-GovQual) for measuring the service quality delivered by governmental web sites. E-GovQual is a four-dimensional, 21 item scale. We hope that it will assist practitioners in systematically assessing and improving the service quality provided by governmental web sites. Through understanding the service quality dimensions for governmental sites, an organization will stand a much better chance of gaining and serving much more citizens. Furthermore, the four-dimension measurement scale adds to extant literature by establishing a basis for further theoretical advances on service quality related to the electronic service provision to the citizens. We next offer directions for further research on the field and discuss practical implications of our findings.

The scale demonstrates good psychometric properties based on findings from a variety of reliability and validity tests. E-GovQual's development was based on the responses of citizens that actually use governmetal sites. While the citizens, participating in the survey, are typical users of e-government sites their preferences do not necessarily represent the preferences of the non users of e-government sites as well. So, further

research with samples of citizens that are potential users of e-government sites should follow in order to reveal their reservations in using the web, for their transactions with the state. In addition the participants in this study may possess attributes and behaviors that differ from those in other parts of the world. Further research should be conducted in more mature sites that can fulfill a request electronically while with the site that we chose only submission of a request takes place. Finally the generalizability of the study is limited due to its exploratory design and the case selection criteria.

6 e-GovQual Instrument for Inquiry Method

6.1 Introduction

After having concluded to an e-government service quality model and all the evaluation criteria that affect the service delivered we wanted to provide IT managers and practitioners with an instrument that can serve as a useful diagnostic tool in order to measure and improve service delivery.

Quality indicators have been introduced in e-government service to evaluate the quality delivered to citizens. To achieve this goal, a selection of a range of quality indicators appropriate for e-government service was made. Quality evaluation models in e-government usually encompass several quality criteria, and each criterion is further split into numerous sub-criteria. However, how to best balance these indicators is an important issue. An incomplete measurement model can result in inappropriate actions that may harm organizations' e-government service delivery. When choosing an appropriate range of service quality measures, it is necessary to balance these measures, to ensure that one quality criterion, sub-criterion or a set of criteria or sub-criteria, is not emphasized to the detriment of the others. Moreover, the quality indicators selected must be measurable, and allow practitioners to monitor service quality.

As described by Xenos, Dermitzioti and Pierrakeas in 2004 the methods used for assessing the quality of a web site were derived from Usability Testing area and can be divided into three categories: inquiry, inspection and testing methods.

In this thesis we propose two measurement models for evaluating e-government service quality (one for inquiry and one for inspection method), and generate quality

indicators to assist practitioners in identifying the strong and weak points of service delivery.

This chapter describes the development of the e-GovQual instrument for inquiry method. Our model analyses the relationships between quality criteria and sub-criteria for assessment with a multi-attribute decision analysis method. Using the e-GovQual scale developed in Chapter 5, our statistical sample is based on citizens' preferences for the evaluation of an ideal e-government site. To accurately evaluate the influence of the evaluation criteria we used the Analytic Hierarchy Process (AHP). AHP is a flexible multi-criteria decision-making method used to effectively synthesize the judgments given by a team of experts in order to make better decisions in complex settings where both tangible and intangible criteria are considered (Saaty, 1990).

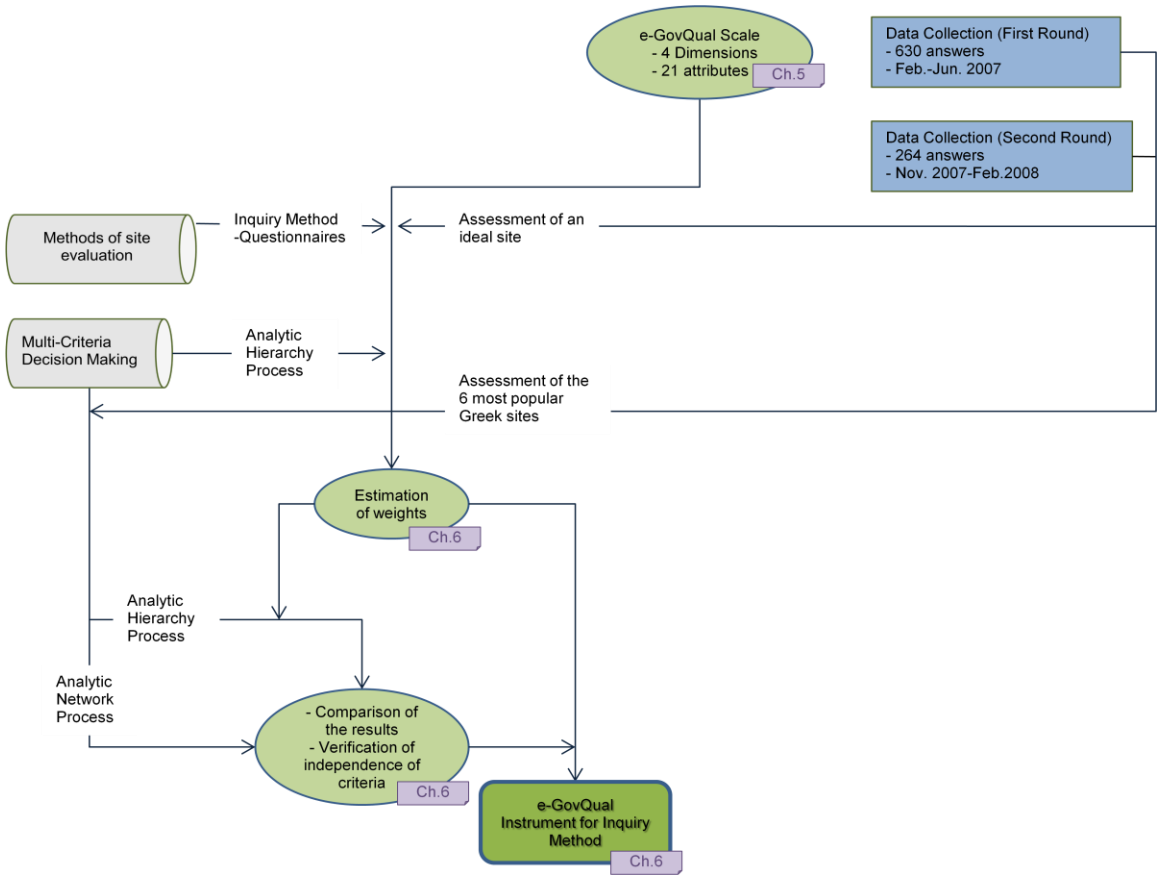

Figure 6.1. Development of e-GovQual instrument for inquiry method.

Furthermore, we apply our model to the evaluation of the six most popular Greek e-government sites. Moreover, in order to test the possible existence of interrelationships among evaluation elements, we also apply the Analytic Network Process (ANP) method, another multi-criteria method that does not require a uni-directional hierarchical relationship and incorporates feedback and interdependent relationships among elements (Saaty, 1996). Finally we compare the results of the two methods as described in Figure 6.1. Our results show no interrelations between evaluation criteria of the model.

6.2 Usability Testing - Questionnaires

As described in the literature in order to evaluate a product, usability testing is a technique used to do so. Usability testing focuses on measuring a human-made product's capacity to meet its intended purpose. Usability testing can be divided into three categories: inquiry, inspection, and formal usability testing. While the first and last involve real users, the second does not.

In the context of Web site and interface assessment, inquiry involves requesting information about a particular site from the users. Inquiry methods are methods that require user participation but not a usability laboratory. These methods are implemented after the users have used the web sites in their own environment under real use conditions. Methods of inquiry include focus groups, interviews, questionnaires, and surveys. Interviews and focus groups are generally conducted at early stages of product or site development, while surveys and questionnaires are generally used later on. Questionnaires are written lists of questions that you distribute to your users. Questionnaires differ from surveys in that they are written lists, not ad hoc interviews, and as such require more effort on the part of your users to fill out the questionnaire and return it to you (Foddy, 1993; Lessler, 1989; Oppenheim, 1992).

With inspection methods like heuristic evaluation and cognitive walkthrough, a site’s designers and information specialists serve as testers and subjects, often putting themselves in the place of the user to perform various tasks using the site. Unlike inquiry and formal usability testing, these forms of assessment do not enlist the participation of actual users. In cognitive walkthrough, experts attempt to accomplish typical user tasks

with a given interface. Heuristic evaluation involves usability experts checking elements of an interface against a checklist of heuristics, or design principles (Nielsen, 1993; Nielsen & Mack, 1994). Basically, in heuristic evaluation experts scrutinize the interface and evaluate each element of the interface against a list of commonly accepted principles--heuristics. The purpose of this method is to save time and money over testing.

In formal usability testing, users are observed using a site, or prototype, to perform given tasks or achieve a set of defined goals. This method involves employing experiments to gather specific information about a design. Formal usability testing was first used in experimental psychology, and originally involved the gathering and analysis of large quantities of data. Today, however, it is more concerned with interpretation and rapid, useful results rather than amassing large bodies of quantitative data. Dumas and Redish (1993) discuss five facets of formal usability testing: (1) the goal is to improve the usability of the interface; (2) testers represent real users; (3) testers perform real tasks; (4) user behavior and commentary are observed and recorded; and (5) data are analyzed to recognize problems and suggest solutions. Applied to Web site interfaces, this test method not only results in a more usable site, but also allows the site design team to function more efficiently, since it replaces opinion with user-centered data. A formal usability test typically involves introducing the interface, asking the user to attempt a set of tasks, observing the human-computer interaction that takes place and evaluating the results to identify design problems exposed by the interaction (Rubin, 1994; Hom, 1998).

In the methodology proposed in this thesis we will employ inquiry and inspection methods since they are more flexible and less cost demanding methods than formal usability testing method. More precisely we will propose the use of questionnaires as far as the inquiry methods are concerned in this chapter and heuristic evaluation as far as inspection methods are concerned in Chapter 7.

The questionnaires are written lists of questions that you distribute to your users. We have already formulated questions about the quality of e-government sites based on the type of information we want to know in the previous chapters (Appendix II and IV). e-GovQual model and scale encompasses several quality criteria, and each criterion is further split into numerous sub-criteria.

6.3 Multi-Criteria Approaches in web-site quality and e-Government Quality

Multi-Criteria Decision Analysis (MCDA) is a discipline aimed at supporting decision makers faced with making numerous and sometimes conflicting evaluations. MCDA aims at highlighting these conflicts and deriving a way to come to a compromise in a transparent process.

Some of the most recent applications of MCDA to the quality of websites include e.g. web site satisfaction benchmarking analysis using an extension of Multi-criteria Satisfaction Analysis method (Grigoroudis, Litos, Moustakis, Politis & Tsironis, 2006); evaluation of the success of Web portals by benchmarking user perceived impact using Simple Additive Weighting method (Delic and Lenz 2008); assessment of the multiple dimensions which might affect user satisfaction from a web portal (Manouselis & Sampson, 2004); citizen satisfaction from e-government web sites (Verdegem & Verleye, 2009); assessment of accessibility of federal e-government sites (Jaeger, 2006); a model for measuring user satisfaction of a Dutch municipal site (Van Den Haak, De Jong & Schellens, 2009) and analysis of e-government websites in order to produce relevant rankings (Rorissa and Demissie, 2010).

The aim of the present study is to improve the criteria and sub-criteria weighting process in e-government site quality by means of MCDA methods. All attempts that have been made so far present a wide range of methods and techniques. Linear Goal programming approaches haven't met a wide acceptance in relevant evaluations as their trend to handle problems with large numbers of variables, constraints and objectives is not so useful for evaluation problems that examine specific criteria and alternatives. It is also a fact that their ability to set weights to the various elements examined could be done by methods like AHP and ANP in a more simple way.

Among all the MCDA techniques widely used to prioritize alternatives many comparisons have revealed that both the AHP and the ANP possess a number of benefits over the other MCDA methods, such as: (i) they provide a realistic description of the problem, (ii) they support group decision-making, (iii) they soundly structure the decision-making process, (iv) they incorporate both quantitative and qualitative factors,

(v) they clearly express the relative importance of factors, (vi) they allow the decision makers to focus on each small part of the problem, (vii) they facilitate the evaluation of alternative scenarios, by supporting what if and sensitivity analysis. For the above mentioned reasons we have concluded to AHP and ANP methods.

Analytic hierarchy process (AHP) was first proposed by Thomas L. Saaty in 1971 and was published in 1980 (Saaty, 1980). It has been widely applied in areas such as multiple criteria decision making and has become a popular application for performance evaluation. AHP works well under the assumption of the independence of criteria. According to Saaty (2000), AHP is based on the three following principles: (1) The experts define the elements of the problem (i.e. decision criteria) and arrange them in the form of a hierarchy of objectives with parent elements in a given level connected to their children elements in a level below. The top level of the hierarchy represents the goal of the problem, while the bottom level contains the alternatives that can be chosen to maximize the objective. The first and the last level are connected through a series of intermediate levels, which represent the sub-criteria and other concerns in which the goal is decomposed. (2) The experts assess (i.e. weight) the relative importance of criteria, sub-criteria and alternatives with respect to the elements in the higher level to which they are connected. (3) All the judgments throughout the structure are used to derive corresponding priority scales that are then synthesized to determine the overall priorities of the alternatives.

As decision making becomes more complicated, a relationship of interdependence and feedback may arise among criteria. If we neglect such relationship (like AHP), errors are more likely to occur in the evaluation results. Therefore, in order to avoid the drawback mentioned above, Saaty developed Analytic Network Process (ANP) that simultaneously takes into account both the relationships of feedback and dependence (Saaty, 1996).

As shown in Figure 6.2(a), a strict hierarchical structure of the evaluation criterion required by AHP is presented in which A, B, and C represent the objective of the decision making process, criteria, and sub-criteria, respectively. However, ANP does not require such a strict hierarchical structure. As shown in Figure 6.2(b), the arrows pointing to each other between B and D indicate that an external interdependent or feedback relationship

exists. In addition, an arrow pointing to B indicates an internal interdependent relationship among the evaluation criteria within B.

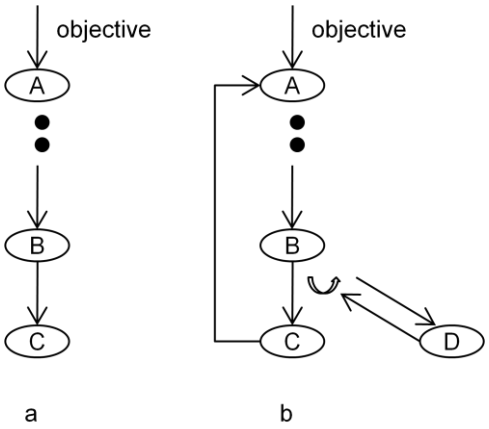

Figure 6.2. The different frameworks for AHP and ANP (Saaty, 1996).

As shown in Table 6.1, the distinctions are obvious between AHP and ANP with regard to the relationship among such things as criteria, hierarchy framework, feedback relationship, and method of weight calculation.

As described by Saaty and Vargas (2006), if we wish to require that the priorities of the alternatives should not be influenced by the number or quality of other alternatives, or if the criteria are not attributes directly related to the alternatives, then we use the AHP. In other words, in the ANP the control criteria are attributes of the alternatives and their priorities depend on the alternatives directly whereas in the AHP indirectly (by comparing them with respect to a higher criterion or goal influenced by any existing or ideal alternative). In AHP one answers the question: "How important is criterion 1 compared to criterion 2 with respect to the goal?" while in ANP criteria are prioritized by asking how important they are in the alternatives being considered.

Therefore, in this thesis we use AHP in order to study the importance of the evaluation criteria involved and develop our proposed quality assessment model. Moreover, in order to test the possible existence of interrelationships among evaluation criteria, we apply AHP and ANP methods to the evaluation of the six most popular Greek e-government sites and compare the results of the two methods.

Specific studies have approached the evaluation of e-government website quality based on AHP as a multi criteria decision method. More specifically, Dominic, Jati, Sellappan and Nee (2011) approach the problem in a more technical way measuring and examining the websites via web diagnostic tools. Based on those tools it examines a wide range of criteria but it misses all these quality criteria that cannot be measured in a strict technical way. Zhu, Du and Han (2007) try to establish specific evaluation criteria by Delphi method and calculate the relative weights while Bueyuekoezkan and Ruan (2007) present a framework of website quality evaluation for measuring the performance of government websites. Finally, Ngai (2003) proposes a selection of web sites for online advertising using AHP.

Table 6.1. Differences between AHP and ANP

Characteristics	*AHP*	*ANP*
Relationship among the criteria	The criteria must be independent	The interdependent relationships among criteria are permitted
Hierarchy framework	Linear framework	Nonlinear network framework
Feedback relationship	No feedback relationship is feasible	Feedback relationship can be examined
Method of weights calculation	Step 1: Generate the pairwise comparison matrix Step 2: Find the maximum eigenvalue lmax of the pairwise comparison matrix Step 3: Calculate the eigenvector with respect to lmax Step 4: Normalize the eigenvector to get the relative weights	Step 1: Generate the supermatrix Step 2: Find the weighted supermatrix in accordance with the column stochastic principle Step 3: Find the limited weighted supermatrix to get the relative weights

There are several studies that also apply ANP method to a variety of subjects. In the study of Hsieh, Lin and Lin (2008) ANP method is applied for the research of customer's expectation of service quality in hot spring hotels in Taiwan. Another

approach is presented by Tsai, Chou and Lai (2010), in which Analytic Network Process method is applied on national park websites.

Furthermore, specific studies (Cortes-Aldana, Garcia-Melón, Fernández-de-Lucio, Aragones-Beltrán & Poveda-Bautista, 2009; Aragones-Beltran, Pastor-Ferrando, Garcia-Garcıa & Pascual-Agullo, 2010; Promentilla, Furuichi, Ishii & Tanikawa, 2006; Yang, Huang and Chuang, 2008) do apply both ANP and AHP comparing and analyzing the results and the effectiveness of its method.

6.4 Estimation of the Weights with the Use of AHP

After having identified the quality evaluation criteria for assessing e-government service quality performance in Chapter 5 we formulated the framework shown in Figure 6.3.

The framework can be divided into three levels. The first level is the overall goal. The criteria (dimensions of e-GovQual) for evaluating the performance of an e-government website are listed in the second level; these criteria are independent. Each criterion has several sub-criteria (attributes of e-GovQual) that are listed in the third level. We assume that the relationship between the second level and the third level is a strict hierarchical structure in each and every criterion of the proposed framework.

After building the AHP-based framework, pairwise comparisons are performed. As shown in Figure 6.3, the relationship between factors in the first and second levels (part A) and between the sub-criteria of each criterion in the third level and respective criterion of the second level follow a strict hierarchical structure. Therefore, the AHP approach was applied once to part A and four times, once for every criterion of the proposed framework, in part B.

In this step, citizens' opinions were used in order to perform pairwise comparisons and identify the interrelationships among the criteria and sub-criteria. These interrelationships provide the foundation for prioritizing improvement efforts when attempting to maximize the return from performance improvement activities. More precisely, questionnaires were filled by a sample of 467 citizens-users of Greek e-government web sites. The data we used was the scores regarding the ideal e-government

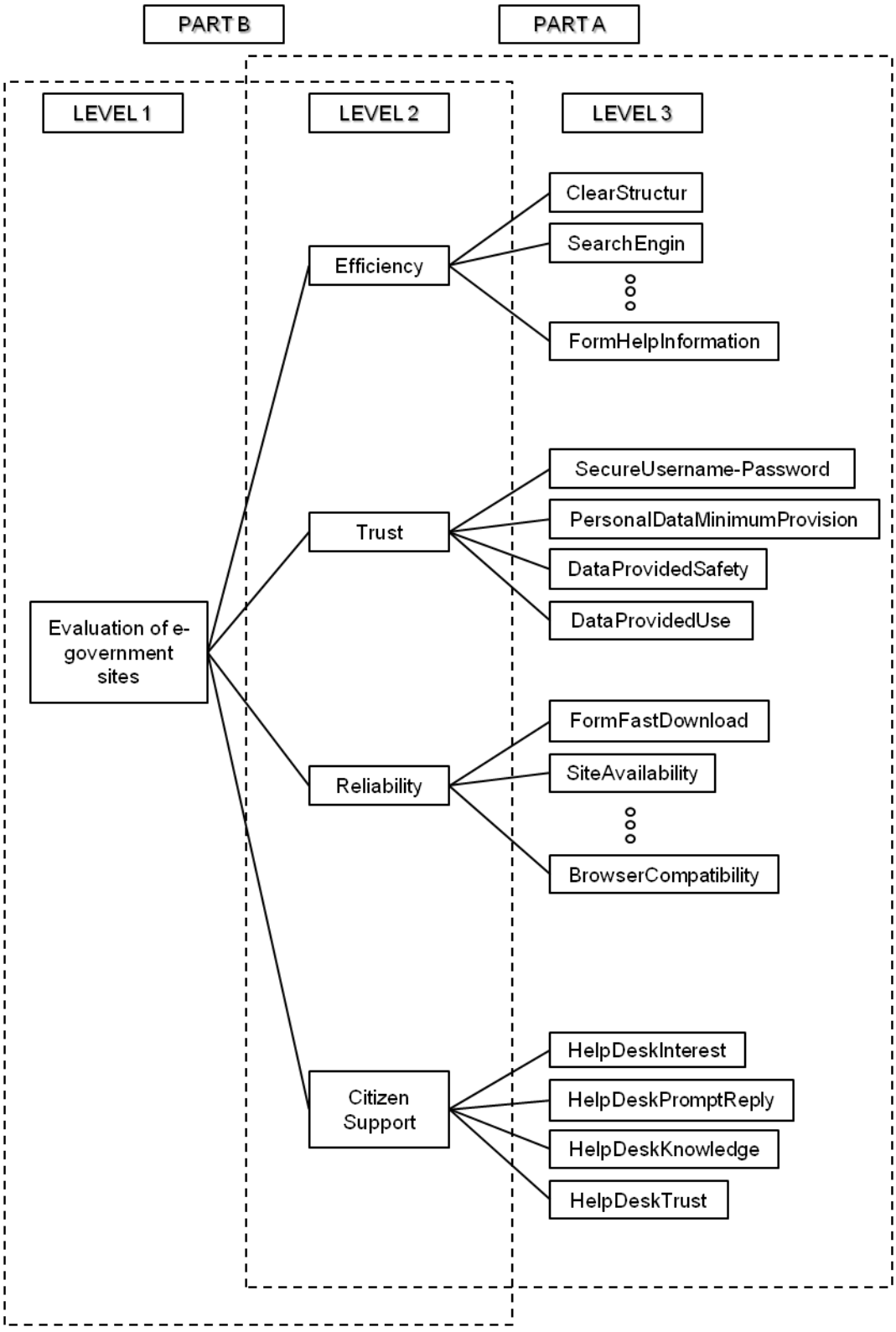

Figure 6.3. The AHP- based framework for evaluating e-government service quality.

web site. In that way we construct separately comparison matrices of the criteria and sub-criteria of our model.

Saaty's 1-9 scale (Saaty, 2005) was utilized to gauge answers, in which 1 indicates "equal importance", 3 indicates "moderate importance", 5 indicates "strong importance", 7 indicates "very strong importance" and 9 indicates "extreme importance". Even numbered values fall in between importance levels.

Table 6.2 presents an example of pairwise comparison.

Table 6.2. Pairwise comparison (E-Efficiency; T-Trust; R-Reliability, CS-Citizen Support).

In order to achieve most the efficient e government web-site, which criteria should be emphasized more?																		
	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	
E									*									T
										*								R
										*								CS
T										*								R
									*									CS
R										*								CS

Table 6.3 shows the comparison matrix. The criteria in level 2 are compared in terms of their contribution to achieving the primary objective. After each element is compared, a paired comparison matrix (A) is formed (Table 6.3).

Table 6.3. Pairwise comparison matrix A (E-Efficiency; T-Trust; R-Reliability, CS-Citizen Support).

	E	*T*	*R*	*CS*
E	1	1	½	½
T	1	1	½	1
R	2	2	1	1
CS	2	1	1	1

The matrix $\boldsymbol{A}$ can be defined by:

$$\boldsymbol{A} = \begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{bmatrix}, \qquad (6.1)$$

where n is the order of matrix.

It is important in that point to examine the consistency property in the pairwise comparison by the procedure as following (Saaty 2005):

- Build the normalized pairwise comparison matrix A'

$$\boldsymbol{A'} = \begin{bmatrix} a_{11}' & a_{12}' & \cdots & a_{1n}' \\ a_{21}' & a_{22}' & \cdots & a_{2n}' \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1}' & a_{n2}' & \cdots & a_{nn}' \end{bmatrix}, \tag{6.2}$$

and

$$a_{ij}' = \frac{a_{ij}}{\sum_{i=1}^{n} a_{ij}} \text{ for } i, j = 1, 2, \ldots, n, \tag{6.3}$$

- Then we calculate the eigenvalue and the eigenvector

$$\boldsymbol{W} = \begin{bmatrix} w_1 \\ w_2 \\ \vdots \\ w_n \end{bmatrix}, \text{ and } w_i = \frac{\sum_{i=1}^{n} a_{ij}'}{n} \text{ for } i = 1, 2, \ldots, n, \tag{6.4}$$

$$\boldsymbol{W'} = \boldsymbol{AW} = \begin{bmatrix} w_1' \\ w_2' \\ \vdots \\ w_n' \end{bmatrix}, \tag{6.5}$$

and

$$\lambda_{max} = \frac{1}{n}\left(\frac{w_1'}{w_1} + \frac{w_2'}{w_2} + \cdots + \frac{w_n'}{w_n}\right) \tag{6.6}$$

where W is the eigenvector, wi is the eigenvalue of criterion I, and λmax is the largest eigenvalue of the pairwise comparison matrix.

- Finally we check the consistency property.

More specifically, CI is the consistency index, CR is the consistency ratio, λmax is the largest eigenvalue of the pairwise comparison matrix, n is the matrix order, and RI

is random index. Table 6.4 shows a set of recommended RI values presented by Saaty (Saaty 2005).

Table 6.4. Random index.

N	2	3	4	5	6	7	8	9	10
RI	0	0.52	0.89	1.11	1.25	1.35	1.40	1.45	1.49

When CR > 0.10 for a matrix larger than 4x4, it indicates an inconsistent judgment. In that point, decision makers should revise the original values in the pairwise comparison matrix. Table 6.5 presents the results for the proposed example.

Table 6.5. The eigenvector and CR value.

W	*W'*	
0.131	0.169	λmax =4.005
0.192	0.205	CI= (4.005-4)/(4-1)=0.0017
0.222	0.338	CR=0,0017/0.9=0.0019
0.455	0.288	

Since CR IS <0.1, the comparison matrix in the example is consistent. The eigenvectors and consistent ratios for the sub-criteria of the respective upper level criteria (efficiency, trust, reliability, citizen support), are given in Table 6.6.

Table 6.6. The relative importance weights of criteria and sub-criteria

Efficiency CR=0.072	*0.169*	*Trust CR=0.074*	*0.205*	*Reliability CR=0.099*	*0.338*	*Citizen Support CR=0.037*	*0.288*
Structur	0.126	SafeCode	0.204	FRFasrAp	0.109	HDIntere	0.120
SearchEng	0.126	PDMinim	0.085	SiteAvai	0.382	HDAnswer	0.191
SiteMap	0.061	PDSafety	0.204	SRSucces	0.158	HDKnowle	0.418
Customiz	0.315	PDUse	0.507	SRInTime	0.047	HDTrust	0.271
INDetail	0.210			FastDown	0.225		
InUp2Dat	0.037			BrowsCom	0.079		
FRpreFil	0.116						

The weights of each sub-criterion (DCW) in Table 6.6 are obtained by using the AHP approach between the sub-criteria of each criterion in the third level and respective

criterion of the second level, while the weights of each criterion (CW) are obtained by using AHP approach in level 1 and level 2.

6.5 Check for Interrelationships Among Criteria/ Evaluation of the Six Most Popular Greek e-government sites

6.5.1 Case illustration

The online survey of Papadomichelaki and Mentzas (2008) for e-government in Greece, reveal the 6 most visited Greek e-government sites. Moreover, these sites cover the great majority of the 20 basic public e-services as published by European Commission (EU Commission, 2002).

In this study the above mentioned six e- government web sites are utilized to illustrate the application of the proposed evaluation model as depicted in Table 6.7:

Table 6.7. Description of the six e-government studies of the case study.

Institution	*URL*	*Description*
KEP	www.kep.gov.gr	This web site represents the citizen service centres of Greece and provides a broad number of certificates
ASEP	www.asep.gr	This web site represents the Supreme Council for Civil Personnel Selection.
TAXIS	www.taxisnet.gr	This web site represents the General Secretariat for Information Systems. In the website citizens may get information on financial, fiscal and customs issues, as well as on issues pertaining to payroll and retirement.
YPEPTH	www.ypepth.gr	This web site represents the Ministry of Education, Lifelong learning and Religious Affairs.
YPES	www.opengov.gr/ypes	This web site represents the Ministry of the Interior, Decentralization & E-government.
IKA	www.ika.gr	This web site represents the Social Security Organisation in Greece. IKA is the largest social security organisation in Greece and it covers 5,530,000 workers and employees and provides 830,000 pensioners with retirement pension

6.5.2 Calculation and results of the e-government service quality ratings by AHP

The data was collected from the sample of the 467 citizens- users. The citizens- users set scores regarding each web site examined by our study. The evaluation model proposed in Chapter 6 section composes the questionnaire. The measures are determined by applying a five point Likert scale. The scale has integer values between 1 and 5, where 1 indicates "low performance", 3 indicates "moderate performance", and 5 indicates "high performance". Even values fall between performance level. Respectively all the scores given below follow the same scale.

Table 6.8. Unweighted scores of e-government web-site performance.

