



Classification and synthesis of quality approaches in e-government services

Christos Halaris, Babis Magoutas, Xenia Papadomichelaki and Gregoris Mentzas

Information Management Unit, Institute of Communication and Computer Systems, School of Electrical and Computer Engineering, National Technical University of Athens, Athens, Greece

Abstract

Purpose – The purpose of this paper is to present a multi-faceted summary and classification of the existing literature in the field of quality of service for e-government and outline the main components of a quality model for e-government services.

Design/methodology/approach – Starting with fundamental quality principles the paper examines and analyzes 36 different quality approaches concerning public sector services, e-services in general and more specifically e-government services. Based on the dimensions measured by each approach the paper classifies the approaches and concludes on the basic factors needed for the development of a complete quality model of e-government services.

Findings – Based on the classification of literature approaches, the paper provides information about the main components of a quality model that may be used for the continuous monitoring and measuring of public e-services' quality. The classification forms the basis for answering questions that must be addressed by the quality model, such as: What to assess?; Who will perform the assessment? and How the assessment will be done?

Practical implications – This model can be used by the management of public organizations in order to measure and monitor the quality of e-services delivered to citizens.

Originality/value – The results of the work presented in this paper form the basis for the development of a quality model for e-government services.

Keywords E-commerce, Government, Public sector organizations, Quality management

Paper type Literature review

Introduction

Quality of service in the public sector has become an issue of great concern. Many organizations try to self-assess and measure the quality of service delivered. At the same time, significant progress has been made in the development of e-government services. Based on a recent survey (CapGemini, 2006) for the 20 basic public services in the EU, the number of official service providers present online has crossed the 90 percent threshold in the EU-15 plus Norway, Iceland and Switzerland ("EU-18"). More than half of the public administration service providers in the EU-18 and 42 percent in the new member states offer the same level of service online and offline. For



business-oriented services the figures are higher (74 percent in the EU-18) than for those provided for citizens (37 percent in the EU-18).

It is clear that quantitatively we have reached a critical level of online services; but what about the quality of those services? While more and more citizens and enterprises use the online services, manifold problems related to quality of public e-services still exist, according to Top of the Web Survey (e-Government Unit, DG Information Society, European Commission, 2004). Not being able to find the needed service/information, difficult use of e-services, the need for better help regarding the e-service provided on the web site, the language understandability etc. are some of frequently reported usability problems. These, together with issues like back office efficiency and system reliability, create the need of a quality perspective in the development and provision of e-government services.

A quality model which allows the specification of quality of services' dimensions and the relations between them will have significant impact on the improvement of online public services and on the increase of e-citizens satisfaction. Various initiatives investigate the application of quality management principles to the delivery of electronic public services. The purpose of this paper is to present an overview of the existing literature in the field of quality of service for e-government and outline the main components of a new model that will contribute to the qualitative improvement of online services.

The paper is structured in four sections. After this brief introduction, we present in section 2 the basic principles and theoretical foundations that are used as the theoretical background for the classification and synthesis of quality approaches. Section 2 contains also an overview of these approaches, while the actual synthesis and classification are presented in section 3. Finally, section 4 includes our conclusions about the presented models and our recommendations for future work.

Review of existing approaches

Theoretical background

It has been long since Shewhart (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.

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 *et al.* (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.

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, 36 approaches have been elaborated, as presented in Table I.

Area	Approach
Quality of traditional public services	Common assessment framework – CAF (CAF, 2006) Balanced scorecard (Kaplan and Norton, 1992) Six Sigma (Motorola University, 2006a, b; Process Quality Associates Inc, 2001) ISO (ISO, 2006)
Quality of e-government services	Baldrige criteria (Baldrige National Quality Program, 2006) American Customer Satisfaction Index for e-government (egov-ACSI) (American Customer Satisfaction Index, 2006) Customer satisfaction level in e-government (e.g.-CSI) (Kim <i>et al.</i> , 2005) Quality of Norwegian public web sites (Jansen and Ølnes, 2004) European top of the web (e-Government Unit, DG Information Society, European Commission, 2004) Interactive e-government (Barnes and Vidgen, 2003) User satisfaction of e-government services (Horan <i>et al.</i> , 2006) E-government in Thai (Sukasame, 2004)
Quality of e-services	E-S-QUAL (Zeithaml <i>et al.</i> , 2000, 2002; Parasuraman <i>et al.</i> , 2005) User-perceived web quality (Aladwani <i>et al.</i> , 2002) E-Qual (Barnes and Vidgen, 2001, 2002; Barnes <i>et al.</i> , 2001; Brian and Vidgen, 2005) E-commerce web site quality (Bessa and Belchior, 2002) Online service quality (Cai and Jun, 2003) B2C e-commerce web site quality (Mei <i>et al.</i> , 2005) Quality model for portal data (Caro <i>et al.</i> , 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 of web sites (Iwaarden <i>et al.</i> , 2003, 2004) Designs of highly-rated web sites (Ivory and Hearst, 2002; Ivory and Megraw, 2005) WebQual™ (Loiacono <i>et al.</i> , 2000) Web site quality evaluation (Mich <i>et al.</i> , 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 <i>et al.</i> , 2004, 2005) MAIS approach (Cappiello <i>et al.</i> , 2004) IBM approach (Mani and Nagarajan, 2002) METEOR-S approach (Cardoso <i>et al.</i> , 2002) Quality of services for web services (QS-WS) (Sumra and Arulazi, 2003)