Criteria	*Sub- criteria*	*Scores*					
		KEP	*TAXIS*	*YPES*	*YPEPTH*	*ASEP*	*IKA*
Efficiency	Structur	3,72	3,55	3,30	3,83	3,20	3,88
	SearchEng	3,54	3,03	2,80	3,09	3,00	3,71
	SiteMap	3,69	3,17	3,00	3,08	3,60	3,17
	Customiz	3,38	2,73	2,30	2,91	2,67	3,25
	INDetail	3,61	3,43	3,20	3,50	3,25	3,63
	InUp2Dat	3,86	3,82	3,60	2,83	4,20	3,50
	FRpreFil	3,72	3,70	3,22	3,25	3,22	4,00
Trust	SafeCode	3,83	3,97	4,00	4,20	3,25	4,33
	PDMinim	3,92	4,06	3,14	4,00	4,11	3,88
	PDSafety	3,76	3,55	3,50	3,83	3,56	4,00
	PDUse	3,72	3,50	2,71	3,33	2,89	3,20
Reliability	FRFasrAp	3,94	3,85	3,63	3,50	3,33	4,00
	SiteAvai	4,16	4,11	3,90	3,92	4,40	4,38
	SRSucces	3,74	4,02	3,44	3,11	4,10	4,17
	SRInTime	3,77	3,84	3,00	3,00	3,60	4,29
	FastDown	4,08	3,89	3,86	4,00	4,00	4,25
	BrowsCom	4,28	4,15	4,00	4,36	4,10	4,38
Citizen Support	HDIntere	3,97	3,55	4,00	3,67	4,00	3,67
	HDAnswer	3,78	3,83	3,50	4,00	4,00	3,67
	HDKnowle	3,74	3,77	3,50	4,25	4,00	3,67
	HDTrust	3,78	3,72	2,50	4,25	4,50	3,67

Table 6.8 presents the unweighted mean performance of each sub-criterion of all e-government sites as given by the citizens.

The weights of each sub-criterion (*DCW*) are obtained by using the AHP approach between the sub-criteria of each criterion in the third level and respective criterion of the second level (Table 6.6), and the weights of each criterion (*CW*) are obtained by using the AHP approach in level 1 and level 2 (Table 6.5).

Overall performance of each e-government web-site is calculated by using the following procedure: First a sub- criterion (DCS) is combined with a total weighted score of each criterion and is formulated as follows (Table 6.9):

$$CS_{ij} = \sum_{j=1}^{4} \sum_{k=1}^{m} DCS_{ijk} DCW_{jk}\,, \qquad (6.7)$$

where:

CSij indicates the total weighted score of criterion j (j=1,…,m) of web site i;

DCSij , the score of sub-criterion k of criterion j of web site i;

DCWjk , the weighted value of sub-criterion k of criterion j;

i, the number of web sites (i = 1,…,6);

j, the number of criteria (j = 1,2,3,4);

k, the number of sub-criteria (k = 1, . . . ,m); and

m indicates the total number of a sub-criterion k with respect to an upper criterion j.

Table 6.9. Total weighted scores of each criterion (CS) - AHP.

Criterion	*KEP*	*TAXIS*	*YPES*	*YPEPTH*	*ASEP*	*IKA*
Efficiency	3,57	3,19	2,88	3,20	3,11	3,52
Trust	3,77	3,65	3,17	3,67	3,20	3,65
Reliability	4,04	4,01	3,75	3,76	4,08	4,27
Citizen Support	3,79	3,74	3,29	4,13	4,14	3,67

Then the final weighted score for overall performance (OP) (Table 6.10) can be formulated as follows:

$$OP_i = \sum_{j=1}^{6} CS_{ij} CW_j\,, \qquad (7.8)$$

where:

OPi indicates the weighted score of the overall performance of web site i and CWj , indicates the weighted value of criterion j.

Table 6.10. Total final weighted scores and overall performance - AHP.

Criterion	*KEP*	*TAXIS*	*YPES*	*YPEPTH*	*ASEP*	*IKA*
Efficiency	0.60	0.54	0.49	0.54	0.53	0,60
Trust	0.77	0.75	0.65	0.75	0.66	0.75
Reliability	1.37	1.36	1.27	1.27	1.38	1.45
Citizen Support	1.09	1.08	0.95	1.19	1.19	1.06
Overall performance (OP)	3.83	3.73	3.36	3.75	3.76	3.86

6.5.3 Calculation and results of the e-government service quality ratings by ANP

Finally, in order to address the AHP's limitation on the interdependence among the evaluation criteria we applied ANP to confirm that there is no any dependent and feedback relationship.

In order to handle the interdependence characteristics in the ANP, Saaty in 1996 introduces the "supermatrix". In the supermatrix, each element is represented at one row and one respective column. The computed eigenvector of the sub-elements with respect to their parent element is placed to the column representing the parent element and the rows representing the sub-elements.

$$W = \begin{bmatrix} W_{11} & W_{12} & \cdots & W_{1n} \\ W_{21} & W_{22} & \cdots & W_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ W_{n1} & W_{n2} & \cdots & W_{nn} \end{bmatrix} \quad (6.9)$$

where,

$$W_{ij} = \begin{bmatrix} W_{i1}^{(j1)} & W_{i1}^{(j2)} & \cdots & W_{i1}^{(jni)} \\ W_{i2}^{(j1)} & W_{i2}^{(j2)} & \cdots & W_{i2}^{(jni)} \\ \vdots & \vdots & \ddots & \vdots \\ W_{ini}^{(j1)} & W_{ini}^{(j2)} & \cdots & W_{ini}^{(jni)} \end{bmatrix} \quad (6.10)$$

Moreover, if the column sum of any column in the composed supermatrix is greater than 1 (there are more than one eigenvector), that column will be normalized. Such a supermatrix is called as weighted supermatrix.

The limit supermatrix is obtained by raising the weighted supermatrix to powers by multiplying it by itself. When the column of numbers is the same for each column, the limit matrix has been reached, and the matrix multiplication process is halted. The values of this limit matrix are the desired priorities of the elements of the decision network with respect to the goal.

The ANP based framework used in this study can be divided into three levels, as presented in Figure 6.4.

- First level: The first level is the framework goal, which is the evaluation and raking of e-government sites.
- Second level: The second level consists of the four criteria chosen for evaluating e-government sites, Efficiency, Trust, Reliability and Citizen Support.
- Third level: The third level consists of the twenty one sub-criteria.

The elements listed in the second level are interrelated (Part A). In order to analyse the importance of the relationship among the interrelated sub-criteria we assume that the relationship between the elements of stage 3 and 2 (Part B) is interrelated only among the sub-criteria of the same criterion. As a result, the analytic network process (ANP) is applied five times. The process involves two stages.

Stage 1

At first, the ANP method is applied among the sub-criteria of each criterion (Part B), in order to calculate the weight of each sub-criterion. Before moving to stage 2, we follow the next two steps for every web site, in order to calculate the score of every e-government web site's criterion:

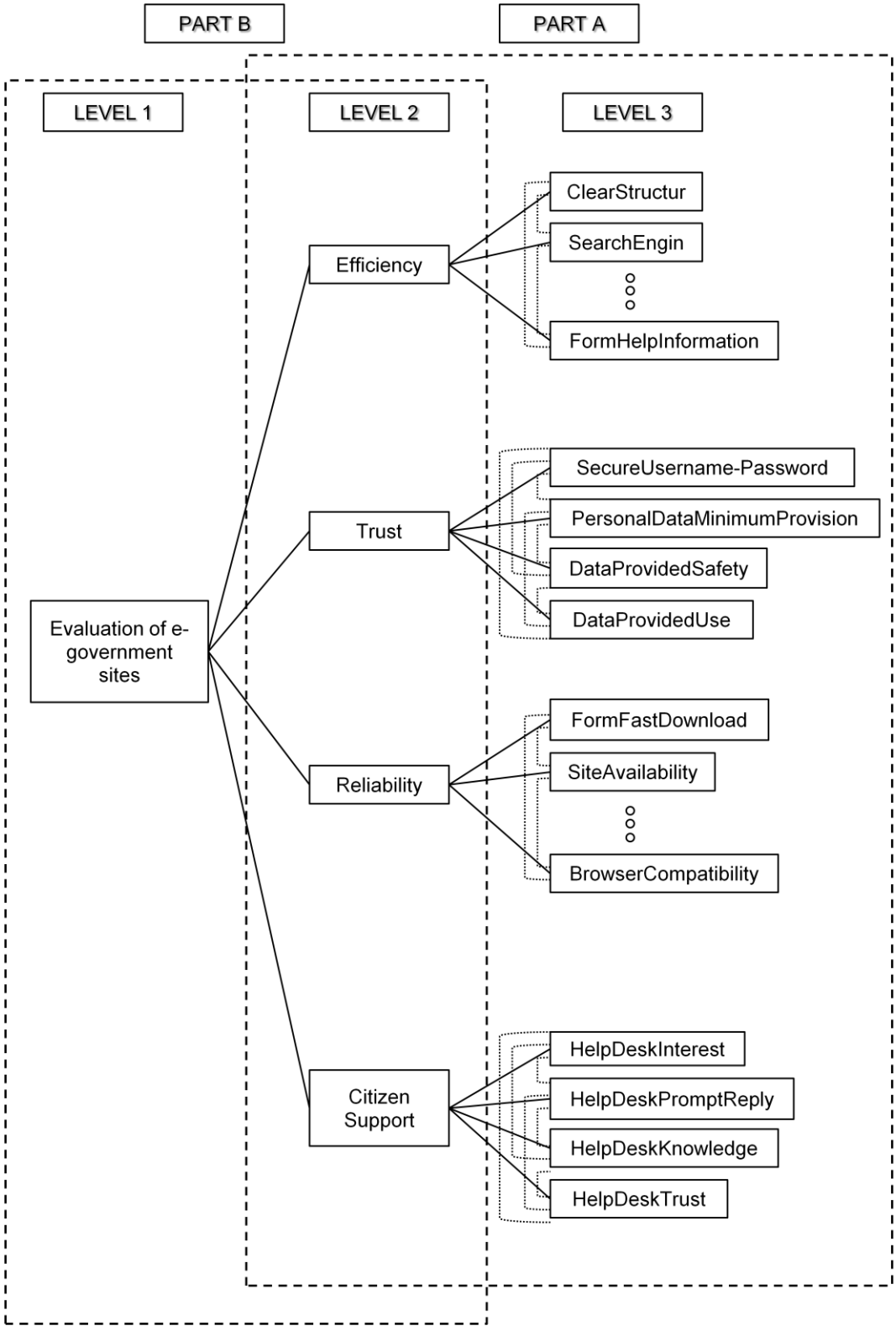

Figure 6.4. The ANP- based framework for evaluating e-government service quality.

1. First, we multiply the weight of each sub-criterion with the the respective score, that citizens have set. In this way, the normalized scores of the sub-criteria are gained.
2. Then, we add the normalized scores of the sub-criteria of each criterion in order to gain the scores needed.

At this stage, we apply the ANP method to the subcriteria that each criterion consists of.

The supermatrix and the limit supermatrix that comes up after each application of the ANP method are shown in Tables 6.11-6.18.

ANP – Efficiency

Table 6.11 Efficiency Supermatrix

	KEP	*TAXIS*	*YPES*	*YPEPTH*	*IKA*	*ASEP*	*Clear Structure*	*Search Engine*	*Site Map*	*Customi-zation*	*Info Detail*	*Info UpTo Date*	*Clear Structure*
KEP	0,00	0,00	0,00	0,00	0,00	0,00	0,19	0,26	0,38	0,35	0,24	0,20	0,21
TAXIS	0,00	0,00	0,00	0,00	0,00	0,00	0,11	0,11	0,12	0,10	0,12	0,17	0,20
YPES	0,00	0,00	0,00	0,00	0,00	0,00	0,07	0,05	0,05	0,04	0,06	0,10	0,06
YPEPTH	0,00	0,00	0,00	0,00	0,00	0,00	0,26	0,14	0,07	0,16	0,22	0,04	0,07
IKA	0,00	0,00	0,00	0,00	0,00	0,00	0,32	0,37	0,12	0,27	0,28	0,09	0,39
ASEP	0,00	0,00	0,00	0,00	0,00	0,00	0,05	0,08	0,27	0,07	0,08	0,40	0,06
Clear Structure	0,18	0,16	0,19	0,38	0,25	0,09	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Search Engine	0,07	0,06	0,06	0,09	0,16	0,05	0,00	0,00	0,00	0,00	0,00	0,00	0,00
SiteMap	0,11	0,06	0,08	0,08	0,04	0,19	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Customi-zation	0,05	0,04	0,03	0,05	0,05	0,04	0,00	0,00	0,00	0,00	0,00	0,00	0,00
InfoDetail	0,10	0,12	0,15	0,21	0,11	0,12	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Info UpToDate	0,31	0,32	0,35	0,04	0,09	0,40	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Clear Structure	0,19	0,24	0,14	0,15	0,30	0,11	0,00	0,00	0,00	0,00	0,00	0,00	0,00

Table 6.12 Efficiency Limit Supermatrix

	KEP	*TAXIS*	*YPES*	*YPEPTH*	*IKA*	*ASEP*	*Clear Structure*	*Search Engine*	*Site Map*	*Customi-zation*	*Info Detail*	*Info UpTo Date*	*Clear Structure*
KEP	0,24	0,24	0,24	0,24	0,24	0,24	0,00	0,00	0,00	0,00	0,00	0,00	0,00
TAXIS	0,15	0,15	0,15	0,15	0,15	0,15	0,00	0,00	0,00	0,00	0,00	0,00	0,00
YPES	0,07	0,07	0,07	0,07	0,07	0,07	0,00	0,00	0,00	0,00	0,00	0,00	0,00
YPEPTH	0,13	0,13	0,13	0,13	0,13	0,13	0,00	0,00	0,00	0,00	0,00	0,00	0,00
IKA	0,26	0,26	0,26	0,26	0,26	0,26	0,00	0,00	0,00	0,00	0,00	0,00	0,00
ASEP	0,16	0,16	0,16	0,16	0,16	0,16	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Clear Structure	0,00	0,00	0,00	0,00	0,00	0,00	0,21	0,21	0,21	0,21	0,21	0,21	0,21
Search Engine	0,00	0,00	0,00	0,00	0,00	0,00	0,09	0,09	0,09	0,09	0,09	0,09	0,09
SiteMap	0,00	0,00	0,00	0,00	0,00	0,00	0,09	0,09	0,09	0,09	0,09	0,09	0,09
Customi-zation	0,00	0,00	0,00	0,00	0,00	0,00	0,04	0,04	0,04	0,04	0,04	0,04	0,04
InfoDetail	0,00	0,00	0,00	0,00	0,00	0,00	0,13	0,13	0,13	0,13	0,13	0,13	0,13
Info UpToDate	0,00	0,02	0,00	0,00	0,00	0,00	0,24	0,24	0,24	0,24	0,24	0,24	0,24
Clear Structure	0,00	0,00	0,00	0,00	0,00	0,00	0,20	0,20	0,20	0,20	0,20	0,20	0,20

ANP – Trust

Table 6.13 Trust Supermatrix

	KEP	*TAXIS*	*YPES*	*YPEPTH*	*IKA*	*ASEP*	*SecureUsername Password*	*PersonalData Minimum rovision*	*DataProvided Safety*	*DataProvided Use*
KEP	0,00	0,00	0,00	0,00	0,00	0,00	0,17	0,21	0,31	0,41
TAXIS	0,00	0,00	0,00	0,00	0,00	0,00	0,10	0,21	0,09	0,23
YPES	0,00	0,00	0,00	0,00	0,00	0,00	0,10	0,04	0,06	0,05
YPEPTH	0,00	0,00	0,00	0,00	0,00	0,00	0,25	0,13	0,17	0,13
IKA	0,00	0,00	0,00	0,00	0,00	0,00	0,34	0,09	0,24	0,10
ASEP	0,00	0,00	0,00	0,00	0,00	0,00	0,04	0,32	0,12	0,08
SecureUsername-Password	0,26	0,32	0,53	0,41	0,52	0,17	0,00	0,00	0,00	0,00
PersonalData MinimumProvision	0,45	0,45	0,16	0,29	0,17	0,52	0,00	0,00	0,00	0,00
DataProvidedSafety	0,17	0,14	0,25	0,20	0,24	0,24	0,00	0,00	0,00	0,00
DataProvidedUse	0,12	0,09	0,07	0,10	0,08	0,08	0,00	0,00	0,00	0,00

Table 6.14 Trust Limit Supermatrix

	KEP	*TAXIS*	*YPES*	*YPEPTH*	*IKA*	*ASEP*	*SecureUsername-Password*	*PersonalData Minimum Provision*	*DataProvided Safety*	*DataProvided Use*
KEP	0,24	0,24	0,24	0,24	0,24	0,24	0,00	0,00	0,00	0,00
TAXIS	0,15	0,15	0,15	0,15	0,15	0,15	0,00	0,00	0,00	0,00
YPES	0,07	0,07	0,07	0,07	0,07	0,07	0,00	0,00	0,00	0,00
YPEPTH	0,18	0,18	0,18	0,18	0,18	0,18	0,00	0,00	0,00	0,00
IKA	0,21	0,21	0,21	0,21	0,21	0,21	0,00	0,00	0,00	0,00
ASEP	0,16	0,16	0,16	0,16	0,16	0,16	0,00	0,00	0,00	0,00
SecureUsername-Password	0,00	0,00	0,00	0,00	0,00	0,00	0,35	0,35	0,35	0,35
PersonalData MinimumProvision	0,00	0,00	0,00	0,00	0,00	0,00	0,35	0,35	0,35	0,35
DataProvidedSafety	0,00	0,00	0,00	0,00	0,00	0,00	0,20	0,20	0,20	0,20
DataProvidedUse	0,00	0,00	0,00	0,00	0,00	0,00	0,09	0,09	0,09	0,09

ANP – Reliability

Table 6.15 Reliability Supermatrix

	KEP	*TAXIS*	*YPES*	*YPEPTH*	*IKA*	*ASEP*	*FormFast Download*	*Site Availability*	*Service Successful*	*Perform Service*	*Site Fast Down-load*	*Browser Compatibility*
KEP	0,00	0,00	0,00	0,00	0,00	0,00	0,24	0,19	0,14	0,23	0,23	0,17
TAXIS	0,00	0,00	0,00	0,00	0,00	0,00	0,18	0,12	0,19	0,17	0,08	0,11
YPES	0,00	0,00	0,00	0,00	0,00	0,00	0,10	0,06	0,08	0,04	0,08	0,07
YPEPTH	0,00	0,00	0,00	0,00	0,00	0,00	0,07	0,06	0,05	0,04	0,13	0,28
IKA	0,00	0,00	0,00	0,00	0,00	0,00	0,35	0,29	0,28	0,41	0,34	0,28
ASEP	0,00	0,00	0,00	0,00	0,00	0,00	0,05	0,29	0,26	0,10	0,13	0,09
FormFast Download	0,12	0,07	0,13	0,11	0,06	0,04	0,00	0,00	0,00	0,00	0,00	0,00
Site Availability	0,24	0,31	0,27	0,19	0,26	0,38	0,00	0,00	0,00	0,00	0,00	0,00
Service Successful	0,06	0,18	0,08	0,06	0,10	0,18	0,00	0,00	0,00	0,00	0,00	0,00
Perform ServiceInTime	0,07	0,07	0,05	0,04	0,18	0,08	0,00	0,00	0,00	0,00	0,00	0,00
SiteFast Download	0,16	0,11	0,16	0,26	0,14	0,13	0,00	0,00	0,00	0,00	0,00	0,00
Browser Compatibility	0,35	0,25	0,32	0,35	0,26	0,18	0,00	0,00	0,00	0,00	0,00	0,00

Table 6.16 Reliability Limit Supermatrix

	KEP	*TAXIS*	*YPES*	*YPEPTH*	*IKA*	*ASEP*	*FormFast Download*	*Site Availability*	*Service Successful*	*Perform Service*	*Site Fast Down-load*	*Browser Compatibility*
KEP	0,19	0,19	0,19	0,19	0,19	0,19	0,00	0,00	0,00	0,00	0,00	0,00
TAXIS	0,13	0,13	0,13	0,13	0,13	0,13	0,00	0,00	0,00	0,00	0,00	0,00
YPES	0,07	0,07	0,07	0,07	0,07	0,07	0,00	0,00	0,00	0,00	0,00	0,00
YPEPTH	0,13	0,13	0,13	0,13	0,13	0,13	0,00	0,00	0,00	0,00	0,00	0,00
IKA	0,31	0,31	0,31	0,31	0,31	0,31	0,00	0,00	0,00	0,00	0,00	0,00
ASEP	0,17	0,17	0,17	0,17	0,17	0,17	0,00	0,00	0,00	0,00	0,00	0,00
FormFast Download	0,00	0,00	0,00	0,00	0,00	0,00	0,08	0,08	0,08	0,08	0,08	0,08
Site Availability	0,00	0,00	0,00	0,00	0,00	0,00	0,27	0,27	0,27	0,27	0,27	0,27
Service Successful	0,00	0,00	0,00	0,00	0,00	0,00	0,11	0,11	0,11	0,11	0,11	0,11
Perform ServiceInTime	0,00	0,00	0,00	0,00	0,00	0,00	0,10	0,10	0,10	0,10	0,10	0,10
SiteFast Download	0,00	0,00	0,00	0,00	0,00	0,00	0,16	0,16	0,16	0,16	0,16	0,16
Browser Compatibility	0,00	0,00	0,00	0,00	0,00	0,00	0,28	0,28	0,28	0,28	0,28	0,28

ANP - Citizen Support

Table 6.17 Citizen Support Supermatrix

	KEP	*TAXIS*	*YPES*	*YPEPTH*	*IKA*	*ASEP*	*HelpDesk Interest*	*HelpDesk PromtReply*	*HelpDesk Knowledge*	*HelpDesk Trust*
KEP	0,00	0,00	0,00	0,00	0,00	0,00	0,40	0,38	0,24	0,19
TAXIS	0,00	0,00	0,00	0,00	0,00	0,00	0,06	0,10	0,10	0,08
YPES	0,00	0,00	0,00	0,00	0,00	0,00	0,20	0,05	0,05	0,03
YPEPTH	0,00	0,00	0,00	0,00	0,00	0,00	0,09	0,20	0,35	0,26
IKA	0,00	0,00	0,00	0,00	0,00	0,00	0,09	0,07	0,07	0,09
ASEP	0,00	0,00	0,00	0,00	0,00	0,00	0,16	0,20	0,18	0,35
HelpDeskInterest	0,49	0,10	0,53	0,08	0,25	0,14	0,00	0,00	0,00	0,00
HelpDeskPromtReply	0,19	0,41	0,21	0,16	0,25	0,14	0,00	0,00	0,00	0,00
HelpDeskKnowledge	0,12	0,29	0,21	0,38	0,25	0,14	0,00	0,00	0,00	0,00
HelpDeskTrust	0,19	0,20	0,06	0,38	0,25	0,57	0,00	0,00	0,00	0,00

Table 6.18 Citizen Support Limit Supermatrix

	KEP	*TAXIS*	*YPES*	*YPEPTH*	*IKA*	*ASEP*	*HelpDesk Interest*	*HelpDesk PromtReply*	*HelpDesk Knowledge*	*HelpDesk Trust*
KEP	0,30	0,30	0,30	0,30	0,30	0,30	0,00	0,00	0,00	0,00
TAXIS	0,09	0,09	0,09	0,09	0,09	0,09	0,00	0,00	0,00	0,00
YPES	0,08	0,08	0,08	0,08	0,08	0,08	0,00	0,00	0,00	0,00
YPEPTH	0,22	0,22	0,22	0,22	0,22	0,22	0,00	0,00	0,00	0,00
IKA	0,08	0,08	0,08	0,08	0,08	0,08	0,00	0,00	0,00	0,00
ASEP	0,23	0,23	0,23	0,23	0,23	0,23	0,00	0,00	0,00	0,00
HelpDeskInterest	0,00	0,00	0,00	0,00	0,00	0,00	0,27	0,27	0,27	0,27
HelpDeskPromtReply	0,00	0,00	0,00	0,00	0,00	0,00	0,20	0,20	0,20	0,20
HelpDeskKnowledge	0,00	0,00	0,00	0,00	0,00	0,00	0,21	0,21	0,21	0,21
HelpDeskTrust	0,00	0,00	0,00	0,00	0,00	0,00	0,32	0,32	0,32	0,32

In this way, the weight of every subcriterion is gained. These weights are summarized in Table 6.19.

At the next steps we estimate the scores of each criterion of each web site and the results are shown in Table 6.20.

As it can be easily seen, under each web site there are two columns in the following tables. The first column contains the scores that citizens set for each web site. The second one contains the results of the first step at Stage 1. Lastly, the last row of each table contains the sums that are calculated at the second step of Stage 1.

Stage 2

At this point the ANP method is applied to the elements of level 2 and 1 (Part A), gaining in this way the weights of every criterion. Then, in order to calculate the final scores and rank the websites, we follow two steps similar to the ones on Stage 1. More analytically, for every website:

1. We multiply the weight of each criterion with the the respective score, that citizens have set. In this way, the normalized scores of the criteria are gained.

2. Then, we add the normalized scores of each criterion in order to gain the final score of the website examined.

Table 6.19 Criteria and respective weights

CRITERIA	*WEIGHTS*
Efficiency	
1 ClearStructure	0,21
2. SearchEngine	0,09
3. SiteMap	0,09
4. Customization	0,04
5. InfoDetail	0,13
6. InfoUpToDate	0,24
7. FormHelpInformation	0,20
Trust	
1. SecureUsername-Password	0,35
2. PersonalDataMinimumProvision	0,35
3. DataProvidedSafety	0,20
4. DataProvidedUse	0,09
Reliability	
1. FormFastDownload	0,08
2. SiteAvailability	0,27
3. ServiceSuccessful	0,11
4. PerformServiceInTime	0,10
5. SiteFastDownload	0,16
6. BrowserCompatibility	0,28
Citizen Support	
1. HelpDeskInterest	0,27
2. HelpDeskPromtReply	0,20
3. HelpDeskKnowledge	0,21
4. HelpDeskTrust	0,32

At this stage we apply the ANP method to the levels two and one of the framework presented before, in order to estimate the weight of each criterion. The supermatrix and the limit Supermatrix of the application is shown in Tables 6.21 and 6.22.

Table 6.20 Scores of each criterion per web site

	KEP		*TAXIS*		*YPES*		*YPEPTH*		*IKA*		*ASEP*	
Efficiency												
ClearStructure	3,72	0,77	3,55	0,74	3,30	0,68	3,83	0,79	3,88	0,80	3,20	0,66
SearchEngine	3,54	0,33	3,03	0,28	2,80	0,26	3,09	0,28	3,71	0,34	3,00	0,28
SiteMap	3,69	0,33	3,17	0,29	3,00	0,27	3,08	0,28	3,17	0,28	3,60	0,32
Customization	3,38	0,15	2,73	0,12	2,30	0,10	2,91	0,13	3,25	0,15	2,67	0,12
InfoDetail	3,61	0,46	3,43	0,44	3,20	0,41	3,50	0,44	3,63	0,46	3,25	0,41
InfoUpToDate	3,86	0,92	3,82	0,91	3,60	0,85	2,83	0,67	3,50	0,83	4,20	1,00
SUM		3,71		3,51		3,22		3,26		3,67		3,44
Trust												
SecureUsername-Password	3,83	1,35	3,97	1,40	4,00	1,41	4,20	1,48	4,33	1,53	3,25	1,15
PersonalData MinimumProvision	3,92	1,39	4,06	1,44	3,14	1,11	4,00	1,42	3,88	1,37	4,11	1,46
DataProvidedSafety	3,76	0,76	3,55	0,72	3,50	0,71	3,83	0,77	4,00	0,81	3,56	0,72
DataProvidedUse	3,72	0,34	3,50	0,32	2,71	0,25	3,33	0,30	3,20	0,29	2,89	0,26
SUM		3,84		3,88		3,48		3,98		4,00		3,58
Reliability												
FormFastDownload	3,94	0,33	3,85	0,32	3,63	0,30	3,50	0,29	4,00	0,33	3,33	0,28
SiteAvailability	4,16	1,14	4,11	1,13	3,90	1,07	3,92	1,08	4,38	1,2	4,40	1,21
ServiceSuccessful	3,74	0,41	4,02	0,44	3,44	0,37	3,11	0,34	4,17	0,45	4,10	0,44
PerformService InTime	3,77	0,37	3,84	0,38	3,00	0,30	3,00	0,3	4,29	0,42	3,60	0,36
SiteFastDownload	4,08	0,63	3,89	0,6	3,86	0,60	4,00	0,62	4,25	0,66	4,00	0,62
BrowserCompatibility	4,28	1,2	4,15	1,16	4,00	1,12	4,36	1,22	4,38	1,22	4,10	1,15
SUM		4,07		4,03		3,75		3,83		4,29		4,06
Citizen Support												
HelpDeskInterest	3,97	1,07	3,55	0,96	4,00	1,08	3,67	0,99	3,67	0,99	4,00	1,08
HelpDeskPromtReply	3,78	0,75	3,83	0,76	3,50	0,69	4,00	0,79	3,67	0,73	4,00	0,79
HelpDeskKnowledge	3,74	0,8	3,77	0,81	3,50	0,75	4,25	0,91	3,67	0,78	4,00	0,86
HelpDeskTrust	3,78	1,2	3,72	1,18	2,50	0,79	4,25	1,35	3,67	1,16	4,50	1,43
SUM		3,82		3,71		3,32		4,04		3,67		4,16

Table 6.21 Stage 2 Supermatrix

	KEP	*TAXIS*	*YPES*	*YPEPTH*	*IKA*	*ASEP*	*Efficiency*	*Trust*	*Reliability*	*Citizen Support*
KEP	0,00	0,00	0,00	0,00	0,00	0,00	0,30	0,14	0,18	0,15
TAXIS	0,00	0,00	0,00	0,00	0,00	0,00	0,16	0,18	0,13	0,11
YPES	0,00	0,00	0,00	0,00	0,00	0,00	0,06	0,05	0,06	0,05
YPEPTH	0,00	0,00	0,00	0,00	0,00	0,00	0,08	0,26	0,07	0,27
IKA	0,00	0,00	0,00	0,00	0,00	0,00	0,29	0,29	0,38	0,09
ASEP	0,00	0,00	0,00	0,00	0,00	0,00	0,13	0,08	0,18	0,33
Efficiency	0,12	0,09	0,09	0,08	0,11	0,08	0,00	0,00	0,00	0,00
Trust	0,19	0,29	0,24	0,29	0,26	0,12	0,00	0,00	0,00	0,00
Reliability	0,49	0,46	0,51	0,17	0,53	0,33	0,00	0,00	0,00	0,00
Citizen Support	0,19	0,16	0,15	0,46	0,11	0,47	0,00	0,00	0,00	0,00

Table 6.22 Stage 2 LimitSupermatrix

	KEP	*TAXIS*	*YPES*	*YPEPTH*	*IKA*	*ASEP*	*Efficiency*	*Trust*	*Reliability*	*Citizen Support*
KEP	0,17	0,17	0,17	0,17	0,17	0,17	0,00	0,00	0,00	0,00
TAXIS	0,14	0,14	0,14	0,14	0,14	0,14	0,00	0,00	0,00	0,00
YPES	0,05	0,05	0,05	0,05	0,05	0,05	0,00	0,00	0,00	0,00
YPEPTH	0,17	0,17	0,17	0,17	0,17	0,17	0,00	0,00	0,00	0,00
IKA	0,27	0,27	0,27	0,27	0,27	0,27	0,00	0,00	0,00	0,00
ASEP	0,19	0,19	0,19	0,19	0,19	0,19	0,00	0,00	0,00	0,00
Efficiency	0,00	0,00	0,00	0,00	0,00	0,00	0,10	0,10	0,10	0,10
Trust	0,00	0,00	0,00	0,00	0,00	0,00	0,23	0,23	0,23	0,23
Reliability	0,00	0,00	0,00	0,00	0,00	0,00	0,41	0,41	0,41	0,41
Citizen Support	0,00	0,00	0,00	0,00	0,00	0,00	0,26	0,26	0,26	0,26

In this way we estimate the weight of each criterion and the results are shown in Table 6.23.

Table 6.23 Weights of each criterion per web site

Criteria	*KEP*	*TAXIS*	*YPES*	*YPEPTH*	*IKA*	*ASEP*
Efficiency	0,12	0,09	0,09	0,08	0,11	0,08
Trust	0,20	0,29	0,25	0,29	0,26	0,12
Reliability	0,50	0,46	0,51	0,17	0,53	0,33
Citizen Support	0,18	0,16	0,15	0,46	0,10	0,47

At the next step we estimate the final score of each e-government web site is calculated. The results of Stage 2 are shown in Table 6.24. On Table 6.24 under each cell of the web sites there are two columns. The first one contains the scores that came up on Stage 1. The second one contains the results that are calculated at the first step of Stage 2. In the last row of the table are summarised the sums that are calculated at the second step of Stage 2. We note here that since the citizens' responses were given in a scale from 1 (low performance) to 5 (high performance) the overall performance follows respectively, taking values between 1 and 5 with 5 noted as 'high performance'.

Table 6.24 ANP-Final scores

Criteria	*KEP*		*TAXIS*		*YPES*		*YPEPTH*		*IKA*		*ASEP*	
Efficiency	3,71	0,35	3,51	0,33	3,22	0,31	3,26	0,31	3,67	0,35	3,44	0,33
Trust	3,84	0,88	3,88	0,89	3,48	0,80	3,98	0,92	4,00	0,92	3,58	0,82
Reliability	4,07	1,67	4,03	1,66	3,75	1,54	3,83	1,58	4,29	1,77	4,06	1,67
Citizen Support	3,82	0,99	3,71	0,96	3,32	0,86	4,04	1,05	3,67	0,95	4,16	1,08
Overall performance (OP)		*3,91*		*3,85*		*3,51*		*3,85*		*3,99*		*3,90*

We note here that since the citizens' responses were given in a scale from 1 (low performance) to 5 (high performance) the overall performance follows respectively, taking values between 1 and 5 with 5 noted as 'high performance'.

6.5.4 Discussion of web site performance

Figure 6.5, depicts the graphical representation of overall performance as resulted by applying AHP. The overall performance of the six web sites is very good. Figure 6.5 also presents the differences between the six web sites. IKA web site has the best performance

overall and sets the highest score in Reliability. The performance of IKA web site is close to KEP web site which comes in the second place. ASEP, YPEPTH and TAXIS web sites follow with little differences among each other. YPES web site's performance is estimated at the lowest score in all 4 criteria.

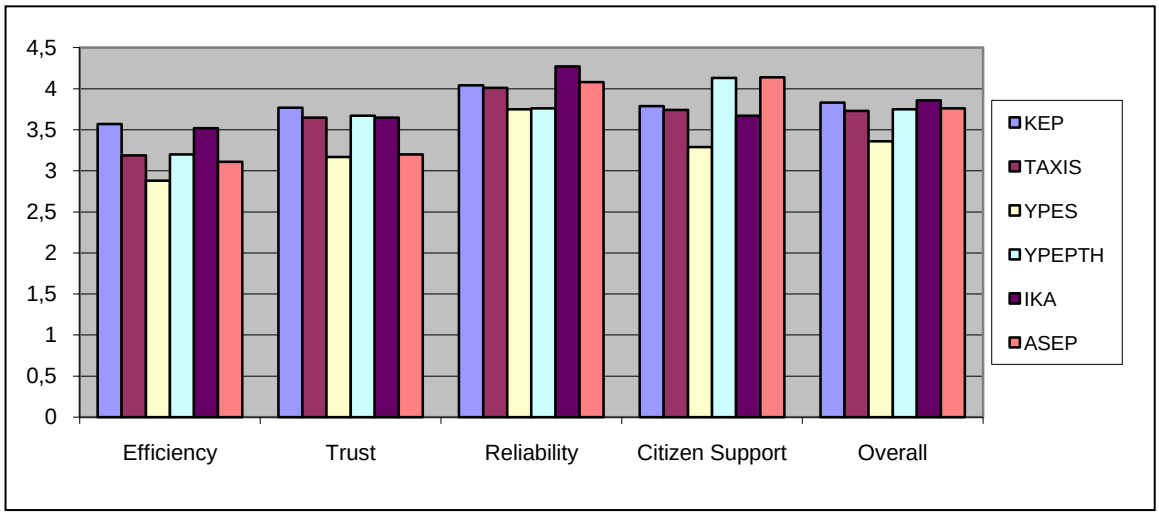

Figure. 6.5. Web sites' performance by AHP.

In order to ensure that there is no interdependence between the criteria and between the sub-criteria used in the model and the scale we also implemented ANP for the six e-government sites in our study.

As far as the weights of the criteria are concerned the order of them has came up the same in both processes. The results are shown in Figure 6.6.

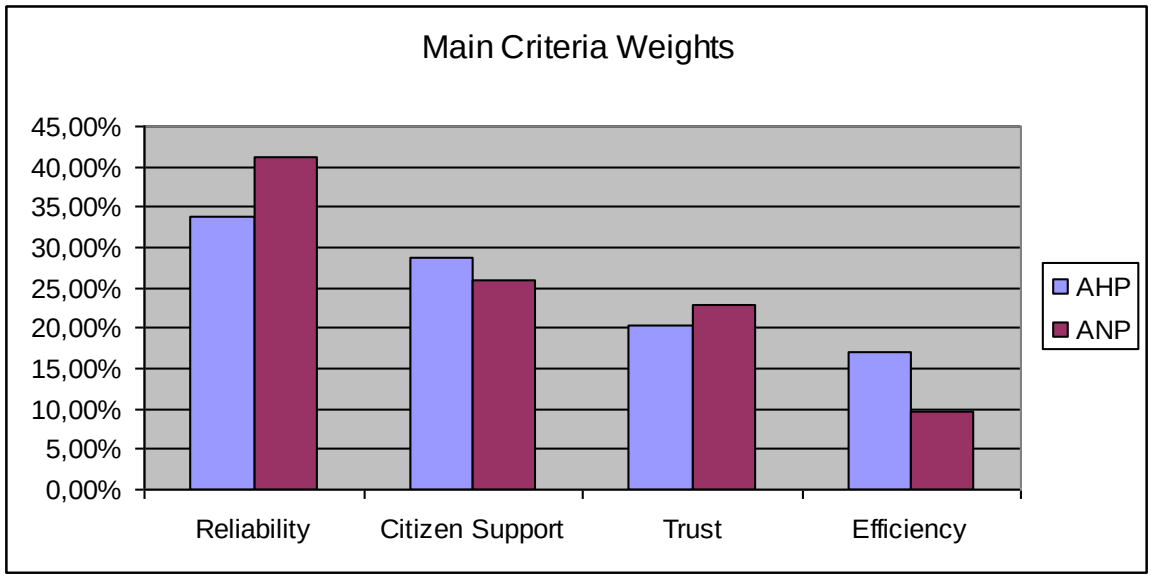

Figure 6.6. Order of criteria – AHP vs ANP.

Moreover, the application of both methods resulted in exactly the same ranking of the e-government web sites examined as shown in Figure 6.7.

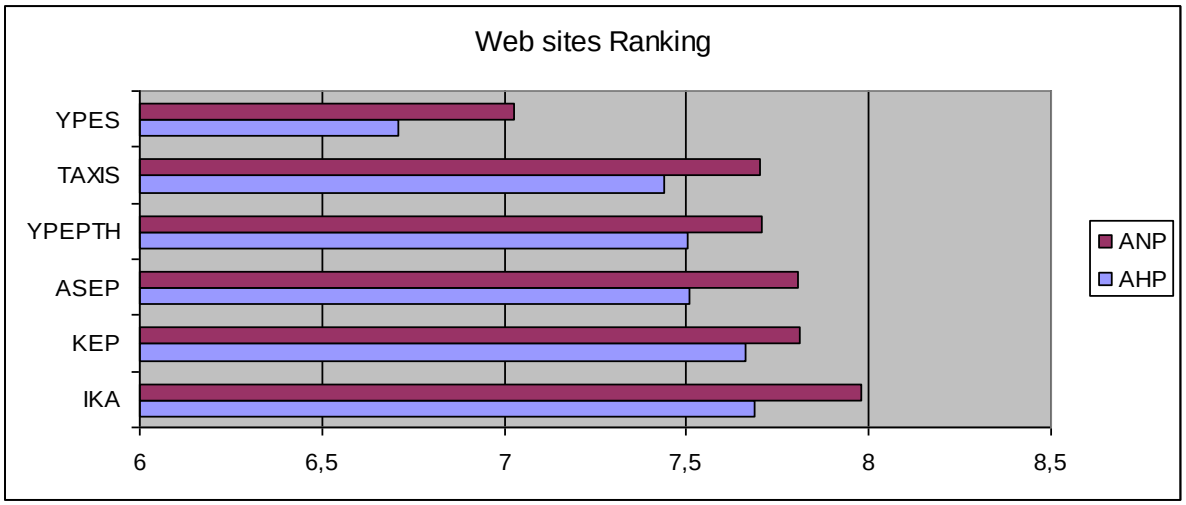

Figure 6.7. Web sites' ranking – ANP vs ANP.

The same ranking that came up for both web sites and weights of criteria proves that there aren't any relationships among the elements examined. However, this independence of the elements could not be assumed before the analysis. The application of both methods was necessary in order to arrive in that conclusion.

6.6 Conclusions

E-government service evaluation is affected by numerous factors, and the interdependence between these factors is complex. Various studies have tried to identify the factors that influence the service quality delivered by an e-government site and to assess the service delivered (Barnes & Vidgen, 2003; Eschenfelder, 2004, Loiacono, Watson & Goodhue, 2000, Papadomichelaki and Mentzas, 2009; Webb & Webb, 2004). In most of them the assessment of e-government service is qualitative and either does not address the issue of the relative importance of criteria or they assign weights in an arbitrary manner.

In this chapter, we used the analytical hierarchy process (AHP) to determine the weight of each criterion and sub-criterion (Table 6.6), detected in an e-government service quality model developed in our previous work. The citizens' preferences for an

ideal e-government site were adopted in the establishment of estimation of criteria and sub-criteria weights. These weights show the impact of each criterion and sub-criterion to the overall e-government service quality according to citizens.

We found that all of the four criteria Efficiency, Trust, Reliability and Citizen Support significantly influence citizens' evaluation of site quality. Nevertheless users of e-government considered Reliability as the most important criterion, while Citizen Support Trust and Efficiency follow in importance. The most important sub-criterion concerning Reliability was the extend that the site is available and accessible whenever the citizen needs it, while for the Citizen Support criterion the most important sub-criterion was the extend that the employees have the knowledge to answer the users' questions. In the case of Trust criterion, was whether the data provided by users in the site is used only for the reason they were submitted on the first place, whereas for Efficiency it was the extent that a site can be customized to individual user's needs.

Furthermore, in a case study with the six most popular e-government sites of Greece we applied AHP and ANP that does not require a uni-directional hierarchical relationship and incorporates feedback and interdependent relationships among elements. Our results show that the order of the criteria and the ranking of the six e-government sites came up for both methods the same something that proves that there aren't any relationships among the elements examined that could cause deviation of the analytical results. The results do not vary depending on weather criteria interrelationships are taken into account or not. However, this independence of the elements could not be assumed before the analysis. The application of both methods was necessary in order to arrive to that conclusion. Through understanding the weights of the criteria and the sub-criteria that affect e-government service quality a public organization will stand a much better chance in serving citizens.

7 e-GovQual Instrument for Inspection Method

7.1 Introduction

In this chapter we developed e-GovQual instrument for inspection method. As we described in Chapter 6 we will employ heuristic evaluation as inspection method. A heuristic is a guideline or general principle or rule of thumb that can guide a design decision or be used to critique a decision that has already been made. Heuristic evaluation, developed by Jakob Nielsen and Rolf Molich (1990), is a method for structuring the critique of a system using a set of relatively simple and general heuristics. The general idea behind heuristic evaluation is that several evaluators independently evaluate a system to come up with potential usability problems.

We modified e-GovQual scale in order to use it for heuristic evaluation method. After literature research we identified the metrics that were incorporated in the instrument and defined the way of assessment and the weights for all the evaluation criteria. The resulted instrument consisted of 3 dimensions, 15 attributes and 50 metrics. This instrument was implemented on 50 websites of public authorities, which belong to 5 European countries (Greece, United Kingdom, Ireland, Malta and Finland). The websites assessed were providing the 12 basic public services to citizens as defined by European Commission (EU Commission, 2002).

The first goal of this chapter was the development of an instrument for inspection method. The second goal was the classification of the 5 countries according to their ratings and the comparison of the results with Cap Gemini's results. In that way we examine the convergent validity of our scale which illustrates the extent to which the measure correlates highly with other measures designed to measure the same construct.

Another goal was to evaluate the websites and to estimate if they were suitable for the 12 services for the citizens as they are announced by the European Commission. The whole process is depicted on Figure 7.1.

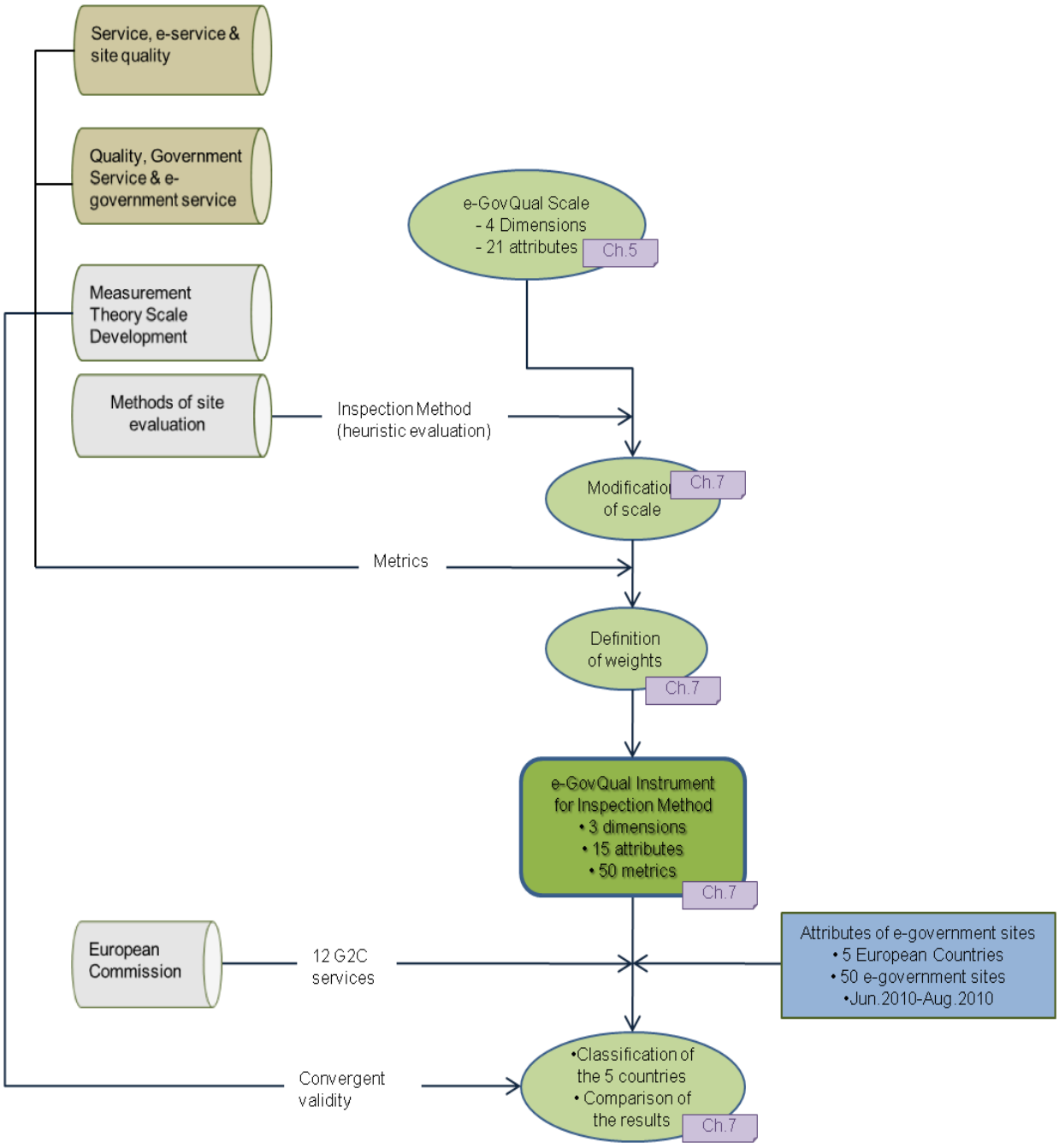

Figure 7.1. Development of e-GovQual instrument for inspection method

7.2 Usability Testing – Heuristic Evaluation

As already noted in this thesis we are providing a methodology for evaluating the quality of an e-government site by inspection method and more precisely by heuristic evaluation.

A heuristic evaluation is a discount usability inspection method for computer software that helps to identify usability problems in the user interface (UI) design. It specifically involves evaluators examining the interface and judging its compliance with recognized usability principles (the "heuristics"). These evaluation methods are now widely taught and practiced in the sectors, where UIs are often designed in a short space of time on a budget that may restrict the amount of money available to provide for other types of interface testing.

The main goal of heuristic evaluations is to identify any problems associated with the design of user interfaces. Usability consultant Jacob Nielsen developed this method on the basis of several years of experience in teaching and consulting about usability engineering. Heuristic evaluations are one of the most informal methods (Nielsen & Molich, 1990) of usability inspection in the field of human-computer interaction. There are many sets of usability design heuristics; they are not mutually exclusive and cover many of the same aspects of user interface design. Quite often, usability problems that are discovered are categorized—often on a numeric scale—according to their estimated impact on user performance or acceptance. Often the heuristic evaluation is conducted in the context of use cases (typical user tasks), to provide feedback to the developers on the extent to which the interface is likely to be compatible with the intended users' needs and preferences.

This usability inspection method does not require user testing which can be burdensome due to the need for users, a place to test them and a payment for their time. Heuristic evaluation requires only one expert, reducing the complexity and expended time for evaluation. Most heuristic evaluations can be accomplished in a matter of days. The time required varies with the size of the artifact, its complexity, the purpose of the review, the nature of the usability issues that arise in the review, and the competence of

the reviewers. Although heuristic evaluation can uncover many major usability issues in a short period of time, a criticism that is often leveled is that results are highly influenced by the knowledge of the expert reviewer(s).

Jakob Nielsen's heuristics are probably the most-used usability heuristics for user interface design. Nielsen developed the heuristics based on work together with Rolf Molich in 1990 (Nielsen & Molich, 1990; Molich & Nielsen, 1990). The final set of heuristics that are still used today were released by Nielsen in 1993. The heuristics are as follows:

Visibility of system status: The system should always keep users informed about what is going on, through appropriate feedback within reasonable time.

Match between system and the real world: The system should speak the user's language, with words, phrases and concepts familiar to the user, rather than system-oriented terms. Follow real-world conventions, making information appear in a natural and logical order.

User control and freedom: Users often choose system functions by mistake and will need a clearly marked "emergency exit" to leave the unwanted state without having to go through an extended dialogue. Support undo and redo.

Consistency and standards: Users should not have to wonder whether different words, situations, or actions mean the same thing. Follow platform conventions.

Error prevention: Even better than good error messages is a careful design which prevents a problem from occurring in the first place. Either eliminate error-prone conditions or check for them and present users with a confirmation option before they commit to the action.

Recognition rather than recall: Minimize the user's memory load by making objects, actions, and options visible. The user should not have to remember information from one part of the dialogue to another. Instructions for use of the system should be visible or easily retrievable whenever appropriate.

Flexibility and efficiency of use: Accelerators—unseen by the novice user—may often speed up the interaction for the expert user such that the system can cater to both inexperienced and experienced users. Allow users to tailor frequent actions.

Aesthetic and minimalist design: Dialogues should not contain information which is irrelevant or rarely needed. Every extra unit of information in a dialogue competes with the relevant units of information and diminishes their relative visibility.

Help users recognize, diagnose, and recover from errors: Error messages should be expressed in plain language (no codes), precisely indicate the problem, and constructively suggest a solution.

Help and documentation: Even though it is better if the system can be used without documentation, it may be necessary to provide help and documentation. Any such information should be easy to search, focused on the user's task, list concrete steps to be carried out, and not be too large.

7.3 Evaluation Framework

For assessing the service quality of public authority web sites we propose a framework that applies three different levels of detail. The first (higher) level consists of the three dimensions (Efficiency, Trust and Reliability) that measure the three different aspects of e-government web sites as described in e-GovQual. The dimension of Citizen Support was neglected since the attributes it contained are considered subjective thus they cannot be measured by a usability evaluator. The second level consists of attributes that measure each distinct dimension. The third level consists of the specific metrics used to perform the evaluation.

By taking into account Nielsen’s heuristics we adjusted each quality evaluation criterion of the scale, to the requirements of the method. Also our effort was to form the criteria in such a way that the evaluator would be as objective as possible. We tried to form the evaluator’s answers in a YES/NO way so as to eliminate biased data. Some criteria were inspected in multiple ways. This process resulted in a list of 50 criteria.

The modifications that were made to the attributes of e-GovQual scale in order to be able to serve for inspection method are the following.

Table 7.1: Modification of the attributes of e-GovQual Scale in order to serve for inspection method

Dimensions	*e-GovQual scale's attributes*	*Attributes used for inspection method*
Efficiency	1. This e-government site's structure is clear and easy to follow.	1. This e-government site's structure is clear and easy to follow.
	2. This e-government site's search engine is effective.	2. This e-government site's search engine is effective.
	3. This e-government site's site map is well organized.	3. This e-government site's site map is well organized.
	4. This e-government site is well customized to individual users' needs.	4. This e-government site is well customized to individual users' needs.
	5. The information displayed in this e-government site is appropriate detailed.	5. The information displayed in this e-government site is appropriate detailed.
		6. Aesthetics
	6. The information displayed in this e-government site is fresh.	7. The information displayed in this e-government site is fresh.
	7. Information about field's completion in this e-government site is enough.	8. Efficiency in field's completion in this e-government site.
Trust	1. Acquisition of username and password in this e-government site is secure.	1. Acquisition of username and password in this e-government site is secure.
	2. Only necessary personal data are provided for authentication on this e-government site.	2. Data provided in this e-government site are used only for the reason submitted.
	4. Data provided in this e-government site are used only for the reason submitted.	
	3. Data provided by users in this e-government site are archived securely.	
Reliability	1. Forms in this e-government site are downloaded in short time.	1. Forms in this e-government site are downloaded in short time.
	2. This e-government site is available and accessible whenever you need it.	2. This e-government site's content is accessible.
	3. This e-government site performs the service successfully upon first request.	3. This e-government site provides answers to citizens' inquiries in short time.
	4. This e-government site provides services in time.	
	5. E-government site's pages are downloaded quickly enough.	4. E-government site's pages are downloaded quickly enough.
	6. This e-government site works properly with your default browser.	5. This e-government site works properly with your default browser.
Citizen Support	1. Employees showed a sincere interest in solving users' problem.	
	2. Employees give prompt replies to users' inquiries.	
	3. Employees have the knowledge to answer users' questions.	
	4. Employees have the ability to convey trust and confidence.	

In the dimension of Efficiency we renamed the attribute of "Information about field's completion in this e-government site is enough" to "Efficiency in field's completion in this e-government site" with which we wanted to emphasize form completion; moreover we added the attribute of Aesthetics.

In the dimension of Trust the second attribute "Only necessary personal data are provided for authentication on this e-government site" was merged with the forth "Data provided in this e-government site are used only for the reason submitted", while the third "Data provided by users in this e-government site are archived securely" was eliminated since it could not be measured.

In the dimension of Reliability the third attribute "This e-government site performs the service successfully upon first request" and the forth attribute "This e-government site provides services in time" were merged to "This e-government site provides answers to citizens' inquiries in short time". Also the second attribute "This e-government site is available and accessible whenever you need it" was reformed to "This e-government site's content is accessible".

In Table 7.1 the alteration of the attributes of e-GovQual model is illustrated.

The metrics of each proposed dimension is analyzed in detail as follows.

7.3.1 Efficiency

The Efficiency dimension focuses on the e-government site's structure, search engine, site map, customization, information, aesthetics and efficiency in field's completion.

The metrics of Efficiency dimension refer to the availability of navigation menus and their consistent placement on each web page of the site (Alexander and Tate, 1999), to the availability of links to the home page (Basu, 2002) and of the path that the user has followed. They also refer to the availability of an internal search engine and its level of sophistication, searching capabilities, relevancy of search results, availability of drop down menu, site map, availability of A-Z list and accessibility of site map from every page.

Furthermore there is a metric referring to the number of foreign languages that the web site offers, while another to the degree of content completeness in each of the offered

foreign languages. We considered it important to include the second metric, as in our experience many sites offer only part of their content in foreign languages. Other metrics refer to the availability of contact information (electronic address, telephone, postal address) for the organization but also for the webmaster, while another one refers to the possibility for citizens to contact the authority's representatives for requests or complaints.

Table 7.2 The Efficiency dimension

Dimension	*Attributes*	*Metrics*
Efficiency	1. This e-government site's structure is clear and easy to follow.	Availability of navigation menu, navigation path, 'home page' annotation
	2. This e-government site's search engine is effective.	Availability of search engine, searching capabilities, relevancy of search results, availability of drop down menu
	3. This e-government site's site map is well organized.	Availability of site map, availability of A-Z list, accessibility of site map from every page
	4. This e-government site is well customized to individual users' needs.	Multilingualism, number of foreign languages and content completeness in them, availability of translation material, accessibility for disabled, flexibility of text formatting, accessibility for non Internet savvy users, customization capabilities, contact availability, availability of message boards
	5. The information displayed in this e-government site is appropriate detailed.	Consistency of titles and text, availability of internal and external links, number of hyper-links, number of broken links.
	6. Aesthetics	Existence of text formatting, easy to read fonts, existence of multiple fonts, contrast between background and fonts, differentiation of links.
	7. The information displayed in this e-government site is fresh.	Availability of revision date, last revision date, update frequency
	8. Efficiency in field's completion in this e-government site.	Existence of structured fields, availability of feedback information, availability of TAB function for moving in different fields of a form

Moreover, there are metrics examining the consistency of titles and text the availability of internal and external links and the number of hyper links and of broken links (Nielsen, 2000). Metrics also exist for the fonts and coloring throughout the web site (Basu, 2002), the existence of multiple fonts and the contrast between fonts and

background. Some other metrics look for the revision date and the update frequency of the information of the site.

Finally the last metrics employed for assessing this dimension refer to the existence of structured fields in form completion, the availability of TAB function for moving in different fields of a form and the availability of feedback information. An overview of attributes and metrics measuring the Efficiency dimension is provided in Table 7.2

7.3.2 Trust

As already mentioned the second dimension in the proposed framework is Trust.

For assessing the privacy factor the proposed framework includes the following metrics. One metric refers to the onsite availability of a privacy and security statement, while another metric refers to whether citizens' private data are transmitted over a secure connection and if explicit information on the data usage is available onsite. Table 7.3 depicts Trust dimension's attributes and corresponding metrics.