Table I.
Overview of relevant approaches

Quality of traditional public services

The approaches in the area of traditional public services address quality as the result of effective management of various parameters (e.g. 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. CAF (CAF Resource Center, 2006) is a common European quality framework developed by the European Foundation for Quality Management (EFQM, 2007) that gradually would be used across the public sector as a tool for organizational self assessment. The model identifies for consideration, nine main quality aspects (boxes), grouped into two categories (enablers and results). More specific, “enablers” are operations evaluation areas and examine how an organization functions. According to 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.

The balanced scorecard (Kaplan and Norton, 1992) 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, the 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) communicate the vision and link it to individual performance;
- (3) business planning; and
- (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.

Six Sigma (Motorola University, 2006a, b), (Process Quality Associates Inc, 2001) 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.

The ISO 9000 (ISO, 2006) 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.

Finally, the Baldrige Criteria (Baldrige National Quality Program, 2006) 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 and 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.

In Table II the criteria/perspectives/principles of each process oriented approach are presented. The leadership criterion assess how leaders develop and facilitate the achievement of the mission and vision, develop values required for long-term success and implement these via appropriate actions and behaviors, and are personally involved in ensuring that the management system is developed and implemented. The strategy and planning criterion is related with the plan of action to achieve the objectives of an organization, while the human resources one with the management of human resources of the organization. More specifically, this criterion investigates the degree of managing developing and making use of the knowledge and full potential of the employees of an organization in order to support the effective operation of its processes. Process management criterion assess how the organization manages, improves and develops its processes while the customer perspective one what results the organization is achieving in relation to the satisfaction of its customers. Finally, key performance results measure what the organization is achieving in relation to its mandate and specified objectives.

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

Criteria	CAF	Balanced scorecard	Six Sigma	ISO	Baldrige criteria
Leadership	S			S	S
Strategy and planning					S
Human resources	S	S		S	S
Business and process management	S	S	S	S	S
Customer perspective	S,T	T	S	T	S
Key performance results	S	S		S,T	S

Notes: T = True, S = Substitute

Table II.
Review table for process oriented approaches

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):

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.

Quality of e-government services

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.

The American Customer Satisfaction Index (American Customer Satisfaction Index, 2006) 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. 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.

The American egov-ACSI (American Customer Satisfaction Index, 2006) 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). The second model of this group, the Korean g-CSI (Kim *et al.*, 2005), 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 web site 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 web site 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.

With 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.

The Western Norway Research Institute initiated a project that uses a set of 25 indicators and a set of quality criteria for evaluating public web sites 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.

The European Top of the Web approach (e-Government Unit, DG Information Society, European Commission, 2004) 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); and
- overall evaluation, i.e. user’s overall satisfaction with the service and whether the users’ expectations are met or not.

The interactive E-Government (Barnes and 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.

User satisfaction of e-government services (Horan *et al.*, 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.

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.

In Table III the criteria/perspectives/principles of each model are presented. Service reliability refers to the ability of the e-government portal to deliver the e-service consistently, producing the same results, preferably meeting or exceeding service's specifications. Personalization criterion is related with the process of tailoring pages to individual users' characteristics or preferences. Information/content quality is a term to describe the quality of the content of information systems and furthermore is a measure of the value which the information provides to the user of that information. Concerning the navigation/accessibility criterion, web site navigation is the science and skill which is applied to a web site that helps visitors move from one page to another, while accessibility is a general term used to describe the degree to which a system is usable by as many people as possible without modification. Customer service in the web is mainly related with technical support to citizens through e-mail, chat, voice and the web. Finally, the overall evaluation criterion is related with the provision of a single number/scale value that indicates the level of citizens' satisfaction.

Regarding the meaning of T and S symbols the same description that was provided for Table II 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.

Quality of e-services

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).

Parasuraman *et al.* (2005) and Zeithaml *et al.* (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:

- (1) The basic E-S-QUAL scale, a 22-item scale of four dimensions: efficiency, fulfillment, system availability, and privacy.