Table 7.3 The Trust dimension

Dimension	*Attributes*	*Metrics*
Trust	1. Acquisition of username and password in this e-government site is secure.	Availability of privacy statement, citizens' private data are transmitted over secure connection
	2. Data provided in this e-government site are used only for the reason submitted.	Availability of information on data usage

7.3.3 Reliability

The Reliability dimension refers to the feasibility and speed of accessing using and receiving services of the site.

Based on the aforementioned evidence, the proposed framework includes the following metrics for assessing the Reliability dimension. Two of the metrics measure technical accessibility and gauge a web site's and a form's download time through a

simple PSTN connection. Another metric refers to accessibility options for the disabled and examines whether a web site passes the first accessibility level of web content accessibility guidelines (WCAG) standard of world wide web consortium (W3C, 1999) while a further one examines the response time to an e-mail sent to the site webmaster. The last metric examines the browser compatibility of the site as well as the availability of links for downloading free software (i.e. Acrobat Reader) that is necessary for viewing the content offered on the web site; this is an important feature on accessibility to information for non internet savvy users (Alexander and Tate, 1999). An overview of attributes and metrics measuring the Reliability dimension is provided in Table 7.4.

Table 7.4 The Reliability dimension

Dimension	*Attributes*	*Metrics*
Reliability	1. Forms in this e-government site are downloaded in short time.	Downloading time
	2. This e-government site's content is accessible.	Availability of WCAG and W3C accessibility guidelines
	3. This e-government site provides answers to citizens' inquiries in short time.	Response agility
	4. E-government site's pages are downloaded quickly enough.	Downloading time
	5. This e-government site works properly with your default browser.	Browser compatibility, availability of relative software if needed

7.3.4 Development of the questionnaire

A questionnaire was designed to cover the metrics of the framework. The questionnaire is comprised of 50 metrics: 38 items are dichotomous, 7 items utilize nominal scales and 5 items are completely quantifiable (referring to number of hyperlinks, the percentage of broken links, the number of different font styles, the downloading time and the degree of browser compatibility of the site). The complete questionnaire is provided in Table 7.5.

With regard to items scoring, we award between 0 and 10 points for each answer. Thus, dichotomous items are awarded with 0 for a negative answer or 10 points for a positive one. Items measured in nominal scales as well as quantifiable items may be awarded with different values between 0 and 10 depending on the answer (Cox & Dale,

2002; Panopoulou, Tambouris & Tarabanis, 2008). Specifically for measuring items utilizing nominal scales, we followed the following rationale.

- "Does the web site offer content in other languages besides Greek?". In this metric we award 0 points if the web site does not offer content in any other language, 5 points if the content of the site is available in only one language and 10 points for two or more languages available in the site. The rationale behind it was that the more languages available in a site the more usable the site is.
- "For each other language, how much is the offered content?". In this metric we awarded 0 points for a 'Not in operation' answer, 5 points if only a summary of the web site content is available and 10 points if the whole content of the site is available in other languages.
- "Is it possible for citizens to communicate through e-mails, message boards?". In this metric we award 0 points if none of the two options is available, 5 points if a message board is available, 7.5 points if a citizen can communicate through e-mail and 10 points if both options are available.

Table 7.5 Dimensions, attributes, metrics and respective weights for inspection method

Dimensions	*Attributes*	*Metrics*	*Answers*
Efficiency (33.33%)	1. This e-government site's structure is clear and easy to follow. (12.5%)	1. Is the navigation menu well organized and with a clear structure? (28%)	No/Yes, organized according to topic or department
		2. Does the navigation menu remain at the same area on all pages of the web site? (24%)	No/Yes
		3. Is the navigation path visible on all pages of the web site? (24%)	No/Yes
		4. Is the option "Return to the homepage" available on all pages of the web site? (24%)	No/Yes
	2. This e-government site's search engine is effective. (12.5%)	5. Is a search engine available online? (50%)	No/Yes
		6. Is search function available for the whole site? (10%)	No/Yes
		7. Is search function available within specific category? (10%)	No/Yes
		8. Are drop down lists available? (10%)	No/Yes
		9. Are the results on one page, few and relevant? (10%)	No/Yes
		10. Are the criteria recognized whether single or plural? (10%)	No/Yes
	3. This e-government site's site map is well organized. (12.5%)	11. Is a site map or A-Z index available online? (70%)	No/Yes
		12. Is a site map accessible on every page? (30%)	No/Yes
	4. This e-government site is well customized to individual users' needs. (12.5%)	13. Does the web site offer content in other languages besides Greek? (10%)	No/Yes, in just one other language/Yes, in two other languages/Yes, in more than two other languages
		14. For each other language, how much is the offered content? (10%)	Not in operation/Only a summary of the web site content/The whole content is available in other languages
		15. Is free translation material available from the site? (5%)	No/Yes
		16. Is there ability to vary the text size or is there availability of audio description? (5%)	No/Yes
		17. Does the site support telecommunications device for deaf? (5%)	No/Yes
		18. Is there Text Telephone available? (TTY) (10%)	No/Yes

		19. Is the site visible by color blind citizens? (10%)	No/Yes
		20. Does the site provide personalization options? (5%)	No/Yes
		21. Are there pools organized online that refer to issues of regional interest? (10%)	No/Yes
		22. Is it possible for citizens to send an email to an employee of a particular department? (10%)	No/Yes
		23. Is it possible for citizens to subscribe on a list for receiving e-mails (10%)	No/Yes
		24. Is it possible for citizens to communicate through e-mails, message boards (10%)	None/Message boards, Email/both
	5. The information displayed in this e-government site is appropriate detailed. (12.5%)	25. Are the titles consistent with the text below? (20%)	No/Yes
		26. Do links correctly describe the destination site or page? (10%)	No/Yes
		27. Is text or graphics used as hyperlinks? (20%)	Text/Graphics
		28. Are links to other relevant web sites (of both the private and public sector) available? (10%)	No/Yes
		29. Number of hyperlinks (20%)	Number
		30. Which is the percentage of broken links? (20%)	Percentage
	6. Aesthetics (12.5%)	31. Do the activated links have a different color or are they underlined? (20%)	No/Yes
		32. Is the font style easily visible? (20%)	No/Yes
		33. Number of different font styles (20%)	Number of different font styles
		34. Block letters/Italics (20%)	None/Not block letters/Not italics/ Both
		35. Is there sufficient contrast between background and foreground colors? (20%)	No/Yes
	7. The information displayed in this e-government site is fresh. (12.5%)	36. Is there a revision date? (50%)	No/Yes
		37. When was the web site updated for the last time? (50%)	Today or yesterday/Less than a week ago/Less than a month ago/Less than a year ago/Update indication not available online

	8. Efficiency in field's completion in this e-government site is satisfactory . (12.5%)	38. Are there fields with structured answers? (30%)	No/Yes
		39. Is there a feedback mechanism to inform the citizen about the status of an online submission? (40%)	No/Yes
		40. Is it possible to move across the fields of a form only by pressing TAB button? (30%)	No/Yes
Trust (33.33%)	1. Acquisition of username and password in this e-government site is secure. (50%)	41. Is a privacy and security statement available online? (50%)	No/Yes
		42. Are citizen personal data transmitted over a secure connection (i.e. https)? (30%)	No/Yes
		43. Do electronic service transactions use a legal binding validation or recognition form? (20%)	No/Yes
	2. Data provided in this e-government site are used only for the reason submitted. (50%)	44. Is information on the usage of these personal data available online? (100%)	No/Yes
Reliability (33.33%)	1. Forms in this e-government site are downloaded in short time. (20%)	45. Do forms need more than 5 sec to load? (100%)	No/Yes
	2. This e-government site is available and accessible whenever you need it. (20%)	46. Does the web site pass successfully the first WCAG W3C accessibility level? (100%)	No/Yes
	3. This e-government site replies to citizens' requests in short time. (20%)	47. How long did it take the webmaster to reply to an e-mail sent to him/her the morning of a working day? (100%)	Less than a day/Less than a week/More than a week
	4. E-government site's pages are downloaded quickly enough. (20%)	48. Downloading time required (100%)	Answer given in seconds
	5. This e-government site works properly with your default browser. (20%)	49. Which is the degree of browser compatibility of the site? (70%)	Number of stars
		50. In the case that specific software is required either for viewing files or for any other online functionality, does the web site provide a link for downloading this software? (30%)	No/Yes

- "Is text or graphics used as hyperlinks?". In this metric we award 7.5 for graphics used and 10 for text used. According to the literature extensive use of graphics can distract the user from the content of the site.
- "Block letters/Italics". In this metric we award 0 points if neither block letters nor italics are used in the site, 5 points if either block letters or italics are used and 10 points if both are used. According to Oreste (2005) there shouldn't be extensive use of block letters and italics in a site. Nevertheless both are necessary in order to emphasize to some information.
- "When was the web site updated for the last time?". In this metric we award 10 points for a 'Today or yesterday' answer, 7.5 points if the site was updated within the previous week, 5 points if the site was updated within last month, 2.5 if the site was updated within last year and 0 points if an update indication is not available online.
- "How long did it take the webmaster to reply to an e-mail sent to him/her the morning of a working day?". In this metric we award 10 points if the web master answered the same day, 5 points if the web master replied within the week and 0 points if it took more than a week for the webmaster to reply.

Furthermore, for measuring items utilizing quantifiable items, we followed the following rationale.

- "Number of hyperlinks". In this metric which shows the number of hyperlinks of the site, we award 5 points if the number of hyperlinks lies between 0 and 30, 7.5 if there are more than 121 hyperlinks and 10 points if the number of hyperlinks lies between 31 and 120. The rationale behind point award was that there should be a minimum number of links to find information on the site but on the other hand too much information ends up confusing the user.
- "Which is the percentage of broken links?". This metric indicates the percentage of broken links in the site. We award 0 points for percentages above 75%, 2.5 points for percentages between 51 and 75%, 5 points for a

percentage between 26 and 50%, 7.5 points for percentages 6 to 25% and 10 points for a site with 5% or less of broken links.

- "Number of different font styles". This metric denotes the number of different font styles used in the site. We award 10 points if there are 4 different font styles used in the site, 7.5 points if there are 2 or 3 different font styles in the site and 5 points if there is only one font style used. We have to note here that there weren't sites with more than four different font styles used.
- "Downloading time required". This metric indicates the required time to download a page. We award 0 points if downloading time takes more than 10 seconds, 5 points for downloading time between 6 and 10 seconds and 10 points for downloading time less than 5 seconds.
- "Which is the degree of browser compatibility of the site?". This metric was evaluated by NetMechanic, a web diagnostic tool. In the evaluation the tool awards from zero to five stars to the site under examination. We award 0 points for sites that did not get any stars, 2.5 points for one star attained, 5 points for two and three stars awarded, 7.5 points for 4 stars succeeded and finally 10 points for 5 stars succeeded.

It should be noted that questionnaire items were prepared in such a way so as to allow only standardized and quantitative answers; thus avoiding the evaluator's subjectivity interfering with the results. For example, we tried to avoid questions such as "Is the web site frequently updated?" with possible answers "Very frequently", "Not so frequently", etc. We rather preferred questions such as "When was the web site last updated?" with predefined answers such as "Today or yesterday", "Less than a week ago", "Less than a month ago", etc.

It should also be noted that when obtaining the results to some questions we utilized the following web diagnostic tools.

1. NetMechanic (http://netmechanic.com/). This web diagnostic tool was used in order to gauge browser compatibility of the site (metric #49). This tool scans a site and reports any unsupported HTML tags and attributes that block viewing on specific browsers.

2. Vischeck (http://vischeck.com/) was used to check whether the site is visible by color blind citizens (metric #19).
3. Link Checker (http://www.anybrowser.com/linkchecker.html). This tool checks the validity of links in any static webpage. We used it in order to calculate the number of hyperlinks in the websites (metric #29) as well as to estimate the percentage of broken links of the websites (metric #30).
4. Dr. Watson (http://watson.addy.com/). Dr. Watson is a free web diagnostic tool for analyzing a web page on the Internet. Watson checks out many aspects of a site, including link validity, download speed, search engine compatibility, and link popularity. We used Dr. Watson in order to compute the downloading required time (metric #48).
5. WebXACT (http://www.w3c.hu/talks/2006/wai_de/mate/watchfire.html). This tool checks to see if a site complies with the w3c's accessibility recommendations. This web diagnostic tool was used in order to test the web sites' conformance to the first accessibility level of WCAG/W3C (metric #46).

For developing an overall score for each web site a weighting scheme for dimensions, attributes and metrics was employed. The weights were selected based on the authors' experience and on the studies of Cox and Dale (2002) and Panopoulou, Tambouris and Tarabanis (2008). As far as the dimensions are concerned the weights were equally distributed with 33.33 percent to Efficiency, Trust and Reliability. As far as the attributes are concerned the weights were equally distributed among the attributes of the same dimension ie. the attributes of Efficiency dimension were assigned with 12.5 percent each, the attributes of Trust dimension were assigned with 50 percent each and the attributes of Reliability dimension with 20 percent each. The weights of the attributes within each dimension sum up to 100. Metrics inside each dimension were also assigned weights. The weights of the metrics within each attribute also sum up to 100; these are provided per metric in Table 7.5.

7.4 Mapping and Comparison of Evaluation Methods.

In Table 7.6 we present a mapping of our approach and different approaches in web site evaluation. This mapping facilitates easier comparison of the different methods and quicker tracking of strengths and weaknesses of each. For example, the Garcia, Maciel and Pinto (2005) and Nielsen (2004) models although very detailed remain focused at what we call the general characteristics aspect of e-government web sites. The model proposed by Smith (2001) utilizes a more holistic approach; it also addresses the content and services aspects. The Panopoulou, Tambouris & Tarabanis (2008) model does not remain focused on e-government service quality but deals with e-participation as well.

Table 7.6 Mapping of different evaluation methods for web sites

Our inspection instrument	*Cox & Dale (2002)*	*Panopoulou, Tambouris & Tarabanis (2008)*	*Smith (2001)*	*Garcia, Maciel, & Pinto (2005)*	*Nielsen (2004)*
Efficiency • Site's structure • Site's search engine • Site's site map • Site's customization • Detail of Information • Aesthetics • Freshness of information • Efficiency in field completion	• Clarity of Purpose • Design • Communication • Feedback	• Navigation • Multilingualism • Accessibility • Public Outreach • News and Updating • Consultation	• Content • Currency • Metadata • Accuracy • Links • Feedback mechanisms • Design • Navigability	• Cognitive Effort • Tolerance • Trust	• Visibility of System Status • Match between the system and the real world • User Control and Freedom • Aesthetic and minimalist design
Trust • Security • Use of Data provided	• Security • Reliability	• Privacy	• Privacy	• Trust	
Reliability • Forms downloading time • Availability and accessibility • Responsiveness • Downloading time • Browser compatibility	• Accessibility • Speed	• Accessibility	• Accessibility	• Cognitive Effort • Reach	

However, Cox and Dale (2002) provide an analytical instrument for assessing a web site but it was derived by a conceptual model for web site quality and not from e-government perspective.

Nevertheless, we believe that the framework proposed in this paper has some advantages in relation to all the other methods proposed in the literature. Specifically, it addresses all aspects of web site quality in much depth and detail. Moreover it focuses in e-government since it was derived by e-GovQual model that was refined validated and tested by citizens-users of e-government services.

7.5 Selection of evaluated web sites

The launch of the European strategy for the development of e-government was the "e-Europe 2002" initiative, presented in March 2000 at the Lisbon European Council and approved at the Council of Feira (June 2000). The main objective for e-government being that Member States should ensure "generalized electronic access to main basic public services by 2003". The Commission began the process of defining the indicators necessary to carry out the evaluation. A list of indicators was approved by the Council of Internal Market Ministers in November 2000. This list included only three indicators related to e-government:

- Percentage of basic services available online.
- Public use of government online services for information/for submission of forms.
- Percentage of public procurement which can be carried out online.

In order to specify the way the indicators "Percentage of basic public services available online" had to be measured, the European Commission developed and published a list of 20 public services that needed detailed survey. A distinction was made between services for citizens and for businesses, 12 for citizens and 8 for businesses as illustrated on Table 7.7. The key was the take-up of the services, regardless of by what body or at what level of government these are delivered. In establishing indicators for e-Government, the approach taken is to focus on the demand side, i.e. the bottom-up reality of citizens' and businesses' contacts with government. Since 2001, the Commission has

entrusted the measurement and analysis of the evolution of these indicators for the 20 services to Capgemini.

Table 7.20 Basic public services

	Public Services for Citizens		*Public Services for Businesses*
1.	Income taxes: declaration, notification of assessment	1.	Social contribution for employees
2.	Job search services by labor offices	2.	Corporation tax: declaration, notification
3.	Social security contributions (3 out of the following 4): · Unemployment benefits · Child allowances · Medical costs (reimbursement or direct settlement) · Student grants	3.	VAT: declaration, notification
4.	Personal documents (passport and driver's license)	4.	Registration of a new company
5.	Car registration (new, used and imported cars)	5.	Submission of data to statistical offices
6.	Application for building permission	6.	Custom declaration
7.	Declaration to the police (e.g. in case of theft)	7.	Environment-related permits (incl. reporting)
8.	Public libraries (availability of catalogues, search tools)	8.	Public procurement
9.	Certificates (birth and marriage): request and delivery		
10.	Enrolment in higher education / university		
11.	Announcement of moving (change of address)		
12.	Health related services (interactive advice on the availability of services in different hospitals; appointments for hospitals)		

In our research we are going to evaluate the 12 basic public services to citizens. This instrument was implemented on 50 websites of public authorities, which belong to 5 European countries (Greece, United Kingdom, Ireland, Malta and Finland). The selection of the above mentioned countries was because they are all members of the European Union and follow the same directives in relation to e-government but also was based on the criterion of availability of the sites in English language. On Table 7.8 the 50 evaluated sites are illustrated.

Table 7.8. Web sites evaluated

Service	Country	URL
Income taxes: declaration, notification of assessment	Greece	http://www.taxisnet.gr/, http://www.gsis.gr
	Great Britain	http://www.hmrc.gov.uk/individuals/tmaself-assessment.shtml, http://www.direct.gov.uk/en/MoneyTaxAndBenefits/Taxes/index.htm
	Ireland	http://www.ros.ie/
	Malta	http://www.ird.gov.mt/
	Finland	http://www.vero.fi/
Job search services by labor offices	Greece	http://portal.oaed.gr/
	Great Britain	http://www.jobcentreplus.gov.uk/, http://www.direct.gov.uk/en/Employment/Jobseekers/LookingForWork/
	Ireland	http://www.fas.ie/
	Malta	http://www.etc.gov.mt/ , https://www.eures.com.mt/
	Finland	http://www.mol.fi
Social security contributions	Greece	http://www.ermis.gov.gr, www.iky.gr
	Great Britain	http://www.jobcentreplus.gov.uk/, http://www.direct.gov.uk/en/MoneyTaxAndBenefits/, http://www.hmrc.gov.uk/childbenefit
	Ireland	http://www.welfare.ie/EN/Pages/unemployed.aspx , www.education.ie
	Malta	http://mfss.gov.mt/services/sif/service_info.asp?cluster=children&serviceid=67 , http://www.beneficcjisocjali.gov.mt , http://www.smgbonline.com/
	Finland	http://www.kela.fi/
Personal documents	Greece	http://www.passport.gov.gr, www.ermis.gov.gr
	Great Britain	http://www.passport-application.gov.uk, http://www.direct.gov.uk/en/TravelAndTransport/Passports/index.htm, http://www.dvla.gov.uk/drivers.aspx
	Ireland	http://foreignaffairs.gov.ie/home/index.aspx?id=253, www.rsa.ie
	Malta	http://www.passaporti.gov.mt/ , http://www.licenzji-tas-sewqan.gov.mt
	Finland	http://www.poliisi.fi/
Car registration	Greece	http://www.gsis.gr, http://www.taxisnet.gr
	Great Britain	http://www.dvla.gov.uk/vehicles/vehicle.htm http://www.direct.gov.uk/en/Motoring/BuyingAndSellingAVehicle/
	Ireland	http://www.revenue.ie/
	Malta	http://www.vehicleregistration.gov.mt
	Finland	http://www.ake.fi/ake
Application for building permission	Greece	http://www.poleodomia.gov.gr; http://www.ermis.gov.gr
	Great Britain	http://www.planningportal.gov.uk, http://www.direct.gov.uk/en/HomeAndCommunity/Planning/PlanningPermission/

	Ireland	http://www.dublincity.ie/swiftlg/apas/run/wchvarylogin.display
	Malta	http://www.mepa.gov.mt/
	Finland	-
Declaration to the police	Greece	www.astynomia.gr
	Great Britain	http://www.direct.gov.uk/en/YoungPeople/CrimeAndJustice/GoingToThePolice/
	Ireland	www.garda.ie
	Malta	http://www.pulizija.gov.mt/
	Finland	http://www.poliisi.fi/
Public libraries	Greece	http://www.ypepth.gr/, http://www.nlg.gr
	Great Britain	-
	Ireland	http://www.library.ie/public/index.shtml; www.borrowbooks.ie
	Malta	http://opac.library.gov.mt/ http://www.libraries-archives.gov.mt/
	Finland	http://www.kirjastot.fi/
Certificates	Greece	www.ermis.gov.gr
	Great Britain	http://www.gro.gov.uk/gro/content/certificates/, http://www.direct.gov.uk/en/Governmentcitizensandrights/Registeringlifeevents/
	Ireland	www.certificates.ie
	Malta	http://www.certifikati.gov.mt/
	Finland	-
Enrolment in higher education / university	Greece	http://www.ypepth.gr/
	Great Britain	http://www.ucas.com/apply/, http://www.direct.gov.uk/en/EducationAndLearning/UniversityAndHigherEducation/
	Ireland	http://www.cao.ie/
	Malta	http://www.certifikati.gov.mt/
	Finland	http://www.oph.fi/
Announce-ment of moving	Greece	http://www.gsis.gr, http://www.taxisnet.gr http://www.ermis.gov.gr
	Great Britain	-
	Ireland	-
	Malta	http://www.changeaddress.gov.mt/
	Finland	http://www.posti.fi
Health related services	Greece	http://www.yyka.gr/
	Great Britain	http://www.nhsdirect.nhs.uk
	Ireland	http://www.citizensinformation.ie/categories/health
	Malta	http://www.ehealth.gov.mt/
	Finland	http://www.stm.fi/Resource.phx/stm/index.htx

As can be noted from the table above in some countries there are basic services that are not offered online thus there isn't any electronic address available.

7.6 Instrument Implementation-Results

The questionnaire was employed by one experienced evaluator in order to evaluate 50 e-government sites of 5 European countries. Table 7.9 depicts the countries and the services under assessment. The evaluation was conducted from June till August of 2010. Although only one evaluator was employed, the objectivity of the results may be guaranteed by the closed type of the questions used, as has been previously mentioned.

Table 7.9. Web sites evaluated

Countries	*Public Services for Citizens*
Greece Great Britain Ireland Malta Finland	1. Income taxes: declaration, notification of assessment 2. Job search services by labor offices 3. Social security contributions (3 out of the following 4): • Unemployment benefits • Child allowances • Medical costs (reimbursement or direct settlement) • Student grants 4. Personal documents (passport and driver's license) 5. Car registration (new, used and imported cars) 6. Application for building permission 7. Declaration to the police (e.g. in case of theft) 8. Public libraries (availability of catalogues, search tools) 9. Certificates (birth and marriage): request and delivery 10. Enrolment in higher education / university 11. Announcement of moving (change of address) 12. Health related services (interactive advice on the availability of services in different hospitals; appointments for hospitals)

It should also be noted here, that during the assessment some of the tools did not work for some web pages due to security issues that those pages apply. The results for these pages were extracted based on the evaluation of the rest of the metrics.

Tables 7.10 to 7.21 depict the results of the assessment in relation with each of the 12 basic services

Table 7.10. Income taxes: declaration, notification of assessment

Metrics	Greece (www.gsis.gr) 26/06/10	Great Britain http://www.hmrc.gov.uk/paye/intro/ (02/08/10)	Great Britain http://www.direct.gov.uk/en/MoneyTaxAndBenefits/Taxes/index.htm (03/08/10)	Ireland www.revenue.ie (04/08/10)	Malta www.ird.gov.mt (09/08/10)	Finland www.vero.fi (11/08/10)
1. Is the navigation menu well organized and with a clear structure?	Yes	Yes	Yes	Yes	Yes	Yes
2. Does the navigation menu remain at the same area on all pages?	Yes	Yes	Yes	Yes	Yes	Yes
3. Is the navigation path visible on all pages of the web site?	Yes	Yes	Yes	Yes	No	Yes
4. Is the option “Return to the homepage” available on all pages?	Yes	Yes	Yes	Yes	Yes	Yes
5. Is a search engine available online?	Yes	Yes	Yes	Yes	Yes	Yes
6. Is search function available for the whole site?	Yes	Yes	Yes	Yes	Yes	Yes
7. Is search function available within specific category?	No	Yes	Yes	No	Yes	No
8. Are drop down lists available?	Yes	Yes	Yes	Yes	Yes	Yes
9. Are the results on one page, few and relevant?	Yes	No	Yes	Yes	Yes	Yes
10. Are the criteria recognized whether single or plural?	Yes	Yes	No	Yes	Yes	Yes
11. Is a site map or A-Z index available online?	Yes	Yes	Yes	Yes	Yes	Yes
12. Is a site map accessible on every page?	No	Yes	Yes	Yes	No	Yes
13. Does the web site offer content in other languages besides Greek?	One language	No	One language	One language	One language	One language
14. For each other language, how much is the offered content?	N/A	N/A	Whole content	Whole content	Whole content	Whole content
15. Is free translation material available from the site?	No	No	No	No	No	No
16. Ability to vary the text size or audio description?	No	Yes	Yes	Yes	No	Yes
17. Does the site support telecommunications device for deaf?	No	Yes	No	No	No	No
18. Is there Text Telephone available? (TTY)	No	Yes	Yes	No	No	No
19. Is the site visible by color blind citizens?	Yes	No	Yes	No	Yes	Yes
20. Does the site provide personalization options?	Yes	Yes	Yes	Yes	Yes	No
21. Are there pools organized online?	Yes	Yes	Yes	Yes	Yes	Yes
22. Is it possible for citizens to send an email to an employee?	Yes	Yes	Yes	Yes	No	Yes
23. Is it possible for citizens to subscribe on a list for receiving e-mails	No	Yes	No	No	No	No

24. Is it possible for citizens to communicate through e-mails, m. boards ?	Email	Email	Email	Email	Both	Email
25. Are the titles consistent with the text below?	Yes	Yes	Yes	Yes	Yes	Yes
26. Do links correctly describe the destination site or page?	Yes	Yes	Yes	Yes	Yes	Yes
27. Is text or graphics used as hyperlinks?	Graphics	Graphics	Text	Text	Text	Text
28. Are links to other relevant web sites available?	Yes	Yes	Yes	Yes	Yes	Yes
29. Number of hyperlinks	196	90	165	62	56	92
30. Which is the percentage of broken links?	60,40%	14,50%	0,00%	3,23%	0,00%	0,00%
31. Do the activated links have a different color or are they underlined?	Yes	Yes	Yes	Yes	Yes	Yes
32. Is the font style easily visible?	Yes	Yes	Yes	Yes	Yes	Yes
33. Number of different font styles	2	3	3	3	2	3
34. Block letters/Italics	Both	None	None	None	None	None
35. Is there sufficient contrast between background and foreground?	Yes	Yes	Yes	Yes	Yes	Yes
36. Is there a revision date?	No	No	No	No	Yes	Yes
37. When was the web site updated for the last time?	N/A	N/A	N/A	N/A	N/A	N/A
38. Are there fields with structured answers?	Yes	Yes	Yes	Yes	No	No
39. Is there a feedback mechanism to inform about a submission?	No	Yes	Yes	No	Yes	Yes
40. Is it possible to move around in a form only by pressing TAB button?	Yes	Yes	Yes	Yes	Yes	Yes
41. Is a privacy and security statement available online?	Yes	Yes	Yes	Yes	Yes	No
42. Are citizen personal data transmitted over a secure connection?	Yes	Yes	Yes	Yes	Yes	No
43. Electronic transactions use a legal binding validation/recognition form	Yes	Yes	No	Yes	No	No
44. Is information on the usage of these personal data available online?	Yes	Yes	Yes	Yes	Yes	No
45. Do forms need more than 5 sec to load?	No	No	No	No	No	No
46. Does the web site pass the first WCAG W3C accessibility level?	Yes	Yes	Yes	Yes	Yes	No
47. How long did it take the webmaster to reply to an e-mail?	< day	< week	< week	-	-	-
48. Downloading time required	< 5’	< 5’	< 5’	< 5’	< 5’	< 5’
49. Which is the degree of browser compatibility of the site?	2 stars	4 stars	1 star	1 star	3 stars	-
50. Does the web site provide a link for downloading specific software?	Yes	Yes	Yes	Yes	Yes	No
	8,67885	8,788704	8,295004	8,634553	8,586641	5,276556

Table 7.11. Job search services by labor offices

Metrics	Greece www.portal.oaed.gr (01/08/10)	Great Britain http://www.direct.gov.uk/en/MoneyTaxAndBenefits/Taxes/index.htm (03/08/10)	Ireland www.fas.ie (04/08/10)	Malta www.etc.gov.mt (09/08/10)	Finland www.mol.fi (11/08/10)
1. Is the navigation menu well organized and with a clear structure?	Yes	Yes	Yes	Yes	Yes
2. Does the navigation menu remain at the same area on all pages?	Yes	Yes	Yes	Yes	Yes
3. Is the navigation path visible on all pages of the web site?	Yes	Yes	Yes	No	Yes
4. Is the option “Return to the homepage” available on all pages?	Yes	Yes	Yes	Yes	Yes
5. Is a search engine available online?	Yes	Yes	Yes	Yes	Yes
6. Is search function available for the whole site?	Yes	Yes	Yes	Yes	Yes
7. Is search function available within specific category?	No	Yes	No	No	No
8. Are drop down lists available?	Yes	Yes	Yes	Yes	Yes
9. Are the results on one page, few and relevant?	Yes	Yes	Yes	Yes	Yes
10. Are the criteria recognized whether single or plural?	Yes	No	Yes	Yes	Yes
11. Is a site map or A-Z index available online?	Yes	Yes	Yes	Yes	Yes
12. Is a site map accessible on every page?	Yes	Yes	No	No	Yes
13. Does the web site offer content in other languages besides Greek?	No	One language	No	One language	> 2 languages
14. For each other language, how much is the offered content?	N/A	Whole content	N/A	Whole content	Whole content
15. Is free translation material available from the site?	No	No	No	No	No
16. Ability to vary the text size or audio description?	No	Yes	Yes	Yes	Yes
17. Does the site support telecommunications device for deaf?	No	No	No	No	No
18. Is there Text Telephone available? (TTY)	No	Yes	No	No	No
19. Is the site visible by color blind citizens?	Yes	Yes	No	Yes	Yes
20. Does the site provide personalization options?	No	Yes	Yes	No	No
21. Are there pools organized online?	Yes	Yes	Yes	Yes	Yes
22. Is it possible for citizens to send an email to an employee?	No	Yes	Yes	Yes	Yes
23. Is it possible for citizens to subscribe on a list for receiving e-mails	No	No	No	No	No
24. Is it possible for citizens to communicate through e-mails, m. boards ?	Email	Email	Email	Email	Email

25. Are the titles consistent with the text below?	Yes	Yes	Yes	Yes	Yes
26. Do links correctly describe the destination site or page?	Yes	Yes	Yes	Yes	Yes
27. Is text or graphics used as hyperlinks?	Graphics	Text	Text	Text	Text
28. Are links to other relevant web sites available?	Yes	Yes	Yes	Yes	Yes
29. Number of hyperlinks		165	55	86	35
30. Which is the percentage of broken links?		0,00%	1,82%	22,09%	0,00%
31. Do the activated links have a different color or are they underlined?	Yes	Yes	Yes	Yes	Yes
32. Is the font style easily visible?	Yes	Yes	Yes	Yes	Yes
33. Number of different font styles	4	3	3	3	2
34. Block letters/Italics	Italics	None	Italics	Italics	None
35. Is there sufficient contrast between background and foreground?	Yes	Yes	Yes	Yes	Yes
36. Is there a revision date?	No	No	Yes	Yes	No
37. When was the web site updated for the last time?	N/A	N/A	N/A	N/A	< year ago
38. Are there fields with structured answers?	Yes	Yes	Yes	Yes	Yes
39. Is there a feedback mechanism to inform about a submission?	Yes	Yes	No	Yes	Yes
40. Is it possible to move around in a form only by pressing TAB button?	Yes	Yes	Yes	Yes	Yes
41. Is a privacy and security statement available online?	Yes	Yes	Yes	Yes	No
42. Are citizen personal data transmitted over a secure connection?	No	Yes	Yes	Yes	No
43. Electronic transactions use a legal binding validation/recognition form	Yes	No	No	No	No
44. Is information on the usage of these personal data available online?	No	Yes	Yes	Yes	No
45. Do forms need more than 5 sec to load?	No	No	No	No	No
46. Does the web site pass the first WCAG W3C accessibility level?	No	Yes	Yes	No	Yes
47. How long did it take the webmaster to reply to an e-mail?	< day	< week	< week	< day	-
48. Downloading time required	< 5’	< 5’	< 5’	< 5’	< 5’
49. Which is the degree of browser compatibility of the site?	1 star	1 star	1 star	4 stars	3 stars
50. Does the web site provide a link for downloading specific software?	Yes	Yes	Yes	Yes	No
	5,984818	8,295004	8,03253	8,147102	5,457788

Table 7.12. Social security contributions

Metrics	Greece www.iky.gr (02/08/10)	Greece www.ermis.gov.gr (01/08/10)	Great Britain http://www.direct.gov.uk/en/MoneyTaxAndBenefits/Taxes/index.htm (03/08/10)	Ireland www.welfare.ie (04/08/10)	Ireland www.education.ie (04/08/10)	Malta www.mfss.gov.mt (10/08/10)	Malta www.smgbonline.com (10/08/10)	Finland www.kela.fi (11/08/10)
1. Is the navigation menu well organized and with a clear structure?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2. Does the navigation menu remain at the same area on all pages?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3. Is the navigation path visible on all pages of the web site?	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4. Is the option “Return to the homepage” available on all pages?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
5. Is a search engine available online?	No	Yes	Yes	Yes	Yes	Yes	No	Yes
6. Is search function available for the whole site?	No	Yes	Yes	Yes	Yes	Yes	No	Yes
7. Is search function available within specific category?	No	No	Yes	No	Yes	No	No	Yes
8. Are drop down lists available?	No	Yes	Yes	Yes	Yes	Yes	No	Yes
9. Are the results on one page, few and relevant?	No	Yes	Yes	Yes	Yes	Yes	No	Yes
10. Are the criteria recognized whether single or plural?	No	Yes	No	Yes	Yes	Yes	No	Yes
11. Is a site map or A-Z index available online?	No	Yes	Yes	Yes	Yes	Yes	No	Yes
12. Is a site map accessible on every page?	No	Yes	Yes	No	Yes	Yes	No	Yes
13. Does the web site offer content in other languages besides Greek?	One language	> 2 languages	One language	One language	One language	One language	One language	> 2 languages
14. For each other language, how much is the offered content?	Whole content	Whole content	Whole content	Whole content	Whole content	Whole content	Whole content	Whole content
15. Is free translation material available from the site?	No	No	No	No	No	No	No	No
16. Ability to vary the text size or audio description?	No	No	Yes	Yes	Yes	No	No	Yes

17.	Does the site support telecommunications device for deaf?	No	No	No	No	No	No	No	No
18.	Is there Text Telephone available? (TTY)	No	No	Yes	No	No	No	No	No
19.	Is the site visible by color blind citizens?	No	Yes	Yes	Yes	Yes	No	Yes	Yes
20.	Does the site provide personalization options?	Yes	Yes	Yes	Yes	Yes	No	Yes	No
21.	Are there pools organized online?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
22.	Is it possible for citizens to send an email to an employee?	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
23.	Is it possible for citizens to subscribe on a list for receiving e-mails	No	Yes	No	No	No	No	No	No
24.	Is it possible for citizens to communicate through e-mails, m. boards ?	Email	Both	Email	Email	Email	Both	Email	Email
25.	Are the titles consistent with the text below?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
26.	Do links correctly describe the destination site or page?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
27.	Is text or graphics used as hyperlinks?	Text	Graphics	Text	Text	Text	Graphics	Graphics	Graphics
28.	Are links to other relevant web sites available?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
29.	Number of hyperlinks	33	-	165	85	135	101	84	68
30.	Which is the percentage of broken links?	24,24%	-	0,00%	0,00%	0,74%	0,00%	19,05%	0,00%
31.	Do the activated links have a different color or are they underlined?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
32.	Is the font style easily visible?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
33.	Number of different font styles	3	4	3	4	3	3	4	3
34.	Block letters/Italics	Italics	Both	None	Italics	None	None	Both	Block letters
35.	Is there sufficient contrast between background and foreground?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
36.	Is there a revision date?	No	No	No	Yes	No	No	No	Yes
37.	When was the web site updated for the last time?	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
38.	Are there fields with structured answers?	Yes	Yes	Yes	No	No	Yes	Yes	Yes
39.	Is there a feedback mechanism to inform about a submission?	No	Yes	Yes	No	No	Yes	Yes	Yes
40.	Is it possible to move around in a form only by pressing TAB button?	Yes	Yes	Yes	No	No	Yes	Yes	Yes
41.	Is a privacy and security statement available	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes

	online?							
42.	Are citizen personal data transmitted over a secure connection?	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
43.	Electronic transactions use a legal binding validation/recognition form	No	No	No	No	No	No	No	No
44.	Is information on the usage of these personal data available online?	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
45.	Do forms need more than 5 sec to load?	No	No	No	Yes	Yes	No	Yes	No
46.	Does the web site pass the first WCAG W3C accessibility level?	Yes	No	Yes	Yes	No	No	No	Yes
47.	How long did it take the webmaster to reply to an e-mail?	< month	< day	< week	-	-	< week	< month	< day
48.	Downloading time required	6'-10'	< 5'	< 5'	< 5'	< 5'	< 5'	< 5'	< 5'
49.	Which is the degree of browser compatibility of the site?	1 star	3 stars	1 star	1 star	2 stars	1 star	1 star	2 stars
50.	Does the web site provide a link for downloading specific software?	No	Yes	Yes	Yes	Yes	Yes	No	Yes
		3,297587	8,13252	8,295004	8,038779	6,624338	7,503416	5,765673	8,984518

Table 7.13. Personal documents

Metrics	Greece www.passport.gov.gr (02/08/10)	Great Britain http://www.dvla.gov.uk/ (02/08/10)	Great Britain www.passport-application.gov.uk (03/08/10)	Ireland www.foreignaffairs.gov.ie (04/08/10)	Ireland www.rsa.ie (04/08/10)	Malta www.passaporti.gov.mt (10/08/10)	Finland www.poliisi.fi (11/08/10)
1. Is the navigation menu well organized and with a clear structure?	Yes	Yes	No	Yes	Yes	Yes	Yes
2. Does the navigation menu remain at the same area on all pages?	Yes	Yes	No	Yes	Yes	Yes	Yes
3. Is the navigation path visible on all pages of the web site?	Yes	Yes	No	Yes	Yes	Yes	Yes
4. Is the option “Return to the homepage” available on all pages?	Yes	Yes	No	Yes	Yes	Yes	No
5. Is a search engine available online?	Yes	Yes	No	Yes	Yes	Yes	Yes
6. Is search function available for the whole site?	Yes	Yes	No	Yes	Yes	Yes	Yes
7. Is search function available within specific category?	Yes	No	No	Yes	No	No	Yes
8. Are drop down lists available?	Yes	Yes	No	Yes	Yes	Yes	Yes
9. Are the results on one page, few and relevant?	Yes	Yes	No	No	Yes	Yes	Yes
10. Are the criteria recognized whether single or plural?	Yes	Yes	No	Yes	Yes	Yes	Yes
11. Is a site map or A-Z index available online?	Yes	Yes	No	Yes	Yes	Yes	Yes
12. Is a site map accessible on every page?	Yes	Yes	No	Yes	Yes	Yes	Yes
13. Does the web site offer content in other languages besides Greek?	One language	One language	One language	No	One language	One language	> 2 languages
14. For each other language, how much is the offered content?	Whole content	Whole content	N/A	N/A	Whole content	Whole content	Whole content
15. Is free translation material available from the site?	No	No	No	No	No	No	No
16. Ability to vary the text size or audio description?	No	Yes	No	No	No	No	No
17. Does the site support telecommunications device for deaf?	No	Yes	No	No	No	No	No
18. Is there Text Telephone available? (TTY)	No	Yes	No	No	No	No	No
19. Is the site visible by color blind citizens?	No	Yes	Yes	Yes	Yes	Yes	Yes
20. Does the site provide personalization options?	No	Yes	No	No	No	Yes	No
21. Are there pools organized online?	Yes	Yes	No	Yes	Yes	Yes	Yes
22. Is it possible for citizens to send an email to an employee?	No	Yes	No	Yes	Yes	Yes	Yes
23. Is it possible for citizens to subscribe on a list for receiving e-mails	No	No	No	No	No	Yes	No
24. Is it possible for citizens to communicate through e-mails, m.	None	Email	None	Email	Email	Email	Email

	boards ?						
25.	Are the titles consistent with the text below?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
26.	Do links correctly describe the destination site or page?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
27.	Is text or graphics used as hyperlinks?	Graphics	Graphics	Text	Text	Text	Graphics	Text
28.	Are links to other relevant web sites available?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
29.	Number of hyperlinks	74	73	19	88	98	46	218
30.	Which is the percentage of broken links?	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	12,84%
31.	Do the activated links have a different color or are they underlined?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
32.	Is the font style easily visible?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
33.	Number of different font styles	3	3	3	3	2	2	2
34.	Block letters/Italics	None	None	None	None	None	Both	None
35.	Is there sufficient contrast between background and foreground?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
36.	Is there a revision date?	No	No	No	Yes	No	No	No
37.	When was the web site updated for the last time?	N/A	< week	N/A	< year	N/A	N/A	N/A
38.	Are there fields with structured answers?	No	Yes	Yes	No	No	Yes	Yes
39.	Is there a feedback mechanism to inform about a submission?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
40.	Is it possible to move around in a form only by pressing TAB button?	No	Yes	Yes	No	No	Yes	Yes
41.	Is a privacy and security statement available online?	No	Yes	Yes	Yes	Yes	Yes	No
42.	Are citizen personal data transmitted over a secure connection?	No	Yes	Yes	Yes	Yes	Yes	Yes
43.	Electronic transactions use a legal binding validation/recognition form	No	No	No	No	No	No	No
44.	Is information on the usage of these personal data available online?	No	Yes	Yes	Yes	Yes	Yes	No
45.	Do forms need more than 5 sec to load?	No	No	No	Yes	Yes	No	No
46.	Does the web site pass the first WCAG W3C accessibility level?	Yes	Yes	Yes	Yes	Yes	Yes	No
47.	How long did it take the webmaster to reply to an e-mail?	< month	-	< day	-	< month	-	-
48.	Downloading time required	< 5’	< 5’	< 5’	< 5’	< 5’	< 5’	< 5’
49.	Which is the degree of browser compatibility of the site?	2 stars	1 star	1 star	3 stars	1 star	2 stars	3 stars
50.	Does the web site provide a link for downloading specific software?	Yes	Yes	Yes	Yes	Yes	Yes	No
		4,662034	8,717878	7,105539	7,530497	6,972219	8,624138	4,962004

Table 7.14. Car registration

Metrics	Greece (www.gsis.gr) 26/06/10	Great Britain http://www.dvla.gov.uk/drivers.aspx (03/08/10)	Ireland www.revenue.ie (04/08/10)	Finland www.ake.fi (11/08/10)
1. Is the navigation menu well organized and with a clear structure?	Yes	Yes	Yes	Yes
2. Does the navigation menu remain at the same area on all pages?	Yes	Yes	Yes	Yes
3. Is the navigation path visible on all pages of the web site?	Yes	Yes	Yes	Yes
4. Is the option “Return to the homepage” available on all pages?	Yes	Yes	Yes	Yes
5. Is a search engine available online?	Yes	Yes	Yes	Yes
6. Is search function available for the whole site?	Yes	Yes	Yes	Yes
7. Is search function available within specific category?	No	No	No	No
8. Are drop down lists available?	Yes	Yes	Yes	Yes
9. Are the results on one page, few and relevant?	Yes	Yes	Yes	Yes
10. Are the criteria recognized whether single or plural?	Yes	Yes	Yes	Yes
11. Is a site map or A-Z index available online?	Yes	Yes	Yes	No
12. Is a site map accessible on every page?	No	Yes	Yes	No
13. Does the web site offer content in other languages besides Greek?	One language	One language	One language	> 2 languages
14. For each other language, how much is the offered content?	N/A	Whole content	Whole content	Whole content
15. Is free translation material available from the site?	No	No	No	No
16. Ability to vary the text size or audio description?	No	Yes	Yes	No
17. Does the site support telecommunications device for deaf?	No	Yes	No	No
18. Is there Text Telephone available? (TTY)	No	Yes	No	No
19. Is the site visible by color blind citizens?	Yes	Yes	No	Yes
20. Does the site provide personalization options?	Yes	Yes	Yes	No
21. Are there pools organized online?	Yes	Yes	Yes	Yes
22. Is it possible for citizens to send an email to an employee?	Yes	Yes	Yes	Yes
23. Is it possible for citizens to subscribe on a list for receiving e-mails	No	No	No	No
24. Is it possible for citizens to communicate through e-mails, m. boards ?	Email	Email	Email	Email
25. Are the titles consistent with the text below?	Yes	Yes	Yes	Yes
26. Do links correctly describe the destination site or page?	Yes	Yes	Yes	Yes

27. Is text or graphics used as hyperlinks?	Graphics	Graphics	Text	Text
28. Are links to other relevant web sites available?	Yes	Yes	Yes	Yes
29. Number of hyperlinks	196	73	62	59
30. Which is the percentage of broken links?	60,40%	0,00%	3,23%	8,48%
31. Do the activated links have a different color or are they underlined?	Yes	Yes	Yes	Yes
32. Is the font style easily visible?	Yes	Yes	Yes	Yes
33. Number of different font styles	2	3	3	3
34. Block letters/Italics	Yes	None	None	None
35. Is there sufficient contrast between background and foreground?	Yes	Yes	Yes	Yes
36. Is there a revision date?	No	No	No	No
37. When was the web site updated for the last time?	N/A	< week	N/A	N/A
38. Are there fields with structured answers?	Yes	Yes	Yes	Yes
39. Is there a feedback mechanism to inform about a submission?	No	Yes	No	Yes
40. Is it possible to move around in a form only by pressing TAB button?	Yes	Yes	Yes	Yes
41. Is a privacy and security statement available online?	Yes	Yes	Yes	No
42. Are citizen personal data transmitted over a secure connection?	Yes	Yes	Yes	No
43. Electronic transactions use a legal binding validation/recognition form	Yes	No	Yes	No
44. Is information on the usage of these personal data available online?	Yes	Yes	Yes	No
45. Do forms need more than 5 sec to load?	No	No	No	Yes
46. Does the web site pass the first WCAG W3C accessibility level?	Yes	Yes	Yes	No
47. How long did it take the webmaster to reply to an e-mail?	< day	-	-	-
48. Downloading time required	< 5’	< 5’	< 5’	< 5’
49. Which is the degree of browser compatibility of the site?	2 stars	1 star	1 star	3 stars
50. Does the web site provide a link for downloading specific software?	Yes	Yes	Yes	No
	8,67885	8,717878	8,634553	3,780872

Table 7.15. Application for building permission

Metrics	Greece http://www.poleodomia.gov.gr (02/08/10)	Great Britain www.planningportal.gov.uk (03/08/10)	Ireland www.dublincity.ie (04/08/10)	Malta www.mepa.gov.mt (10/08/10)
1. Is the navigation menu well organized and with a clear structure?	Yes	Yes	Yes	Yes
2. Does the navigation menu remain at the same area on all pages?	Yes	Yes	Yes	Yes
3. Is the navigation path visible on all pages of the web site?	Yes	Yes	Yes	Yes
4. Is the option “Return to the homepage” available on all pages?	Yes	Yes	Yes	Yes
5. Is a search engine available online?	Yes	Yes	Yes	No
6. Is search function available for the whole site?	Yes	Yes	Yes	No
7. Is search function available within specific category?	No	No	No	No
8. Are drop down lists available?	Yes	Yes	Yes	No
9. Are the results on one page, few and relevant?	Yes	Yes	Yes	No
10. Are the criteria recognized whether single or plural?	Yes	Yes	Yes	No
11. Is a site map or A-Z index available online?	Yes	No	Yes	Yes
12. Is a site map accessible on every page?	No	No	Yes	Yes
13. Does the web site offer content in other languages besides Greek?	No	One language	One language	One language
14. For each other language, how much is the offered content?	N/A	Whole content	Whole content	Whole content
15. Is free translation material available from the site?	No	No	No	No
16. Ability to vary the text size or audio description?	No	No	No	No
17. Does the site support telecommunications device for deaf?	No	No	No	No
18. Is there Text Telephone available? (TTY)	No	No	No	Yes
19. Is the site visible by color blind citizens?	No	Yes	No	Yes
20. Does the site provide personalization options?	No	Yes	Yes	No
21. Are there pools organized online?	No	Yes	Yes	Yes
22. Is it possible for citizens to send an email to an employee?	Yes	Yes	Yes	Yes
23. Is it possible for citizens to subscribe on a list for receiving e-mails	No	Yes	No	Yes
24. Is it possible for citizens to communicate through e-mails, m. boards ?	None	Email	Email	Both
25. Are the titles consistent with the text below?	Yes	Yes	Yes	Yes
26. Do links correctly describe the destination site or page?	Yes	Yes	Yes	Yes
27. Is text or graphics used as hyperlinks?	Graphics	Graphics	Text	Graphics

28. Are links to other relevant web sites available?	Yes	Yes	Yes	Yes
29. Number of hyperlinks	86	74	243	44
30. Which is the percentage of broken links?	0,00%	2,70%	0,00%	2,27%
31. Do the activated links have a different color or are they underlined?	Yes	Yes	Yes	Yes
32. Is the font style easily visible?	Yes	Yes	Yes	Yes
33. Number of different font styles	4	3	3	2
34. Block letters/Italics	Italics	Italics	Italics	Both
35. Is there sufficient contrast between background and foreground?	Yes	Yes	Yes	Yes
36. Is there a revision date?	No	No	No	Yes
37. When was the web site updated for the last time?	N/A	N/A	N/A	N/A
38. Are there fields with structured answers?	Yes	Yes	No	Yes
39. Is there a feedback mechanism to inform about a submission?	No	Yes	Yes	Yes
40. Is it possible to move around in a form only by pressing TAB button?	Yes	Yes	Yes	Yes
41. Is a privacy and security statement available online?	No	Yes	Yes	Yes
42. Are citizen personal data transmitted over a secure connection?	No	Yes	Yes	Yes
43. Electronic transactions use a legal binding validation/recognition form	No	No	No	Yes
44. Is information on the usage of these personal data available online?	No	Yes	Yes	Yes
45. Do forms need more than 5 sec to load?	No	No	No	No
46. Does the web site pass the first WCAG W3C accessibility level?	Yes	No	Yes	Yes
47. How long did it take the webmaster to reply to an e-mail?	< month	< week	< month	< week
48. Downloading time required	< 5’	< 5’	< 5’	< 5’
49. Which is the degree of browser compatibility of the site?	1 star	1 star	1 star	2 stars
50. Does the web site provide a link for downloading specific software?	Yes	Yes	Yes	Yes
	4,459971	7,222194	7,774223	8,661634

Table 7.16. Declaration to the police

Metrics	Greece www.astynomia.gr (02/08/10)	Great Britain http://www.direct.gov.uk/en/MoneyTaxAndBenefits/Taxes/index.htm (03/08/10)	Ireland www.garda.ie (04/08/10)	Malta www.pulizija.gov.mt (10/08/10)	Finland www.poliisi.fi (11/08/10)
1. Is the navigation menu well organized and with a clear structure?	Yes	Yes	Yes	Yes	Yes
2. Does the navigation menu remain at the same area on all pages?	Yes	Yes	Yes	Yes	Yes
3. Is the navigation path visible on all pages of the web site?	Yes	Yes	Yes	Yes	Yes
4. Is the option “Return to the homepage” available on all pages?	Yes	Yes	Yes	Yes	No
5. Is a search engine available online?	Yes	Yes	Yes	No	Yes
6. Is search function available for the whole site?	Yes	Yes	Yes	No	Yes
7. Is search function available within specific category?	Yes	Yes	Yes	No	Yes
8. Are drop down lists available?	Yes	Yes	Yes	No	Yes
9. Are the results on one page, few and relevant?	No	Yes	Yes	No	Yes
10. Are the criteria recognized whether single or plural?	Yes	No	Yes	No	Yes
11. Is a site map or A-Z index available online?	Yes	Yes	Yes	No	Yes
12. Is a site map accessible on every page?	No	Yes	Yes	No	Yes
13. Does the web site offer content in other languages besides Greek?	One language	One language	One language	One language	> 2 languages
14. For each other language, how much is the offered content?	Whole content	Whole content	Whole content	Whole content	Whole content
15. Is free translation material available from the site?	No	No	No	No	No
16. Ability to vary the text size or audio description?	No	Yes	No	Yes	No
17. Does the site support telecommunications device for deaf?	No	No	No	No	No
18. Is there Text Telephone available? (TTY)	No	Yes	No	No	No
19. Is the site visible by color blind citizens?	No	Yes	Yes	Yes	Yes
20. Does the site provide personalization options?	No	Yes	No	No	No
21. Are there pools organized online?	Yes	Yes	Yes	Yes	Yes
22. Is it possible for citizens to send an email to an employee?	No	Yes	Yes	No	Yes
23. Is it possible for citizens to subscribe on a list for receiving e-mails	No	No	No	No	No
24. Is it possible for citizens to communicate through e-mails, m. boards ?	Email	Email	Email	Both	Email

25. Are the titles consistent with the text below?	Yes	Yes	Yes	Yes	Yes
26. Do links correctly describe the destination site or page?	Yes	Yes	Yes	Yes	Yes
27. Is text or graphics used as hyperlinks?	Graphics	Text	Graphics	Graphics	Text
28. Are links to other relevant web sites available?	Yes	Yes	Yes	Yes	Yes
29. Number of hyperlinks	139	165	99	84	218
30. Which is the percentage of broken links?	95%	0,00%	0,00%	19,05%	12,84%
31. Do the activated links have a different color or are they underlined?	Yes	Yes	Yes	Yes	Yes
32. Is the font style easily visible?	Yes	Yes	Yes	Yes	Yes
33. Number of different font styles	3	3	3	3	2
34. Block letters/Italics	None	None	Block letters	None	None
35. Is there sufficient contrast between background and foreground?	Yes	Yes	Yes	Yes	Yes
36. Is there a revision date?	No	No	No	No	No
37. When was the web site updated for the last time?	N/A	N/A	N/A	N/A	N/A
38. Are there fields with structured answers?	No	Yes	No	No	Yes
39. Is there a feedback mechanism to inform about a submission?	No	Yes	Yes	Yes	Yes
40. Is it possible to move around in a form only by pressing TAB button?	Yes	Yes	Yes	Yes	Yes
41. Is a privacy and security statement available online?	No	Yes	Yes	Yes	No
42. Are citizen personal data transmitted over a secure connection?	No	Yes	Yes	Yes	Yes
43. Electronic transactions use a legal binding validation/recognition form	No	No	No	No	No
44. Is information on the usage of these personal data available online?	No	Yes	Yes	Yes	No
45. Do forms need more than 5 sec to load?	No	No	No	No	No
46. Does the web site pass the first WCAG W3C accessibility level?	No	Yes	No	No	No
47. How long did it take the webmaster to reply to an e-mail?	< day	< week	-	< week	-
48. Downloading time required	< 5’	< 5’	6’-10’	< 5’	< 5’
49. Which is the degree of browser compatibility of the site?	5 stars	1 star	1 star	3 stars	3 stars
50. Does the web site provide a link for downloading specific software?	No	Yes	Yes	Yes	No
	4,455805	8,295004	7,280522	6,828484	4,962004

Table 7.17. Public libraries

Metrics	Greece http://www.ypepth.gr/ (23/06/10)	Ireland www.library.ie (04/08/10)	Malta www.opac.library.gov.mt (10/08/10)	Malta www.libraries.gov.mt (10/08/10)	Finland www.kirjastot.fi (11/08/10)
1. Is the navigation menu well organized and with a clear structure?	Yes	Yes	Yes	Yes	Yes
2. Does the navigation menu remain at the same area on all pages?	Yes	Yes	No	Yes	Yes
3. Is the navigation path visible on all pages of the web site?	Yes	Yes	No	Yes	Yes
4. Is the option “Return to the homepage” available on all pages?	Yes	Yes	No	Yes	Yes
5. Is a search engine available online?	Yes	Yes	No	Yes	Yes
6. Is search function available for the whole site?	Yes	Yes	No	Yes	Yes
7. Is search function available within specific category?	Yes	No	No	Yes	Yes
8. Are drop down lists available?	Yes	Yes	No	Yes	Yes
9. Are the results on one page, few and relevant?	No	Yes	No	Yes	Yes
10. Are the criteria recognized whether single or plural?	Yes	Yes	No	Yes	Yes
11. Is a site map or A-Z index available online?	No	Yes	No	Yes	Yes
12. Is a site map accessible on every page?	No	Yes	No	Yes	Yes
13. Does the web site offer content in other languages besides Greek?	One language	No	No	No	> 2 languages
14. For each other language, how much is the offered content?	Whole content	N/A	N/A	N/A	Whole content
15. Is free translation material available from the site?	No	No	No	No	No
16. Ability to vary the text size or audio description?	No	No	Yes	Yes	Yes
17. Does the site support telecommunications device for deaf?	No	No	No	No	No
18. Is there Text Telephone available? (TTY)	No	No	No	No	No
19. Is the site visible by color blind citizens?	Yes	Yes	Yes	Yes	Yes
20. Does the site provide personalization options?	No	Yes	No	No	Yes
21. Are there pools organized online?	Yes	Yes	Yes	Yes	Yes
22. Is it possible for citizens to send an email to an employee?	No	Yes	No	Yes	Yes
23. Is it possible for citizens to subscribe on a list for receiving e-mails	No	No	No	No	Yes
24. Is it possible for citizens to communicate through e-mails, m. boards ?	Email	Email	Both	Email	Email
25. Are the titles consistent with the text below?	Yes	Yes	Yes	Yes	Yes
26. Do links correctly describe the destination site or page?	Yes	Yes	Yes	Yes	Yes

27. Is text or graphics used as hyperlinks?	Graphics	Graphics	Graphics	Graphics	Graphics
28. Are links to other relevant web sites available?	Yes	Yes	Yes	Yes	Yes
29. Number of hyperlinks	178	147	11	203	115
30. Which is the percentage of broken links?	1,13%	0,68%	0,00%	1,48%	0,00%
31. Do the activated links have a different color or are they underlined?	Yes	Yes	Yes	Yes	Yes
32. Is the font style easily visible?	Yes	Yes	Yes	Yes	Yes
33. Number of different font styles	1	4	2	3	3
34. Block letters/Italics	Block letters	Block letters	None	None	Block letters
35. Is there sufficient contrast between background and foreground?	Yes	Yes	Yes	Yes	Yes
36. Is there a revision date?	No	Yes	No	No	Yes
37. When was the web site updated for the last time?	N/A	N/A	N/A	N/A	N/A
38. Are there fields with structured answers?	No	Yes	No	Yes	Yes
39. Is there a feedback mechanism to inform about a submission?	No	Yes	No	Yes	Yes
40. Is it possible to move around in a form only by pressing TAB button?	Yes	Yes	No	Yes	Yes
41. Is a privacy and security statement available online?	No	No	No	Yes	Yes
42. Are citizen personal data transmitted over a secure connection?	No	No	No	Yes	Yes
43. Electronic transactions use a legal binding validation/recognition form	No	No	No	No	No
44. Is information on the usage of these personal data available online?	No	No	No	Yes	Yes
45. Do forms need more than 5 sec to load?	No	No	Yes	No	No
46. Does the web site pass the first WCAG W3C accessibility level?	No	No	No	No	Yes
47. How long did it take the webmaster to reply to an e-mail?	< month	-	-	-	< week
48. Downloading time required	6'-10'	< 5'	< 5'	< 5'	< 5'
49. Which is the degree of browser compatibility of the site?	1 star	1 star	3 stars	3 stars	1 star
50. Does the web site provide a link for downloading specific software?	Yes	No	Yes	Yes	No
	3,660051	4,582875	2,324768	7,749225	8,397077

Table 7.18. Certificates (birth and marriage)

Metrics	Greece www.ermis.gov.gr (01/08/10)	Great Britain http://www.direct.gov.uk/en/MoneyTaxAndBenefits/Taxes/index.htm (03/08/10)	Ireland www.certificates.ie (04/08/10)	Malta http://www.certifikati.gov.mt/ (10/08/10)
1. Is the navigation menu well organized and with a clear structure?	Yes	Yes	Yes	Yes
2. Does the navigation menu remain at the same area on all pages?	Yes	Yes	Yes	No
3. Is the navigation path visible on all pages of the web site?	Yes	Yes	Yes	Yes
4. Is the option “Return to the homepage” available on all pages?	Yes	Yes	Yes	Yes
5. Is a search engine available online?	Yes	Yes	Yes	Yes
6. Is search function available for the whole site?	Yes	Yes	Yes	Yes
7. Is search function available within specific category?	No	Yes	No	No
8. Are drop down lists available?	Yes	Yes	Yes	No
9. Are the results on one page, few and relevant?	Yes	Yes	Yes	Yes
10. Are the criteria recognized whether single or plural?	Yes	No	No	Yes
11. Is a site map or A-Z index available online?	Yes	Yes	Yes	Yes
12. Is a site map accessible on every page?	Yes	Yes	Yes	Yes
13. Does the web site offer content in other languages besides Greek?	> 2 languages	One language	No	One language
14. For each other language, how much is the offered content?	Whole content	Whole content	N/A	Whole content
15. Is free translation material available from the site?	No	No	No	No
16. Ability to vary the text size or audio description?	No	Yes	Yes	No
17. Does the site support telecommunications device for deaf?	No	No	No	No
18. Is there Text Telephone available? (TTY)	No	Yes	No	No
19. Is the site visible by color blind citizens?	Yes	Yes	Yes	Yes
20. Does the site provide personalization options?	Yes	Yes	Yes	No
21. Are there pools organized online?	Yes	Yes	Yes	Yes
22. Is it possible for citizens to send an email to an employee?	Yes	Yes	Yes	No
23. Is it possible for citizens to subscribe on a list for receiving e-mails	Yes	No	No	No
24. Is it possible for citizens to communicate through e-mails, m. boards ?	Both	Email	Email	Both

25. Are the titles consistent with the text below?	Yes	Yes	Yes	Yes
26. Do links correctly describe the destination site or page?	Yes	Yes	Yes	Yes
27. Is text or graphics used as hyperlinks?	Graphics	Text	Graphics	Graphics
28. Are links to other relevant web sites available?	Yes	Yes	Yes	Yes
29. Number of hyperlinks	-	165	92	86
30. Which is the percentage of broken links?	-	0,00%	1,09%	0,00%
31. Do the activated links have a different color or are they underlined?	Yes	Yes	Yes	Yes
32. Is the font style easily visible?	Yes	Yes	Yes	Yes
33. Number of different font styles	4	3	3	3
34. Block letters/Italics	Both	None	Italics	None
35. Is there sufficient contrast between background and foreground?	Yes	Yes	Yes	Yes
36. Is there a revision date?	No	No	Yes	No
37. When was the web site updated for the last time?	N/A	N/A	N/A	N/A
38. Are there fields with structured answers?	Yes	Yes	Yes	Yes
39. Is there a feedback mechanism to inform about a submission?	Yes	Yes	Yes	Yes
40. Is it possible to move around in a form only by pressing TAB button?	Yes	Yes	Yes	Yes
41. Is a privacy and security statement available online?	Yes	Yes	Yes	Yes
42. Are citizen personal data transmitted over a secure connection?	Yes	Yes	Yes	Yes
43. Electronic transactions use a legal binding validation/recognition form	No	No	No	Yes
44. Is information on the usage of these personal data available online?	Yes	Yes	Yes	Yes
45. Do forms need more than 5 sec to load?	No	No	Yes	No
46. Does the web site pass the first WCAG W3C accessibility level?	No	Yes	Yes	Yes
47. How long did it take the webmaster to reply to an e-mail?	< day	< week	-	-
48. Downloading time required	< 5’	< 5’	< 5’	< 5’
49. Which is the degree of browser compatibility of the site?	3 stars	1 star	1 star	1 star
50. Does the web site provide a link for downloading specific software?	Yes	Yes	Yes	No
	8,13252	8,295004	8,334583	8,161684

Table 7.19. Enrolment in higher education / university

Metrics	Greece http://www.ypepth.gr/ (23/06/10)	Great Britain www.ucas.com (03/08/10)	Ireland www.cao.ie (04/08/10)	Malta www.esims.um.edu.mt (10/08/10)	Finland www.oph.fi (11/08/10)
1. Is the navigation menu well organized and with a clear structure?	Yes	Yes	Yes	Yes	Yes
2. Does the navigation menu remain at the same area on all pages?	Yes	Yes	Yes	Yes	Yes
3. Is the navigation path visible on all pages of the web site?	Yes	Yes	Yes	Yes	Yes
4. Is the option “Return to the homepage” available on all pages?	Yes	Yes	Yes	Yes	Yes
5. Is a search engine available online?	Yes	Yes	Yes	Yes	Yes
6. Is search function available for the whole site?	Yes	Yes	Yes	Yes	Yes
7. Is search function available within specific category?	Yes	No	No	No	Yes
8. Are drop down lists available?	Yes	Yes	Yes	No	Yes
9. Are the results on one page, few and relevant?	No	Yes	Yes	Yes	Yes
10. Are the criteria recognized whether single or plural?	Yes	Yes	Yes	Yes	Yes
11. Is a site map or A-Z index available online?	No	Yes	No	Yes	Yes
12. Is a site map accessible on every page?	No	Yes	No	Yes	Yes
13. Does the web site offer content in other languages besides Greek?	One language	One language	One language	One language	> 2 languages
14. For each other language, how much is the offered content?	Whole content	Whole content	Whole content	Whole content	Whole content
15. Is free translation material available from the site?	No	No	No	No	No
16. Ability to vary the text size or audio description?	No	No	No	No	Yes
17. Does the site support telecommunications device for deaf?	No	Yes	No	No	No
18. Is there Text Telephone available? (TTY)	No	Yes	No	No	No
19. Is the site visible by color blind citizens?	Yes	No	Yes	Yes	Yes
20. Does the site provide personalization options?	No	Yes	Yes	No	No
21. Are there pools organized online?	Yes	Yes	Yes	Yes	Yes
22. Is it possible for citizens to send an email to an employee?	No	Yes	No	Yes	Yes
23. Is it possible for citizens to subscribe on a list for receiving e-mails	No	Yes	No	No	No
24. Is it possible for citizens to communicate through e-mails, m. boards ?	Email	Email	Email	Email	Email
25. Are the titles consistent with the text below?	Yes	Yes	Yes	Yes	Yes
26. Do links correctly describe the destination site or page?	Yes	Yes	Yes	Yes	Yes
27. Is text or graphics used as hyperlinks?	Graphics	Graphics	Graphics	Graphics	Graphics

28. Are links to other relevant web sites available?	Yes	Yes	Yes	Yes	Yes
29. Number of hyperlinks	178	54	43	13	218
30. Which is the percentage of broken links?	1,13%	1,85%	0,00%	0,00%	90,83%
31. Do the activated links have a different color or are they underlined?	Yes	Yes	Yes	Yes	Yes
32. Is the font style easily visible?	Yes	Yes	Yes	Yes	Yes
33. Number of different font styles	1	3	2	3	3
34. Block letters/Italics	Block letters	None	None	Both	Italics
35. Is there sufficient contrast between background and foreground?	Yes	Yes	Yes	Yes	Yes
36. Is there a revision date?	No	No	No	Yes	Yes
37. When was the web site updated for the last time?	N/A	N/A	N/A	N/A	N/A
38. Are there fields with structured answers?	No	Yes	Yes	Yes	Yes
39. Is there a feedback mechanism to inform about a submission?	No	Yes	Yes	Yes	Yes
40. Is it possible to move around in a form only by pressing TAB button?	Yes	Yes	Yes	Yes	Yes
41. Is a privacy and security statement available online?	No	Yes	Yes	Yes	No
42. Are citizen personal data transmitted over a secure connection?	No	Yes	Yes	Yes	No
43. Electronic transactions use a legal binding validation/recognition form	No	No	No	Yes	No
44. Is information on the usage of these personal data available online?	No	Yes	Yes	Yes	No
45. Do forms need more than 5 sec to load?	No	No	No	No	No
46. Does the web site pass the first WCAG W3C accessibility level?	No	Yes	No	Yes	Yes
47. How long did it take the webmaster to reply to an e-mail?	< week	< week	-	-	< month
48. Downloading time required	6'-10'	< 5'	< 5'	-	< 5'
49. Which is the degree of browser compatibility of the site?	1 star	2 stars	3 stars	-	2 stars
50. Does the web site provide a link for downloading specific software?	Yes	Yes	Yes	Yes	Yes
	3,660051	8,401243	7,3326	9,563627	5,224478

Table 7.20. Announcement of moving

Metrics	Greece www.ermis.gov.gr (01/08/10)	Malta www.changeadress.gov.mt (10/08/10)	Finland www.posti.fi (11/08/10)
1. Is the navigation menu well organized and with a clear structure?	Yes	Yes	Yes
2. Does the navigation menu remain at the same area on all pages?	Yes	Yes	Yes
3. Is the navigation path visible on all pages of the web site?	Yes	Yes	Yes
4. Is the option “Return to the homepage” available on all pages?	Yes	Yes	Yes
5. Is a search engine available online?	Yes	Yes	Yes
6. Is search function available for the whole site?	Yes	Yes	Yes
7. Is search function available within specific category?	No	No	Yes
8. Are drop down lists available?	Yes	Yes	Yes
9. Are the results on one page, few and relevant?	Yes	Yes	Yes
10. Are the criteria recognized whether single or plural?	Yes	Yes	Yes
11. Is a site map or A-Z index available online?	Yes	Yes	Yes
12. Is a site map accessible on every page?	Yes	Yes	Yes
13. Does the web site offer content in other languages besides Greek?	> 2 languages	One language	> 2 languages
14. For each other language, how much is the offered content?	Whole content	Whole content	Whole content
15. Is free translation material available from the site?	No	No	No
16. Ability to vary the text size or audio description?	No	No	No
17. Does the site support telecommunications device for deaf?	No	No	No
18. Is there Text Telephone available? (TTY)	No	No	No
19. Is the site visible by color blind citizens?	Yes	Yes	Yes
20. Does the site provide personalization options?	Yes	No	Yes
21. Are there pools organized online?	Yes	Yes	Yes
22. Is it possible for citizens to send an email to an employee?	Yes	Yes	Yes
23. Is it possible for citizens to subscribe on a list for receiving e-mails	Yes	Yes	No
24. Is it possible for citizens to communicate through e-mails, m. boards ?	Both	Email	Email
25. Are the titles consistent with the text below?	Yes	Yes	Yes
26. Do links correctly describe the destination site or page?	Yes	Yes	Yes

27. Is text or graphics used as hyperlinks?	Graphics	Text	Graphics
28. Are links to other relevant web sites available?	Yes	Yes	Yes
29. Number of hyperlinks	-	70	89
30. Which is the percentage of broken links?	-	0,00%	1,12%
31. Do the activated links have a different color or are they underlined?	Yes	Yes	Yes
32. Is the font style easily visible?	Yes	Yes	Yes
33. Number of different font styles	4	3	3
34. Block letters/Italics	Both	Both	Block letters
35. Is there sufficient contrast between background and foreground?	Yes	Yes	Yes
36. Is there a revision date?	No	Yes	No
37. When was the web site updated for the last time?	N/A	N/A	N/A
38. Are there fields with structured answers?	Yes	Yes	Yes
39. Is there a feedback mechanism to inform about a submission?	Yes	Yes	Yes
40. Is it possible to move around in a form only by pressing TAB button?	Yes	Yes	Yes
41. Is a privacy and security statement available online?	Yes	Yes	Yes
42. Are citizen personal data transmitted over a secure connection?	Yes	Yes	Yes
43. Electronic transactions use a legal binding validation/recognition form	No	Yes	Yes
44. Is information on the usage of these personal data available online?	Yes	Yes	Yes
45. Do forms need more than 5 sec to load?	No	No	No
46. Does the web site pass the first WCAG W3C accessibility level?	No	Yes	No
47. How long did it take the webmaster to reply to an e-mail?	< day	-	-
48. Downloading time required	< 5’	< 5’	< 5’
49. Which is the degree of browser compatibility of the site?	3 stars	2 stars	1 star
50. Does the web site provide a link for downloading specific software?	Yes	No	Yes
	8,13252	9,030347	8,072109

Table 7.21. Health related services

Metrics	Greece www.yyka.gov.gr (25/06/10)	Great Britain www.nhsdirect.nhs.uk (03/08/10)	Ireland www.citizensinformation.ie (04/08/10)	Malta http://www.ehealth.gov.mt/ (10/08/10)	Finland www.stm.fi (11/08/10)
1. Is the navigation menu well organized and with a clear structure?	Yes	Yes	Yes	Yes	Yes
2. Does the navigation menu remain at the same area on all pages?	Yes	Yes	Yes	Yes	Yes
3. Is the navigation path visible on all pages of the web site?	Yes	Yes	Yes	Yes	Yes
4. Is the option “Return to the homepage” available on all pages?	Yes	Yes	Yes	Yes	Yes
5. Is a search engine available online?	Yes	Yes	Yes	Yes	Yes
6. Is search function available for the whole site?	Yes	Yes	Yes	Yes	Yes
7. Is search function available within specific category?	No	No	No	Yes	Yes
8. Are drop down lists available?	Yes	Yes	Yes	Yes	Yes
9. Are the results on one page, few and relevant?	No	Yes	Yes	Yes	Yes
10. Are the criteria recognized whether single or plural?	Yes	No	Yes	Yes	Yes
11. Is a site map or A-Z index available online?	No	Yes	No	Yes	Yes
12. Is a site map accessible on every page?	No	Yes	No	Yes	Yes
13. Does the web site offer content in other languages besides Greek?	No	No	> 2 languages	One language	> 2 languages
14. For each other language, how much is the offered content?	N/A	N/A	Whole content	Whole content	Whole content
15. Is free translation material available from the site?	No	No	No	No	No
16. Ability to vary the text size or audio description?	No	No	No	No	Yes
17. Does the site support telecommunications device for deaf?	No	No	No	No	No
18. Is there Text Telephone available? (TTY)	No	No	No	No	No
19. Is the site visible by color blind citizens?	Yes	No	Yes	Yes	Yes
20. Does the site provide personalization options?	No	Yes	Yes	No	Yes
21. Are there pools organized online?	Yes	Yes	Yes	Yes	Yes
22. Is it possible for citizens to send an email to an employee?	Yes	Yes	No	No	Yes
23. Is it possible for citizens to subscribe on a list for receiving e-mails	No	Yes	No	No	Yes
24. Is it possible for citizens to communicate through e-mails, m. boards ?	Both	Both	Email	Both	Email
25. Are the titles consistent with the text below?	Yes	Yes	Yes	Yes	Yes
26. Do links correctly describe the destination site or page?	Yes	Yes	Yes	Yes	Yes

27. Is text or graphics used as hyperlinks?	Graphics	Text	Text	Graphics	Text
28. Are links to other relevant web sites available?	Yes	Yes	Yes	Yes	Yes
29. Number of hyperlinks	175	67	99	218	105
30. Which is the percentage of broken links?	0,00%	23,89%	0,00%	90,83%	0,00%
31. Do the activated links have a different color or are they underlined?	Yes	Yes	Yes	Yes	Yes
32. Is the font style easily visible?	Yes	Yes	Yes	Yes	Yes
33. Number of different font styles	3	3	2	3	3
34. Block letters/Italics	Italics	None	None	Block letters	Block letters
35. Is there sufficient contrast between background and foreground?	Yes	Yes	Yes	Yes	Yes
36. Is there a revision date?	Yes	No	Yes	Yes	Yes
37. When was the web site updated for the last time?	N/A	N/A	N/A	N/A	N/A
38. Are there fields with structured answers?	No	Yes	Yes	Yes	Yes
39. Is there a feedback mechanism to inform about a submission?	No	Yes	Yes	Yes	Yes
40. Is it possible to move around in a form only by pressing TAB button?	No	Yes	No	Yes	Yes
41. Is a privacy and security statement available online?	No	Yes	Yes	Yes	Yes
42. Are citizen personal data transmitted over a secure connection?	No	Yes	Yes	Yes	Yes
43. Electronic transactions use a legal binding validation/recognition form	No	No	No	Yes	Yes
44. Is information on the usage of these personal data available online?	No	Yes	Yes	Yes	Yes
45. Do forms need more than 5 sec to load?	Yes	No	Yes	No	No
46. Does the web site pass the first WCAG W3C accessibility level?	Yes	Yes	Yes	Yes	No
47. How long did it take the webmaster to reply to an e-mail?	< month	-	-	-	< month
48. Downloading time required	6'-10'	< 5'	< 5'	< 5'	< 5'
49. Which is the degree of browser compatibility of the site?	1 star	1 star	1 star		1 star
50. Does the web site provide a link for downloading specific software?	No	Yes	Yes	Yes	Yes
	3,062194	8,374163	7,290938	9,38438	7,951288

7.7 Discussion

As already mentioned an experienced evaluator employed the questionnaire to 50 e-government sites and more precisely:

- 9 e-government sites of Greece
- 7 e-government sites of Great Britain
- 12 e-government sites of Ireland
- 13 e-government sites of Malta
- 9 e-government sites of Finland

The results of the evaluation of e-government sites are presented in Table 7.22.

Table 7.22. Overall results

Countries	*Scores*
Great Britain	8.129246
Malta	7.717778
Ireland	7.369055
Finland	6.456299
Greece	5.166231

On figure 7.2 the Capgemini's results of the '2009 eGovernment benchmark' (Capgemini, 2009) for 'Full online availability', 'Online sophistication' and 'Online sophistication for citizens' for the five countries of our survey, are depicted.

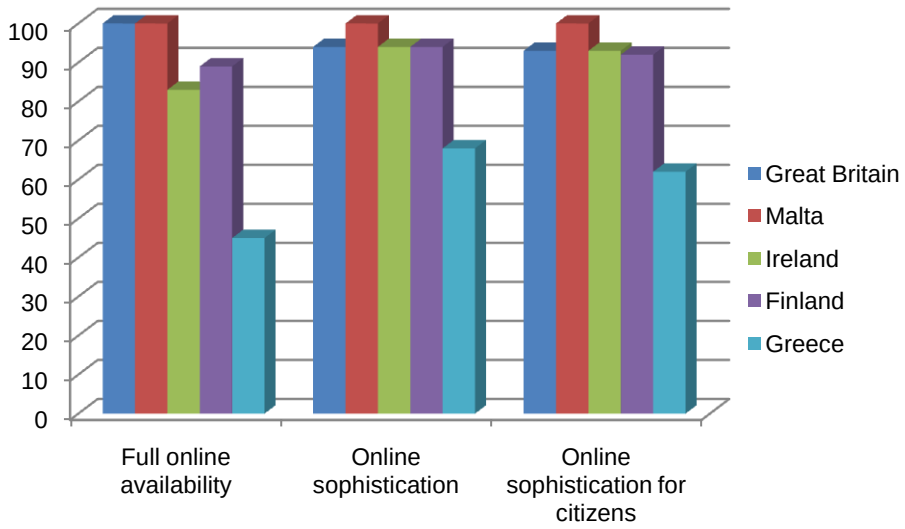

Figure 7.2. Capgemini' s (2009) results

The ranking of the countries concerning e-government service quality came up more or less similar with the ranking of Capgemini (2009) keeping in mind that the two evaluations took place with more than a year difference. Capgemini does not assess service quality as eGovQual does; however it shows a trend that e-GovQual's results follow. In that way we examine the convergent validity of our scale which illustrates the extent to which the measure correlates highly with other measures.

In this evaluation Great Britain scored 8.13, which was the highest score among the five countries under assessment. Great Britain's e-Government strategy is focused on transforming government; by increasing professionalism, sharing services and integrating back offices and improving public service delivery. The strategy is centrally managed from the Cabinet Office. Great Britain is an active participant in EU projects. According to Capgemini (2009) the UK performance based on Information Society and e-Government indicators is high on average, especially in online availability of services.

Malta scores second in the list with a score of 7.72. Malta has set an ambitious and comprehensive strategy for reforming government and the economy. It has shown significant progress on Information Society indictors, and is performing above the EU average. Its e-Government performance has been remarkable in achieving full online availability and sophistication and high user-experience scores. According to Capgemini (2009), this drive is only partly reflected in e-Government usage levels of business, while citizens' up take has stalled slightly below the EU average. Malta's e-Government policy is only one out of seven Information Society policy areas that all fall under responsibility of one Ministry for Infrastructure, Transport and Communication (MITC) and its executive Agency MITA. Its service delivery is also done through trusted third parties.

Ireland came third in the ranking with a score of 7.37. Ireland has shown significant improvements on all Information Society indicators, and is closing the gap with the EU front runners in Internet use and broadband access. Its e-Government performance has also seen considerable improvements, notably in online availability and the usage by business, with some challenges remaining in Citizen's use of e-Government. E-Government in Ireland is placed in the context of a comprehensive program of public service transformation. The Minister for Finance assumed political responsibility for e-Government policy and coordination in 2008. His Department manages those processes,

ensures the effective involvement of all relevant public bodies, and provides the Government with regular progress reports and strategy proposals.

Finland was awarded with 6.46 points although it has been and still is one of the top performing nations in most Information society and e-Government benchmarks. This result is caused by the absence from its websites of metrics evaluating Trust dimension. As it is apparent in Figure 7.3 Finland is awarded a very low score in Trust dimension which lowers its total score. Nevertheless Finland has considerably improved online availability and leads in e-Government usage and user-friendliness. Finland has a truly citizen centric vision of e-Government and an inclusive approach to e-Government strategy formation, involving experts from all layers of government, nongovernment actors and experts. It has deliberately sought to concentrate its e-Government efforts (IT deployment and administrative transformation) under one ministry with support of a powerful CIO function.

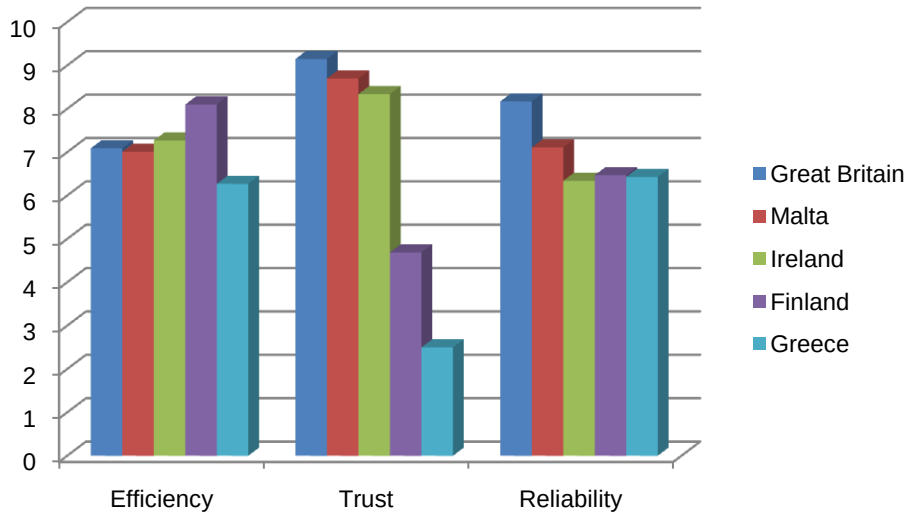

Figure 7.3. Countries' scores per dimension

Lastly Greece with 5.17 points is taking on the challenge to enable a step change in its Information Society performance. It is prioritizing its investment in information technologies to become more competitive. E-Government is part of this strategy, though organizationally positioned in another ministry (Interior) suggesting that e-Government is also seen as an instrument for government reform. Greece's recent efforts have lead to a

stable and relatively high e-Government usage among business. However e-Government use by citizens has stalled and online availability remains below the EU average.

Figure 7.3 depicts each country's score per quality dimension. In Efficiency dimension Finland scores much higher than the other countries. This dimension takes into account technical characteristics of the website and mirrors well structured and organized websites. In Trust dimension Great Britain is placed far ahead the rest of the countries. Trust dimension demonstrates transactions' security issues. The low score achieved in this dimension by Finland caused its low total score. Finally, in Reliability dimension Great Britain scores higher than the rest of the countries. Results indicate that in Finland websites at all government services place emphasis mainly on the content, navigation and citizen friendliness of the site while in Great Britain most websites at all government services place emphasis firstly on technical characteristics such as accessibility and privacy and secondly on general characteristics such as navigation, content etc.

More analytically, as depicted in Figure 7.4, we present each country's score per basic service. We must note here that in the cases that a basic service is covered by two websites in the same country, we take into account the website with the highest score.

In the basic services:

- "Income taxes: declaration, notification of assessment" which stands for a standard procedure to declare labor income tax of an employee,
- "Job search services by labor offices" which comprises the standard procedure to obtain job offerings as organized by official labor offices and not private market initiatives and
- "Car registration (new, used, imported cars)" which covers the standard procedure to register a new, used or imported car,

Great Britain is awarded the highest score while Finland the lowest.

Great Britain also gets the highest score while Greece the lowest in the services:

- "Personal documents: passport and driver's license" service which stands for the standard procedure to obtain an international passport a driver's license for a personal vehicle and not for professional use and in the

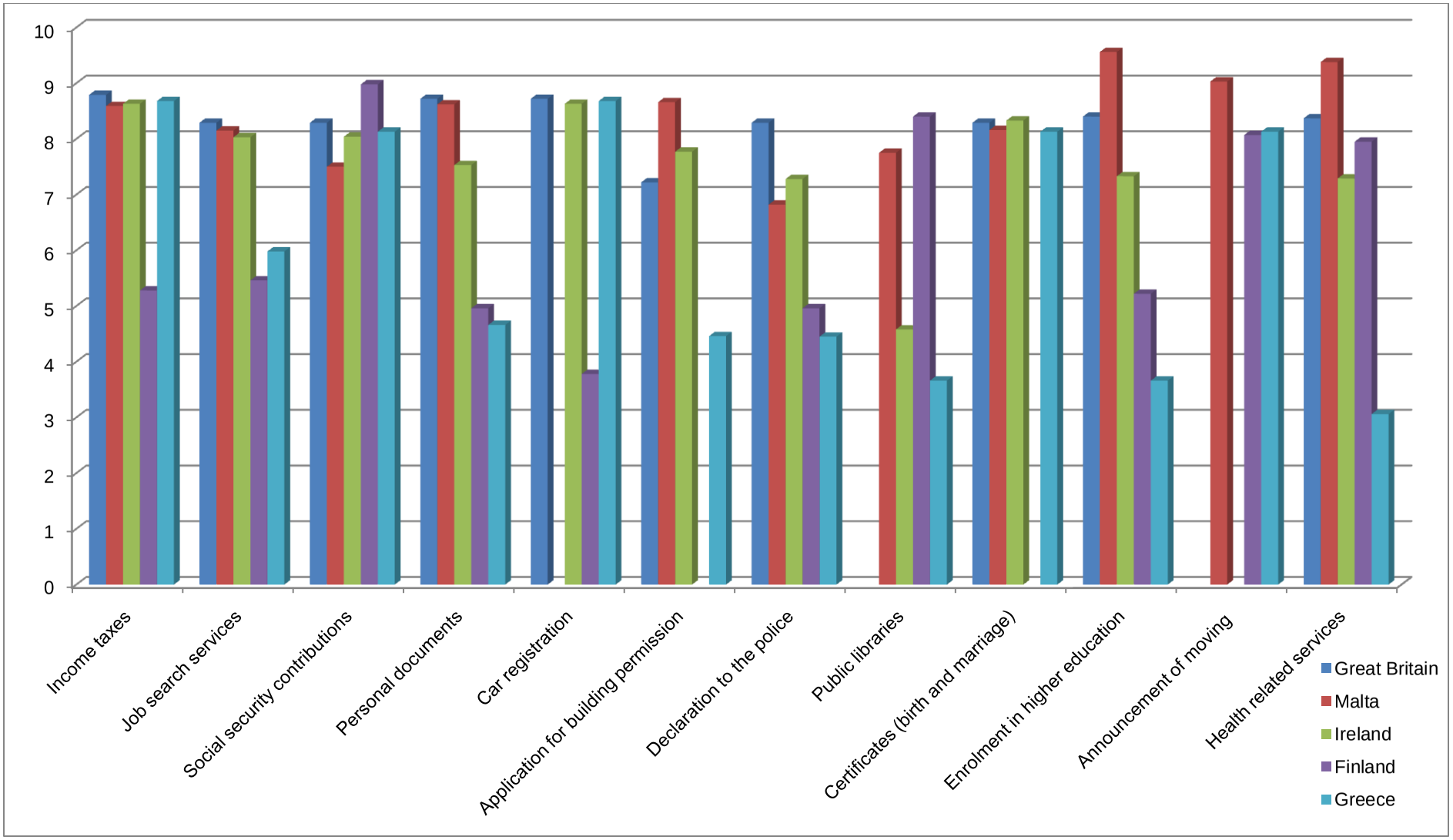

Figure 7.4. Countries' scores per basic services for citizens

- "Declaration to the police (e.g. in case of theft)" basic service which includes the standard procedure to officially declare a theft of personal goods (ex. car or home burglary) to a local police office.

In the basic services:

- "Application for building permission" which stands for the standard procedure to obtain a building or renovation permission for a personal building (regular, initial request, i.e. not taking into consideration contesting and appeal),
- "Enrolment in higher education / university" which comprises the standard procedure to enroll students in a university or another institution of higher education subsidized by an official administrative body in the country and
- "Health related services (interactive advice on the availability of services in different hospitals; appointments for hospitals)" which covers the standard procedure to obtain an appointment at a hospital officially recognised by a national, regional or local authority,

Malta gets the highest position while Greece follows last.

In the basic services:

- "Social security benefits: Unemployment benefits, Child allowances, Medical costs (reimbursement or direct settlement) and Student grants" which includes the standard procedure to obtain social security benefits, replacement income in case of unemployment, child allowance, reimbursement of costs covered by obligatory medical insurance and student grants for higher education and
- "Public libraries (availability of catalogues, search tools)" which incorporates the standard procedure to consult the catalogue(s) of a public library to obtain specific information regarding a specific carrier (Book, CD, …),

Finland is awarded with the highest score.

Furthermore, Malta shares the first place with Finland in the service "Announcement of moving (change of address)" which is described as the standard

procedure for the announcement of change of address of a private person moving within the country.

Moreover, Ireland possesses the first position in the basic service "Certificates (birth and marriage): request and delivery" which includes the standard procedure to obtain a birth or marriage certificate (can be one document out of the National register of persons in some countries).

As noted from Figure 7.3 not all websites in all evaluated countries were available at the assessment time. For example in Great Britain there were no available websites for the services "Announcement of moving (change of address)" and "Public libraries (availability of catalogues, search tools)". An announcement of moving is not required legally in Great Britain while as far as the second service is concerned each library in Great Britain has its own site and there isn't a central website including all libraries of the country. Moreover, in Malta the web site concerning "Car registration (new, used, imported cars)" was not accessible during the evaluation period since it was under construction. In Ireland there is no web site for "Announcement of moving (change of address)" since such an announcement is not required legally in this country. Lastly, in Finland there are no available websites for the services "Application for building permission" and "Certificates (birth and marriage): request and delivery". Regarding the first one, building permission is issued by the local authorities while as far as the second is concerned in Finland the issue of birth and marriage certificates is not necessary.

Furthermore, as also noted earlier in some cases the web diagnostic tools (e.g. number of hyperlinks, browser compatibility) did not function properly and did not provide us with results, as can be seen by the blank cells of Tables 7.10 to 7.21. In those cases the weights of their metrics were equally distributed to the rest of the metrics of the same attribute.

Finally since the websites are dynamic and are constantly changing and evolving we have to stress here that the results of our assessments are in respect to the particular period of evaluation. As an example of it we have the evaluation of www.ypepth.gr of Greece that currently is replaced by www.minedu.gov.gr a more modern, citizen oriented e-government site.

7.8 Conclusions

In this chapter we propose an instrument for evaluating by inspection the web sites of public authorities. Our framework employs a holistic approach to the evaluation of governmental web sites in that it includes dimensions and attributes relevant to the general characteristics and features of the web sites as they were previously tested, refined and validated statistically by citizens' point of view.

We modified e-GovQual scale in order to use it for heuristic evaluation method, we identified the metrics that were incorporated in the instrument and defined the way of assessment and the weights for all the evaluation criteria. The resulted instrument consisted of 3 dimensions, 15 attributes and 50 metrics. This instrument was implemented on 50 websites of public authorities, which belong to 5 European countries (Greece, United Kingdom, Ireland, Malta and Finland). The websites assessed were providing the 12 basic public services to citizens as defined by European Commission (EU Commission, 2002).

We classified the 5 countries according to their ratings and compared the results with Gap Gemini's (2010) results for the online availability of citizen services. Both surveys follow the same trend so the convergent validity of our scale was verified.

8 Conclusions and Further Research

In this chapter, conclusions of the present doctoral thesis are discussed, as far as the proposed quality model and instruments for evaluating e-government sites are concerned (Section 8.1). In Section 8.2 limitations of this work and possible improvements are highlighted, while the chapter concludes in section 8.3, where directions for further research are identified.

8.1 Conclusions

The impact of Information and Communication Technology (ICT) on public administration is on the rise as governments worldwide continue to redeploy conventional public services through the Internet (Pew Internet and American Life Project 2002). This has given birth to a genre of net-enabled public services or electronic government (e-government). With the proliferation of public e-services, research has indicated that service quality in the delivery of e-government services is paramount in encouraging citizens' adoption (Hazlett and Hill 2003, Teicher et al. 2002). Yet, Buckley (2003) admitted that given the multiplicity of motivations and service targets underlying public institutions, researchers already face an uphill task of defining and measuring service quality for e-governments, much less uncover the antecedents leading to the provision of high quality public e-services.

This doctoral thesis sets out to accomplish several objectives. The main research goal of the thesis is the development of a quality model for e-government services as well as the development and application of two instruments for assessing e-government services – one for inquiry method and one of inspection method.

We set out to provide answers to questions such as:

- What to assess?
- How the assessment will be done?

The quality model that we develop measures and monitors all quality aspects and dimensions identified by the state of the art review, using appropriate quality tools such as surveys and objective metrics and by taking into account different perspectives.

8.1.1 What to assess?

The first step for the development of the quality model is a critical review of state of the art approaches and an appropriate synthesis and classification of them as has been presented in Chapter 2. These approaches focus on different aspects of quality and on a different level of detail. Some of them deal with major quality areas such as information, while others examine in more detail these quality areas. A detailed examination of quality of information for example, is provided by considering information freshness, completeness and ease of understanding. Another differentiation point between literature approaches is the meaning that each one gives to a quality factor. Some approaches use a quality factor's name with different meaning than others or refer to the same quality aspect with different names.

Synthetic tables presented at Chapter 2 of this doctoral thesis are the result of our effort to correlate the meaning each researcher gives to each dimension with the corresponding dimensions of other models. This correlation was not always feasible on a detailed level, so we have used a higher view of quality factors in order to achieve it. The result of the correlation of quality aspects' meaning was the identification of four layers of quality assessment:

- Back office Process Performance layer
- Site Technical Performance layer
- Site Quality layer
- Customer's overall satisfaction

This categorization enables a synthetic view of literature and helps us answer the question about what should be assessed for the evaluation of e-government services.

The quality model (e-GovQual) of e-government service quality we offer bridges the gap between service quality and e-government literatures. Consistent with extant research, we posit that e-government service quality is derived from the co-existence of four distinct but complementary dimensions: Efficiency, Trust, Reliability, Citizen Support and Trust (Chapter 4). Whereas, Efficiency is determined by the ease of using the site and the quality of information it provides, Trust is the degree to which the citizen believes the site is safe from intrusion and protects personal information. Furthermore, Reliability designates the feasibility and speed of accessing, using and receiving services of the site and finally Citizen Support is defined as the ability to get help when needed.

8.1.2 How the assessment will be done?

For the second question that must be addressed for the development of a quality model for public e-services and namely for the question about how the assessment will be done, we use the theory of usability testing methods and more precisely of inquiry and inspection methods and develop two instruments one for questionnaire method and one for inspection method.

Assessment with questionnaires

As already demonstrated e-government service evaluation is affected by numerous factors, and the interdependence between these factors is complex. Various studies have tried to identify the factors that influence the service quality delivered by an e-government site and to assess the service delivered (Barnes & Vidgen, 2003; Eschenfelder, 2004, Loiacono, Watson & Goodhue, 2000, Reference1, 2009; Webb & Webb, 2004). In most of them the assessment of e-government service is qualitative and either does not address the issue of the relative importance of criteria or they assign weights in an arbitrary manner. So in the development of the instrument for inquiry method (Chapter 6), we use the analytical hierarchy process (AHP) to determine the weight of each criterion and sub-criterion detected in an e-GovQual model and scale developed in Chapter 5. The citizens' preferences for an ideal e-government site were

adopted in the establishment of estimation of criteria and sub-criteria weights. These weights show the impact of each criterion and sub-criterion to the overall e-government service quality according to citizens.

We find that all of the four criteria Efficiency, Trust, Reliability and Citizen Support significantly influence citizens' evaluation of site quality. Nevertheless users of e-government consider Reliability as the most important criterion, while Citizen Support Trust and Efficiency follow in importance. The most important sub-criterion concerning Reliability is the extend that the site is available and accessible whenever the citizen needs it, while for the Citizen Support criterion the most important sub-criterion is the extend that the employees have the knowledge to answer the users' questions. In the case of Trust criterion, is whether the data provided by users in the site is used only for the reason they were submitted on the first place, whereas for Efficiency it is the extent that a site can be customized to individual user's needs.

Furthermore, in a case study with the six most popular e-government sites of Greece we apply AHP and ANP that does not require a uni-directional hierarchical relationship and incorporates feedback and interdependent relationships among elements. Our results show that the order of the criteria and the ranking of the six e-government sites comes up for both methods the same, something that proves that there aren't any relationships among the elements examined that could cause deviation of the analytical results. The results do not vary depending on weather criteria interrelationships are taken into account or not. However, this independence of the elements could not be assumed before the analysis. The application of both methods was necessary in order to arrive to that conclusion.

Assessment with heuristic evaluation

In the development of an instrument for evaluating by inspection the web sites of public authorities, our framework employs a holistic approach to the evaluation of governmental web sites in that it includes dimensions and attributes relevant to the general characteristics and features of the web sites as they were previously tested, refined and validated statistically by citizens' point of view. We modify e-GovQual scale

in order to use it for heuristic evaluation method, we identify the metrics that are incorporated in the instrument and define the way of assessment and the weights for all the evaluation criteria. The resulted instrument consists of 3 dimensions, 15 attributes and 50 metrics. This instrument is implemented on 50 websites of public authorities, which belong to 5 European countries (Greece, United Kingdom, Ireland, Malta and Finland). The websites assessed were providing the 12 basic public services to citizens as defined by European Commission (EU Commission, 2002).

We classified the 5 countries according to their ratings and compared the results with Gap Gemini's (2010) results for the online availability of citizen services. Both surveys follow the same trend so the convergent validity of our scale was verified.

As the discussion above illustrates there is a need for further research to deepen our understanding of the assessment, antecedents and consequences of the quality of electronic service delivery. However, the findings of the present study have several important, even if broad, implications for practitioners. Therefore we provide a list of recommended actions for each area of concern detected by e-GovQual (Table 8.1). Although the recommended actions in some cases might appear obvious and may also hold true for other websites, for completeness we provide a full list.

Table 8.1. E-Gov sites area of concern and recommended actions

Area of concern	*Recommended action*
Reliability	Have sufficient hardware and software and communications capacity to meet peak demand. Develop a system that can be displayed and used independently of the web browser used.
Efficiency	Support citizen interaction via the web by: Design pages that are easy to read and understand with detailed, up-to-date and reliable information. Any limitations in the accuracy and currency of the Information should be made clear. When information on the website is converted from print publications, attention should be paid to restructuring the information for the hypertext environment, and to regular updating. Update and review dates should be clearly stated on all pages. Develop an efficient navigation system and sufficient orientation information. Sites should be designed to reduce loading and searching time and make searching easier

	Develop a system capable to provide tailored information. A quality web site should also be designed appealing, use text, colors and graphics that are pleasing to citizen's eye. Designers should take account of guidelines for making pages accessible to users with disabilities and imply for foreign language translation
Citizen Support	Assist citizens in their quest for information or during their transactions by user friendly guidelines, help pages, FAQ, or even personal advice. Contact details (electronic and conventional) for the entity should be easy to find on the website especially for the case that citizens experience problems.
Trust	Adopt and promote security and privacy policies and procedures that make citizens feel secure in dealing with the organization. There should be a statement informing citizens about the organization's policy on the privacy and security of their interactions with the site.

The quality model and the two instruments presented in this doctoral thesis trigger future research on extending the knowledge of quality criteria affecting e-government in order to more fully develop guidelines for site development and provide researchers and practitioners with a tool to benchmark e-government sites. Through understanding the quality criteria and their respective weights that affect e-government service quality a public organization will stand a much better chance in serving citizens. For practitioners, our model and scale can serve a useful diagnostic tool; they can use the validated scale to measure and improve service delivery. Finally our model and scale add to the extant literature by establishing a basis for further research on electronic government service quality.

8.2 Limitations and Possible Improvements

As with any study, several limitations should be noted that may be revisited in future studies.

Although in this doctoral thesis we present the development of an e-government service quality model and two instruments for the assessment of governmental sites we don't provide a step by step guide for e-government practitioners. We plan to develop a methodology for assessing e-government service quality by applying e-GovQual. This methodology will guide e-government practitioners step-by-step to the assessment of the

quality of the e-government site depending on the funds, the resources and the time provided by the organization, the effort requirements on the part of the users the organization desires and the stage of development and maturity of the site.

Furthermore, in order to encourage more citizens to participate in e-government a supplementary survey could be done to discover the barriers to it. The current survey collected responses only from the actual users of e-government. Practitioners should be aware of what restrains a citizen from using e-government instead of the traditional channel, in order to attract more potential users. This constitutes one of the next task that the authors plan to undertake.

Moreover, the current study focused on e-government service quality in Greece. Limiting the study to a single country did eliminate problems associated with the effects of cultural differences. Future research should consider cross-country validations in order to ascertain the generalizability of the results presented with this work. Also by translating English items into Greek, it is possible that the meaning of some terms may have been unintentionally altered. It is also possible that terms from one language are interpreted differently in another language. Additionally, as the sample was collected in Greece, generalisability to other countries might also be limited due to different level of e-government maturity. Future work can find out how national culture influences the determination of e-government site quality. Also, a complete study of online public service delivery should deepen more and explore in detail the specific components of each of the four sophistication stages.

Finally, the e-government sites used in the study might not represent all e-government domains. In the second data collection, each respondent was asked to evaluate only the site he is most familiar with, so previous experience of respondents with certain sites was not measured.

8.3 Further Research

In this section we provide suggestions for further research which could be based on this thesis. We consider as interesting the following research directions:

- A question which might motivate further research is whether the proposed model could be extended to explore technical quality as well. As already mentioned in Section 1.3 our model is based on the American perspective (Parasuraman's SERVQUAL, 1988) which neglects technical quality defined as "what service is provided" or "the outcome of the process" in comparison to the European perspective (Gronroos 1982; 1984), and focuses more on the functional quality defined as "how the service is provided" or "the process in which resources are used". A challenge related to the introduction of technical quality would be the difficulty in evaluating it for some services as well as the low maturity of e-government services in Greece. Only after having completed a full transaction a citizen would be able to assess the technical quality of the service provided. The comparison of the outcome of our model with a model having been developed under the European perspective would be very interesting for service quality area and e-government service quality in particular.
- Another interesting research direction is the extension of the proposed approach, by the addition of a new evaluation axis. This new axis could take into account the back-office procedures as well. By integrating an approach like Six Sigma (a methodology to manage process variations that cause defects and its objective is to deliver high performance, reliability, and value to the end customer), or ISO (used by organizations to determine what is needed to maintain an efficient quality conformance system) and mounting the back-office quality system to the front-office quality system a more effective and holistic approach of quality could be reached.
- Another question which might stimulate further research is whether the proposed approach could be extended to allow a multi perspective evaluation of e-government service quality. This would mean that in addition to the citizens' point of view which is subjective, the service's provider's/organization's

perspective could be integrated in the approach. The citizen point of view, which was taken into account in this thesis is the most important as citizens are the final receivers of the e-services. However, service providers could also provide their opinion about the various quality dimensions and attributes, especially about some technical aspects that most users are not able to evaluate. The integration of the two perspectives would enable the mapping of assessments performed by each of the two 'actors' representing the two different perspectives.

- Finally, a research direction of interest may be to examine the development of a decision support system that could have as input the detailed evaluation of the two proposed quality instruments of this thesis. We could envision for example, the application of a decision support system in the e-government service quality domain. A pop-up questionnaire appears when a citizen logs off the e-government site after having completed the reason that he visited the site in the first place. The system collects answers from the citizens, diagnoses possible problems depending of the scores on different areas of concern and proposes to the administrator a set of alternative recommended actions. Another application of the decision support system could be the evaluation of e-government service quality with different dimension weights depending on the type of the site. In sites that require the submission of personal data Trust dimension seems to be more important to citizens in comparison with informative ones.

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APPENDIX I

An Assessment of Citizen Attitudes for e-Government: The Case of Greece

1 Data Analysis

We administered the refined preliminary questionnaire for the second round of data collection (as described in Section 5.2.3) to a random sample of Internet users through an online survey.

More insight to the demographic information reveals that 40.1% of the male population who use e-government services work as Free Lancers, 20.4% as Government Employees and 20.4% as Private Sector Employees while 39.8% of the female population work as Government employees, 30.9% as Private Sector Employees and 18.7% as Free Lancers.

Also 50.4% of the male population that have previous experience with e-government sites has at least Masters Degree in contrast to the 43.1% of the female population.

The 77.3% of the male population (users of e-government sites) use internet more than 11 hours per week while the respective percentage for female population is 49.2% (Figure 1a). While as far as the Frequency of Internet Use of the e-government users, is concerned we can notice that women possess the 72.5% and men the 27.5% of the respondents that surf on the Internet 1-5 hours per week and the above percentage is inversed to reach the 33.1% for women and 76.9% for men respectively in more than 20 hours of weekly Internet Use (Figure 1b).

The 54.6% of the population up to the age of 35 surf on the internet more than 20 hours per week whereas the respective percentage for ages above 36 falls to 33.8%. Also, the 43% of those who surf on Internet more than 20 hours per week are free lancers.

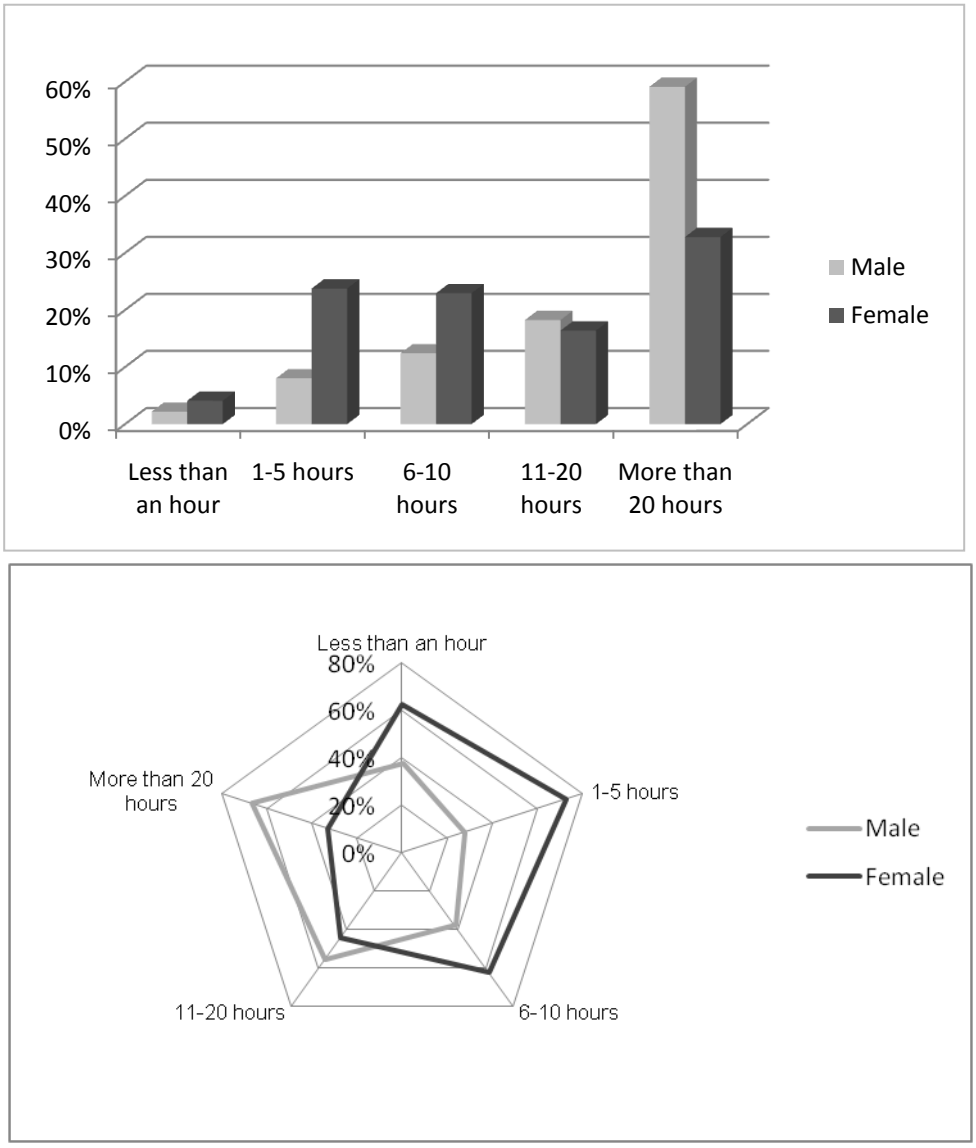


Figure 1. Frequency of Internet Use vs Gender

Another comment that can be made concerns the difference in the frequency of use of an e-government site between the male and female respondents. Among the respondents that use e-government sites daily the 63.3% is female population in contrast to the 36.7% of the male. As the frequency of e-government use decreases the percentages are inverted.

As far as the relation of the e-government sites mostly used with the two genders is concerned we notice a distinct difference particularly in the Internal Revenue Service and the Supreme Council for Civil Personnel Selection. While 75.4% of the male respondents use the Internal Revenue Service frequently, only 59.8% of the female respondents use the same site correspondingly. Although 15.4% of the female respondents visit the Supreme Council for Civil Personnel Selection regularly, only 4.6% of the male respondents visit the same site respectively. For the rest of the sites the population is distributed in a similar way (Figure 2a).

As far as the relation of the e-government sites mostly used with the two genders is concerned we notice a distinct difference particularly in the Internal Revenue Service and the Supreme Council for Civil Personnel Selection. While 75.4% of the male respondents use the Internal Revenue Service frequently, only 59.8% of the female respondents use the same site correspondingly. Although 15.4% of the female respondents visit the Supreme Council for Civil Personnel Selection regularly, only 4.6% of the male respondents visit the same site respectively. For the rest of the sites the population is distributed in a similar way (Fig. 2a).

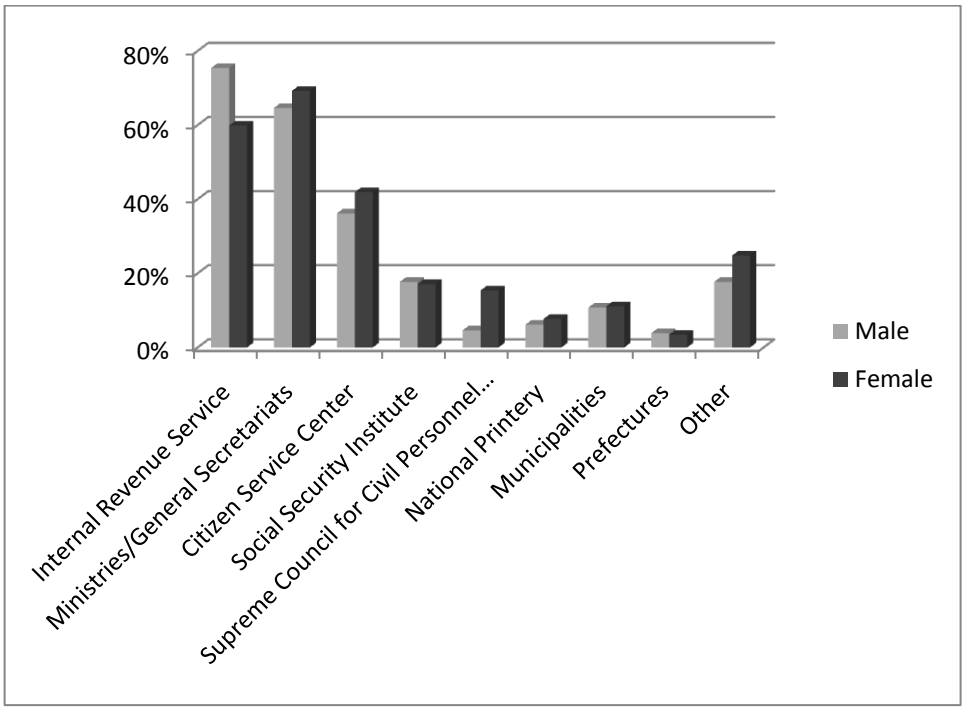
If we examine the frequency of use of e-government in relation with the e-government sites mostly used we can observe that 85% of those who visit daily an e-government site visit websites of Ministries. The above percentage declines to 47.5% as the frequency of visits drops to at least one visit per year. Exactly the reverse phenomenon happens for the Internal Revenue Service. While only 46.4% of the respondents who visit in a daily basis an e-government site use Internal Revenue Service, this percentage rises to 77% for a monthly visit and 75% for an annual visit (Fig. 2b).

As we observe the professional status in comparison with the e-government sites most frequently used what marks out is that the 90.7% of the free lancers use the Internal Revenue Service site.

Something else worth noticing is that there is a clear relation between the Educational Status and the Frequency of Internet Use. The higher the Educational Status is the higher the Frequency of Internet Use.

Intention to reuse the e-government site both for information and service delivery has a positive relation with the Frequency of Internet Use, as well as with the Educational

Status and finally with the evaluation of the citizens of the four dimensions. The higher the Frequency of Use or the higher the Educational Status or the higher the evaluation of the citizens for the four dimensions the stronger the Intension of site reuse.



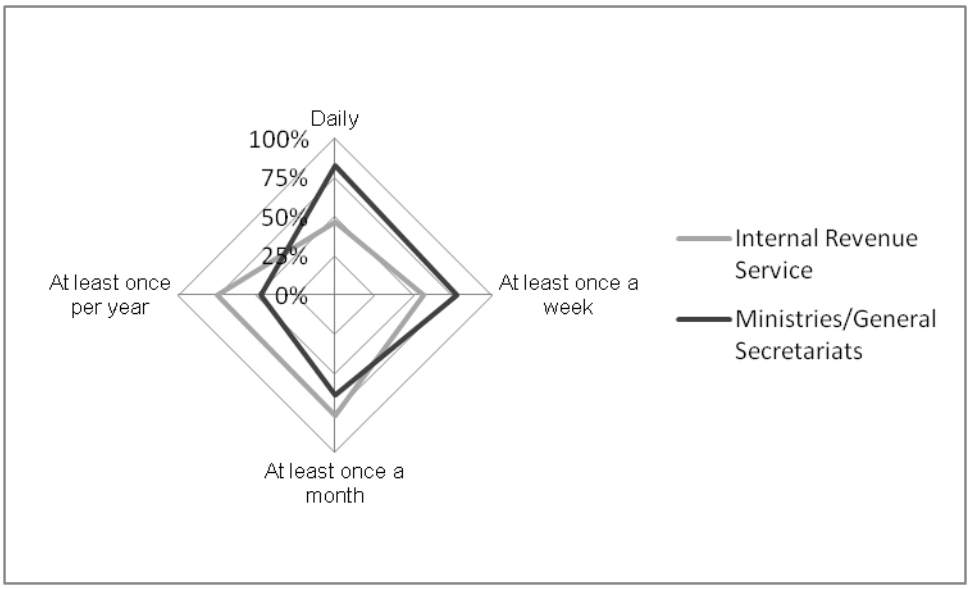


Figure 2. a) Most Frequently Used Sites vs Gender (Multi Response Question),
b) Frequency of e-Government Use vs the two Most Frequently Used sites (Multi Response Question)

Concerning the dimensions that the citizens regard as the most important in an e-government site, the 42.2% considers efficiency as the most important dimension, the 32.2% considers Trust, the 19.2% Reliability while the 6.1% ranks as that the most important dimension Citizen Support. On the other hand as least important dimension, the 55.6% regarded Citizen Support, the 26.3% considered Trust while Reliability and Efficiency were considered as the least important dimension by 9.1% of the respondents each (Fig. 3).

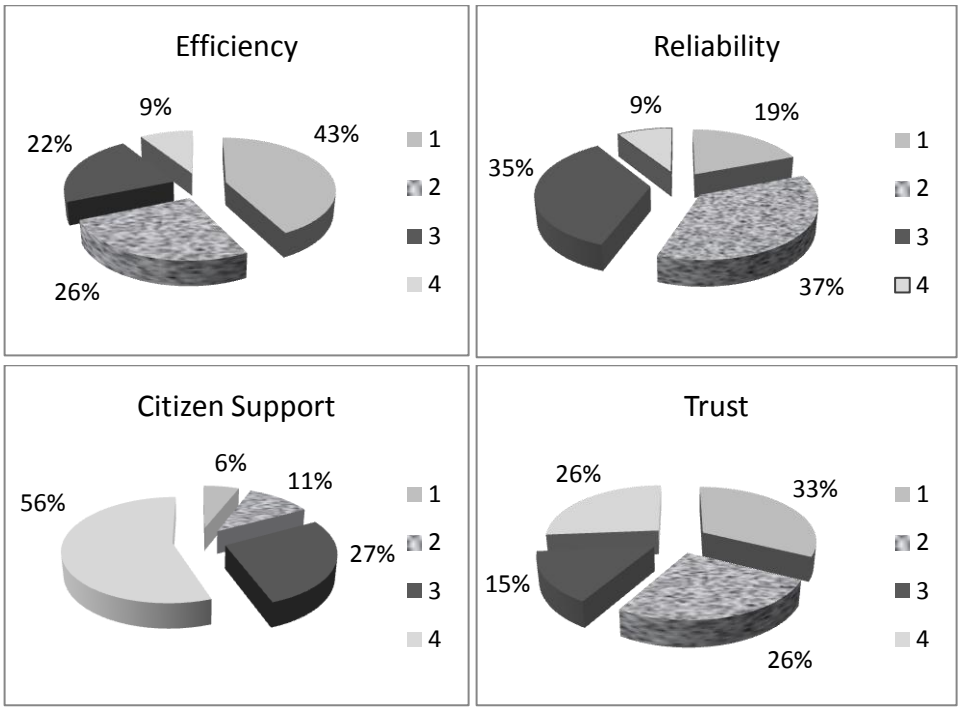


Figure 3 : Ranking of the four Dimensions

Trust is considered to be very important since 58.6% of the respondents ranked it as the first or second most important dimension. Also 78.3% of those who ranked Trust dimension as the most important one use Internal Revenue Service sites and the 62.5% of citizens that use on-line submission regard Trust as the most important dimension.

Between the citizens that ranked Reliability as the most important dimension, the 80.6% use Internal Revenue Service. Also, the 72.6% of the respondents that consider efficiency as the most important dimension are information seekers in comparison with

only 46.4% that are interactors. On the other hand 44.9% of the citizens that uses frequently Ministries' websites that mainly provide information, regard Efficiency as the most important dimension. Finally Citizen Support dimension seems to be the less important dimension regardless of the type of sites most frequently used or the type of services mostly required.

A summary table (Table 4) gives more information on the data. The first four questions rank the four dimensions relating with e-government sites and the services they provide (1 = the most important, 4 = the least important). The second four questions refer to the evaluation of the citizens of the four dimensions respectively. An overall site evaluation follows and finally two questions concerning the service reuse intention and the information reuse intention. In the last seven questions each item was measured using a five point Likert scale where the higher the score the most positive the evaluation.

Table 4. Summary of the Data: Mean, Standard Deviation, Minimum and Maximum Values

Description	*Mean*	*St.Dev*	*Min*	*Max*
Ranking of Efficiency Dimension	2.03	1.019	1	4
Ranking of Reliability Dimension	2.33	0.951	1	4
Ranking of Citizen Support Dimension	3.10	1.002	1	4
Ranking of Trust Dimension	2.34	1.157	1	4
Evaluation of the Site concerning Efficiency Dimension	3.48	0.858	1	5
Evaluation of the Site concerning Reliability Dimension	3.57	0.859	1	5
Evaluation of the Site concerning Citizen Support Dimension	3.12	1.071	1	5
Evaluation of the Site concerning Trust Dimension	3.62	0.955	1	5
Overall Site Evaluation	2.93	0.989	1	5
Service Reuse Intention	4.06	1.075	1	5
Information Reuse Intention	4.03	0.963	1	5

Also on Table 4 it is obvious that the most important dimension is Efficiency while the least important is Citizen Support. From the sites the respondents most frequently use, Citizen Support seems to be less satisfactory dimension. Lastly although the overall site evaluation appear to be lower than the evaluations of the four dimensions,

both the Service Reuse Intention and the Information Reuse Intention are considerable higher.

2 Findings and Related Work

In this work we were particularly interested to discover the quality priorities of each e-government user and we tried to analyze and depict the attitude the Greek citizens have towards the existing e-government sites in Greece. Finally we were interested in implications for e-government practitioners in order to enhance citizens reuse intention of the sites. Overall, we gathered valuable information concerning the way Greek users interact with e-government in Greece.

During the analysis process of this paper several interesting results emerged. First this research found that all of the four dimensions Efficiency, Trust, Reliability and Citizen Support significantly influence citizens' evaluation of overall e-government site quality and intention to reuse. Users of e-government considered Efficiency as the most important factor. The great importance of this dimension has also been noted by other researchers (Santos, 2003; Gefen et al. 2003; Clyde, 2000; Zhang and Von Dran, 2001; Dwivedi and Weerakkody, 2007) for website quality. Trust is also highly ranked as has already been stressed in other studies (Gefen et al. 2003; Chiang, 2009) referring to site quality, indicating that organizations should expend more effort to make the site safer. The need for trust on the web seems to be an issue of paramount importance (Urban et al., 2000) regardless of people's cultural profiles (Huang, 2001).

Second this study revealed that e-government users perceived different importance of quality factors in using different types of e-government sites. For example, in an e-government site where on-line submission takes place Trust was considered to be the most important factor, while Efficiency was the most important factor in sites mainly informational. This result coincides with a finding in e-business literature (Alburquerque and Belchior, 2002; Tang, Chung and Se, 2009). Next, although Citizen Support had only a minor effect on overall e-government site quality in this study, its importance should not be underestimated. Citizen Support might be the least important dimension but as showed by Parasuraman et al. (2005) for e-commerce is basically salient when a citizen

has non-routine encounters with the site. It is also interesting to mention, as Lovelock and Yip (1996) demonstrated, that it is when services involve a high degree of interaction between customers and service personnel that cultural elements have the greater influence.

Third the analytical results showed that the “digital divide” is apparent in Greece as it is in other countries as well. The term "digital divide" refers to the gap between individuals, households, businesses and geographic areas at different socio-economic levels with regard to their opportunities to access information and communication technologies (ICTs) (Organisation for Economic Co-operation and Development, 2001). In the current study only three parameters of “digital divide” could be examined i.e. gender, age and education. Consistent with previous studies (Levy, 2002; Losh 2003), and (Huesing and Selhofer, 2002) in US and EU, this study found a positive relationship between education and Internet Use and a negative relationship between age and Internet Use. More specifically in the context of e-government there are more European studies from France (Mellor, Parr and Hood, 2002) and Turkey (Mellor and Parr, 2002a) and one from New Zealand (Mellor and Parr, 2002b) that concur that the most threatened groups considerably lagging behind are people with low education and elderly people. On the other hand prior literature on the influence of gender on the use of Internet and e-government produced conflicting results. Some researchers (Losh 2003; Huesing and Selhofer, 2002) and (Mellor and Parr, 2002b) identified the gap between genders significant to affect propensity to use Internet and e-government while other group of researchers (Levy, 2002; Mellor, Parr and Hood, 2002; Mellor and Parr, 2002a) found that the gender has no effect, something that unfortunately we did not experience in this study. Losh (2003) also emphasizes the existence of gender gap in Internet use and it attributes it to the fact that women and men in US have different educational and occupational experiences.

As far as implications for practitioners are concerned, this study suggests that to enhance citizen reuse intentions and site assessment, e-government sites should devote organization resources to the important e-government quality dimensions identified by this study. First web site design and information quality cannot be ignored. E-government site design is an important means to provide customer usefulness and ease of use during

online transaction processes. Second, improvement on the level of credibility, security by developing strict security policies and adopt advanced security technologies is a necessity since these factors affect the reuse intention of the citizen.

3 Conclusions

The objective of this research was to depict the attitudes and the preferences of the Greek citizens-users of e-government and to examine which behaviors are specific for Greek population and which are more general.

This study has also limitations that should be revisited in future studies. First the e-government sites used in the study might not represent all e-government domains. Each respondent was asked to evaluate only the site they are most familiar with so previous experience of respondents with certain sites was not measured. Then demographic limitation of the study is the fact that the sample size itself is relatively small. To accurately evaluate Greek citizens' perceptions of e-government service quality a larger sample size is desirable. Finally, since the sample was collected in Greece, generalizability to other countries might be limited due to cultural differences and different level of e-government maturity. Future work can focus on examining and comparing more parameters of digital divide, based on the relative importance of each construct get an e-government quality score and find out how national culture influences the determination of e-government site quality.

APPENDIX II

Questionnaire (Preliminary Scale Development-First Round of Data Collection)

Directions: The following set of statements relate to your feelings about this portal. For each statement please show the extent to which you believe this portal has the feature described by the statement. Selecting a 1 means that you strongly disagree that the portal has the feature and selecting a 5 means that you strongly agree. You may select any of the numbers in the middle that show how strong your feelings are. There are no right or wrong answers-all we are interested in is a number that best shows your perceptions about this portal. There are some questions which may not be applicable for your case i.e. you didn't perform the corresponding actions during your session. In this case please select the "don't know/haven't use' answer.

This portal is easy to use	Strongly Disagree	1	2	3	4	5	Strongly agree
Portal's content is characterized by high quality	Strongly Disagree	1	2	3	4	5	Strongly agree
Interaction with portal, when using forms for requests is functional enough	Strongly Disagree	1	2	3	4	5	Strongly agree
The service requested has been performed reliable and in time	Strongly Disagree	1	2	3	4	5	Strongly agree
Support mechanisms of this portal (help desk, e-mail, FAQ) resolve users' problems	Strongly Disagree	1	2	3	4	5	Strongly agree
To my understanding transactions are performed securely in this portal	Strongly Disagree	1	2	3	4	5	Strongly agree
Ease of Use							
This portal's structure is clear and easy to follow	Strongly Disagree	1	2	3	4	5	Strongly agree
This portal's layout is pleasant, clean and functional	Strongly Disagree	1	2	3	4	5	Strongly agree
This portal's URL is easy to remember	Strongly Disagree	1	2	3	4	5	Strongly agree
This portal's search engine is effective	Strongly Disagree	1	2	3	4	5	Strongly agree
This portal's site map is well organised	Strongly Disagree	1	2	3	4	5	Strongly agree

This portal is well customized to individual users' needs	Strongly Disagree	1	2	3	4	5	Strongly agree
Content & Appearance of Information							
The information displayed in this portal is appropriate detailed	Strongly Disagree	1	2	3	4	5	Strongly agree
The information displayed in this portal is accurate	Strongly Disagree	1	2	3	4	5	Strongly agree
The information displayed in this portal is fresh	Strongly Disagree	1	2	3	4	5	Strongly agree
The information displayed in this portal is easy to understand (it does not use formal language)	Strongly Disagree	1	2	3	4	5	Strongly agree
The information displayed in this portal is relevant	Strongly Disagree	1	2	3	4	5	Strongly agree
This portal offers enough and of high quality hyperlinks	Strongly Disagree	1	2	3	4	5	Strongly agree
Functionality of the interaction environment							
Forms in this portal are downloaded in short time	Strongly Disagree	1	2	3	4	5	Strongly agree
Automatic recalling of user's personal data within portal's forms is satisfactory	Strongly Disagree	1	2	3	4	5	Strongly agree
The level of automatic calculation within portal's forms is satisfactory	Strongly Disagree	1	2	3	4	5	Strongly agree
Information about field's completion in this portal is enough	Strongly Disagree	1	2	3	4	5	Strongly agree
Submitted requests or results of the elaboration are easy to stored locally or printed	Strongly Disagree	1	2	3	4	5	Strongly agree
Reliability							
This portal is available and accessible whenever you need it	Strongly Disagree	1	2	3	4	5	Strongly agree
This portal performs the service successfully upon first request	Strongly Disagree	1	2	3	4	5	Strongly agree
This portal provides services in time	Strongly Disagree	1	2	3	4	5	Strongly agree
Portal's pages are downloaded quickly enough	Strongly Disagree	1	2	3	4	5	Strongly agree
This portal works properly with your default browser	Strongly Disagree	1	2	3	4	5	Strongly agree
Citizen Support							
This portal provides contact information	Strongly Disagree	1	2	3	4	5	Strongly agree
Employees showed a sincere interest in solving users' problem	Strongly Disagree	1	2	3	4	5	Strongly agree
Employees give prompt replies to users' inquiries	Strongly Disagree	1	2	3	4	5	Strongly agree
Employees have the knowledge to answer users' questions	Strongly Disagree	1	2	3	4	5	Strongly agree
Employees are courteous	Strongly Disagree	1	2	3	4	5	Strongly agree
Employees have the ability to convey trust and confidence	Strongly Disagree	1	2	3	4	5	Strongly agree

The FAQ section of this portal covered completely the topic that you were interested in	Strongly Disagree	1	2	3	4	5	Strongly agree
Trust							
Acquisition of username and password in this portal is secure	Strongly Disagree	1	2	3	4	5	Strongly agree
Only necessary personal data are provided for authentication on this portal	Strongly Disagree	1	2	3	4	5	Strongly agree
Data provided by users in this portal are archived securely	Strongly Disagree	1	2	3	4	5	Strongly agree
Data provided in this portal are used only for the reason submitted	Strongly Disagree	1	2	3	4	5	Strongly agree
How does this portal **compare to your idea of an ideal portal**?	Strongly Disagree	1	2	3	4	5	Strongly agree
An excellent portal should be primarily easy to use	Strongly Disagree	1	2	3	4	5	Strongly agree
An excellent portal should primarily been characterized by high quality content	Strongly Disagree	1	2	3	4	5	Strongly agree
Within an excellent portal, emphasis is given to interaction functionality when using forms	Strongly Disagree	1	2	3	4	5	Strongly agree
An excellent portal, primarily delivers the service reliable and in time	Strongly Disagree	1	2	3	4	5	Strongly agree
Within an excellent portal emphasis is given to the security of transactions	Strongly Disagree	1	2	3	4	5	Strongly agree
Within an excellent portal, emphasis is given to support mechanisms (help desk, e-mail, FAQ)	Strongly Disagree	1	2	3	4	5	Strongly agree

How often do you use this portal?

☐Daily

☐At least once a week

☐At least once a month

☐At least once per year

☐Other (please specify)

What were you primarily looking for on this portal?

☐General information about the organization's activities

☐Information about the organization's physical sites

☐Relevant legislation

☐Just browsing / nothing specific

☐Contact info

☐Tenders

☐Career openings

☐News/Announcements

☐Other, please specify

Did you find the information you were hoping to obtain?

☐Yes

☐No
☐Not yet

How did you look for the information you wanted?
☐FAQs
☐Just navigated
☐Search Feature
☐Special Sections on
☐Via another link or website

How did you find out about the organization's portal?
☐Friend
☐News or Magazine Story
☐Organisation's printed materials
☐Other Gov't agency or website
☐Radio Public Service Announcement
☐Search Engine
☐Television Public Service Announcement

Which describes you best?
☐Government employee
☐Academic faculty
☐Private Sector employee
☐Free Lancer
☐9-12 Student
☐University / College student
☐Retired
☐Unemployed
☐Other (please specify)

Your age is?
☐Less than 16
☐16-25
☐26-35
☐36-45
☐46-55
☐56-65
☐> 66

Which of the following is the highest educational degree you have achieved?
☐PhD Degree
☐Masters Degree
☐Bachelors Degree

☐High School Diploma or equivalent
☐Vocational Degree
☐no degree
On average, how many hours do you spend on the Internet each week?
☐Less than 1
☐1-5
☐6-10
☐More than 10

APPENDIX III

Correspondence of the scale attributes and the items depicted on the statistical analysis

Dimension	Attribute	Item depicted in st.analysis
Ease of Use	This portal's structure is clear and easy to follow	Structur
	This portal's layout is pleasant, clean and functional	Aestheti
	This portal's URL is easy to remember	***refined***
	This portal's search engine is effective	SearchEn
	This portal's site map is well organized	SiteMap
	This portal is well customized to individual users' needs	Customiz
Content & Appearance of Information	The information displayed in this portal is appropriate detailed	INDetail
	The information displayed in this portal is accurate	INPrecis
	The information displayed in this portal is fresh	INUp2Dat
	The information displayed in this portal is easy to understand (it does not use formal language)	INUnders
	The information displayed in this portal is relevant	INReleva
	This portal offers enough and of high quality hyperlinks	Hyperlin
Functionality of the Interaction environment	Forms in this portal are downloaded in short time	FRFastAp
	Automatic recalling of user's personal data within portal's forms is satisfactory	FRPreFil
	The level of automatic calculation within portal's forms is satisfactory	FRAutoFil
	Information about field's completion in this portal is enough	FRHelp
	Submitted requests or results of the elaboration are easy to stored locally or printed	FRSave
Reliability	This portal is available and accessible whenever you need it	SiteAvai
	This portal performs the service successfully upon first request	SRSucces
	This portal provides services in time	SRInTime

	Portal's pages are downloaded quickly enough	FastDown
	This portal works properly with your default browser	BrowsCom
Citizen Support	This portal provides contact information	HDInform
	Employees showed a sincere interest in solving users' problem	HDIntere
	Employees give prompt replies to users' inquiries	HDAnswer
	Employees have the knowledge to answer users' questions	HDKnowle
	Employees are courteous	***refined***
	Employees have the ability to convey trust and confidence	HDTrust
	The FAQ section of this portal covered completely the topic that you were interested in	FreqUseP
Trust	Acquisition of username and password in this portal is secure	SafeCode
	Only necessary personal data are provided for authentication on this portal	PDMinim
	Data provided by users in this portal are archived securely	PDSafety
	Data provided in this portal are used only for the reason submitted	PDUse

APPENDIX IV

Questionnaire (Refined Preliminary Scale Development-Second Round of Data Collection)

Which are the three e-government sites that you most frequently visit?.....

Having in mind the e-government site that you most frequently visit please answer the following questions. For each statement please show the extent to which you believe this portal has the feature described by the statement. Selecting a 1 means that you strongly disagree that the portal has the feature and selecting a 5 means that you strongly agree. There are no right or wrong answers-all we are interested in is a number that best shows your perceptions about this portal.

Efficiency							
This portal's structure is clear and easy to follow	Strongly Disagree	1	2	3	4	5	Strongly agree
This portal's search engine is effective	Strongly Disagree	1	2	3	4	5	Strongly agree
This portal's site map is well organized	Strongly Disagree	1	2	3	4	5	Strongly agree
This portal is well customized to individual users' needs	Strongly Disagree	1	2	3	4	5	Strongly agree
The information displayed in this portal is appropriate detailed	Strongly Disagree	1	2	3	4	5	Strongly agree
The information displayed in this portal is accurate	Strongly Disagree	1	2	3	4	5	Strongly agree
The information displayed in this portal is fresh	Strongly Disagree	1	2	3	4	5	Strongly agree
The information displayed in this portal is relevant	Strongly Disagree	1	2	3	4	5	Strongly agree
Automatic recalling of user's personal data within portal's forms is satisfactory	Strongly Disagree	1	2	3	4	5	Strongly agree
The level of automatic calculation within portal's forms is satisfactory	Strongly Disagree	1	2	3	4	5	Strongly agree
Information about field's completion in this portal is enough	Strongly Disagree	1	2	3	4	5	Strongly agree
Reliability							
Forms in this portal are downloaded in short time	Strongly Disagree	1	2	3	4	5	Strongly agree

This portal is available and accessible whenever you need it	Strongly Disagree	1	2	3	4	5	Strongly agree
This portal performs the service successfully upon first request	Strongly Disagree	1	2	3	4	5	Strongly agree
This portal provides services in time	Strongly Disagree	1	2	3	4	5	Strongly agree
Portal's pages are downloaded quickly enough	Strongly Disagree	1	2	3	4	5	Strongly agree
This portal works properly with your default browser	Strongly Disagree	1	2	3	4	5	Strongly agree
Citizen Support							
Employees showed a sincere interest in solving users' problem	Strongly Disagree	1	2	3	4	5	Strongly agree
Employees give prompt replies to users' inquiries	Strongly Disagree	1	2	3	4	5	Strongly agree
Employees have the knowledge to answer users' questions	Strongly Disagree	1	2	3	4	5	Strongly agree
Employees have the ability to convey trust and confidence	Strongly Disagree	1	2	3	4	5	Strongly agree
Trust							
Acquisition of username and password in this portal is secure	Strongly Disagree	1	2	3	4	5	Strongly agree
Only necessary personal data are provided for authentication on this portal							
Data provided by users in this portal are archived securely	Strongly Disagree	1	2	3	4	5	Strongly agree
Data provided in this portal are used only for the reason submitted	Strongly Disagree	1	2	3	4	5	Strongly agree
Overall this e-government site is easy to use and its content is characterized by high quality.	Strongly Disagree	1	2	3	4	5	Strongly agree
Overall this e-government site delivers the service reliable and in time.	Strongly Disagree	1	2	3	4	5	Strongly agree
Overall in this e-government site emphasis is given to support mechanisms (help desk, e-mail, FAQ).	Strongly Disagree	1	2	3	4	5	Strongly agree
Overall in this e-government site emphasis is given to the security of transactions.	Strongly Disagree	1	2	3	4	5	Strongly agree
Overall the quality of the delivered services and the e-government site's form is excellent.	Strongly Disagree	1	2	3	4	5	Strongly agree
I am definitely going to reuse this e-government site for online submission.	Strongly Disagree	1	2	3	4	5	Strongly agree
I am definitely going to reuse this site for information collection	Strongly Disagree	1	2	3	4	5	Strongly agree

Please rank the following four general characteristics related with e-government sites and the services they provide (1 = the most important, 4 = the least important).

The ease of using an e-government site and the quality of information it provides

The feasibility and speed of accessing, using and receiving services of an e-government site

The ability to get help when needed while using an e-government site

The degree to which the citizen believes an e-government site is safe from intrusion and protects personal information

How often do you use an e-government site?
☐Daily
☐At least once a week
☐At least once a month
☐At least once per year

What are you primarily looking for on an e-government site?
☐Information seeking
☐Submission
☐Other, please specify

What is our sex?
☐Male
☐Female

Which describes you best?
☐Unemployed
☐Government employee
☐Free Lancer
☐Private Sector employee
☐Academic faculty
☐Student
☐University / College student
☐Retired

Your age is?
☐Less than 16
☐16-25
☐26-35
☐36-45
☐46-55
☐56-65

Which of the following is the highest educational degree you have achieved?
☐Vocational Degree
☐High School Diploma or equivalent
☐Bachelors Degree
☐Masters Degree

☐PhD Degree

On average, how many hours do you spend on the Internet each week?
☐Less than 1
☐1-5
☐6-10
☐More than 10

APPENDIX V

Statistical Data

1 Correlations

Correlations among Efficiency construct and respective items and descriptive statistics

	Site Structure	Search Engine	Site Map	Customisation	Inf Detail	Inf Precise	InfUp2 Date	Inf Relevant	Form PreFill	Form AutoCalc	Form FillHelp	SiteEfficiency
SearchEngine	0.381											
SiteMap	0.451	0.555										
Customisation	0.353	0.424	0.419									
InfDetail	0.439	0.277	0.479	0.396								
InfPrecise	0.380	0.261	0.431	0.307	0.577							
InfUp2Date	0.295	0.322	0.373	0.364	0.391	0.583						
InfRelevant	0.319	0.335	0.361	0.240	0.489	0.634	0.561					
FormPreFill	0.325	0.331	0.339	0.291	0.358	0.471	0.428	0.528				
FormAutoCalc	0.454	0.267	0.276	0.250	0.399	0.460	0.382	0.481	0.583			
FormFillHelp	0.434	0.313	0.391	0.363	0.531	0.471	0.365	0.497	0.422	0.504		
SiteEfficiency	0.508	0.374	0.507	0.301	0.474	0.586	0.421	0.558	0.477	0.464	0.537	
Mean	3.42	3.00	3.19	2.75	3.35	3.74	3.61	3.84	3.47	3.65	3.21	3.48
St. Deviation	0.893	1.033	0.962	1.056	0.958	0.964	1.027	0.928	1.010	0.986	1.029	0.858

Correlations among Trust construct and respective items and descriptive statistics

	SafeUsername Password	Min PersData	Safe PersData	PersData Use	Site Trust

MinPersData	0.464				
SafePersData	0.548	0.474			
PersDataUse	0.462	0.542	0.639		
SiteTrust	0.600	0.483	0.577	0.573	
Mean	3.80	3.80	3.41	3.19	3.62
St. Deviation	1.059	1.106	1.047	1.198	0.955

Correlations among Reliability construct and respective items and descriptive statistics

	Form FastAppear	Site Availability	Service Successful	Service InTime	SiteFast Appear	Browser Compatibility	Site Reliability
SiteAvailability	0.522						
ServiceSuccessful	0.527	0.578					
ServiceInTime	0.471	0.491	0.576				
SiteFastAppear	0.656	0.535	0.520	0.481			
BrowserCompatibility	0.402	0.540	0.352	0.360	0.481		
SiteReliability	0.396	0.385	0.460	0.602	0.455	0.297	
Mean	3.67	3.97	3.72	3.65	3.80	4.08	3.57
St. Deviation	0.978	1.044	1.074	0.950	0.945	1.041	0.859

Correlations among Citizen Support construct and respective items and descriptive statistics

	HelpDesk Interest	HelpDesk Answer	HelpDesk Knowledge	HelpDesk Trust	SiteCitizen Support
HelpDeskInterest					
HelpDeskAnswer	0.931				
HelpDeskKnowledge	0.664	0.738			
HelpDeskTrust	0.798	0.824	0.799		
SiteCitizenSupport	0.277	0.316	0.392	0.322	
Mean	3.40	3.54	3.47	3.37	1.12

	HelpDesk Interest	HelpDesk Answer	HelpDesk Knowledge	HelpDesk Trust	SiteCitizen Support
HelpDeskInterest					
HelpDeskAnswer	0.931				
HelpDeskKnowledge	0.664	0.738			
HelpDeskTrust	0.798	0.824	0.799		
St. Deviation	1.199	1.194	1.192	1.343	1.071

2 Pattern Matrix[a]

	Component			
	1	2	3	4
LINT(SiteStructure)		,527		
LINT(SearchEngine)		,802		
LINT(SiteMap)		,728		
LINT(Customisation)	-,392	,794		
LINT(InfDetail)		,675		
LINT(InfPrecise)	,370	,453		
LINT(InfUp2Date)		,587		
LINT(InfRelevant)		,361		
LINT(FormPreFill)				,380
LINT(FormAutoCalc)	,311			,387
LINT(FormFillHelp)		,474		
LINT(FormFastAppear)	,749			
LINT(SiteAvailability)	,816			
LINT(ServiceSuccessful)	,623			
LINT(ServiceInTime)	,631			
LINT(SiteFastAppear)	,858			
LINT(BrowserCompatibility)	,746			
LINT(SafeUsernamePassword)				,673
LINT(MinPersData)				,742
LINT(SafePersData)				,778
LINT(PersDataUse)				,795
LINT(HelpDeskInterest)			,773	
LINT(HelpDeskAnswer)			,908	
LINT(HelpDeskKnowledge)			,895	
LINT(HelpDeskTrust)			,906	

Extraction Method: Principal Component Analysis.

Rotation Method: Promax with Kaiser Normalization.

a. Rotation converged in 5 iterations.

APPENDIX VI

List of Publications

Δημοσιεύσεις σε Διεθνή Επιστημονικά Περιοδικά:

[J1] Halaris, C., Magoutas, B., Papadomichelaki, X. and Mentzas, G. (2007). Classification and Synthesis of Quality Approaches in E-government Services. Internet Research Journal: Electronic Networking Applications and Policy, Volume 17, Number 4, 2007, pp. 378-401(24). **(Science Citation Index Expanded, Impact Factor 2009: 0.844)**

[J2] Papadomichelaki, X. and Mentzas, G. (2011). Analyzing Citizen Satisfaction from e-Government in Greece. Electronic Government, 8(4).

[J3] Papadomichelaki, X. and Mentzas, G. (2011). A Multiple-Item Scale for Assessing E-Government Service Quality. Accepted for publication in Government Information Quarterly **(Science Citation Index, Impact Factor 2009: 2.098)**

Δημοσιεύσεις σε Διεθνή Συνέδρια:

[A1] Papadomichelaki X., Magoutas B., Halaris C., Apostolou D. and Mentzas G. (2006). A Review of Quality Dimensions in E-government Services. In M. Wimmer, H.J. Scholl, Å. Grönlund, K.V. Andersen (Eds.): Electronic Government, 5th International Conference, EGOV 2006, Krakow, Poland, September 4-8 2006, Proceedings. LNCS 4084 Springer 2006, pp. 128–138. **(Science Citation Index Expanded, Impact Factor 2007: 0.513)**

[A2] Papadomichelaki, X. (2006). Quality in e-Government Services. 1st DEMO-net PhD Student Colloquium, September 3-4, Krakow, Poland.

[A3] Papadomichelaki, X. and Mentzas, G. (2008). An Assessment of Citizen Attitudes for e-Government: The Case of Greece. METTEG MeTTeG - The 2nd International Conference on Methodologies, Technologies and Tools enabling e-Government, Corfu, Greece.

[A4] Papadomichelaki, X. and Mentzas, G. (2009). A Multiple-Item Scale for Assessing E-Government Service Quality. In M.A. Wimmer, H.J. Scholl, M. Janssen, R. Traunmüller (Eds.): Electronic Government, 8th International Conference, EGOV 2009, Linz, Austria, August 30 – September 3, 2009, Proceedings. Springer Verlag: Heidelberg et al, LNCS # 5693, 200.

[A5] Papadomichelaki, X., Koutsouris, V., Konstantinidis D. and Mentzas, G. (2011). A Multi-Criteria Approach for the Assessment of E-government Service Quality. E-GOV 2011, Delft, Holland, August 28-September 2.