Table III.
Review table for
e-government approaches

	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	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	

Notes: T = True, S = Substitute

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- (2) 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.

In Aladwani's and Palviab'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.

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 web sites (Barnes and Vidgen, 2001, 2002) and (Barnes *et al.*, 2001). Their instrument was originally developed based on user evaluations of four university web sites 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 web site.

E-Commerce web site quality (Bessa and Belchior, 2002) defines a relevant set of web site 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 lifecycle.

Online service quality approach (Cai and 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.

B2C e-commerce web site quality (Mei *et al.*, 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.

In quality model for portal data (Caro *et al.*, 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.

Quality factors in web sites (Cox and 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.

Service quality on the web (Gounaris and 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.

E-service quality (Lee and 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.

Quality aspects in design and use of web sites approach, (Iwaarden *et al.*, 2003) 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).

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.

WebQual™ (Loiacono *et al.*, 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:

- (1) informational fit-to-task;
- (2) tailored communications;

- (3) trust;
- (4) response time;
- (5) ease of understanding;
- (6) intuitive operations;
- (7) visual appeal;
- (8) innovativeness;
- (9) emotional appeal;
- (10) consistent image;
- (11) on-line completeness; and
- (12) relative advantage.

Web site quality evaluation (Mich *et al.*, 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.

Consumer perspective of e-service quality (Zhang and 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.

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.

SITEQUAL provides us with guidelines and an instrument to measure the quality of a web site over time. 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.

IP-Portals approach (Yang *et al.*, 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 *et al.* (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:

- (1) usability;
- (2) usefulness of content;
- (3) adequacy of information;
- (4) accessibility; and
- (5) interaction.

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 combines SERVQUAL with Wang's work, Portal Usage Quality, combines SERVQUAL with TAM, while IP-Portals 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.

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 *et al.*, 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.

IBM (Mani and 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.

Cardoso *et al.* (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.

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 (Mani and Nagarajan,

2002), 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 web sites (Tsai and Chai, 2005), or of sites used in higher open distance education courses (Xenos *et al.*, 2004).

In Table IV the criteria/perspectives/principles of each model are presented. Service reliability, personalization, information/content and navigation/accessibility parameters have been already defined in the description of Table III. Two additional criteria are used by the approaches of e-services category, security and system performance. Security refers to the protection of data, networks and computing power while the system performance criterion is related with performance metrics that indicate the quality of a web portal.

There are some technical approaches of the e-service category which focus at technical web services characteristics that influence quality. 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 III, 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,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 (Mani and Nagarajan, 2002), Meteor-S (Cardoso *et al.*, 2002) 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).

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:

- (1) back office process performance layer, addressing factors mainly found in quality models for traditional government services;

Table IV.
Review table for e-service approaches

	Service reliability	Personalization	Information/content	Navigation/accessibility	Security	System performance
E-S-qual	T	T		T	T	T
User-perceived web quality	T	T	T	T	T	T
E-qual	T	T	T	T	T	T
E-commerce web site quality	T,S	T,S	T,S	T,S	T,S	T,S
Online service quality	T	T	T	T	T	T
B2C e-commerce web site quality	T	T	T	T	T	T
Quality model for portal data	T	T	T	T	T	T
Quality factors in web sites	S	S	S	S	S	S
Service quality on the web	T	T	T	T	T	T
E-service quality	T	T	T	T	T	T
Quality aspects in design and use of web sites	T	T	S	T	T	S
Designs of highly-rated web sites	T	T	T	T	T	T
WebQual	T	T,S	T,S	T,S	T,S	T,S
Web site quality evaluation	T	T	T,S	T,S	T,S	T,S
Consumer perspective of e-service quality	T	T	dT	T	T	T
Web site quality model	T	T,S	T,S	T,S	T	T,S
SITEQUAL	T	T	T	T	T	T
Portal usage quality	T	T	T	T	T	T
IP-portals	T	T	T	T	T	T
MAIS approach	T,S	T	T	T	T,S	T,S
IBM approach	S	T	T	S	S	S
Meteor-S approach	S	T	T	T	S	S
QoS for WS	S	T	T	T	S	S

Notes: T = True, S = Substitute

- (2) site technical performance layer, addressing the factors of the technical performance of the site, i.e. site reliability, security etc.;
- (3) site quality layer, addressing the factors of the site usability, and interface; and
- (4) customer's overall satisfaction addressing the overall level of quality perceived by the user against user's expectations.

For the identification of quality layers we have been also based on the way that an e-government portal is constructed. Jansen and Ølnes (2004) consider a government portal as a complex construction, which consists of several layers and functions. It is essentially an information system (IS), consisting of digital information and an information delivery infrastructure, such as browsers, search engines, encryption, networking systems, etc. (Yang *et al.*, 2005). The main layers of such an IS are the organizational infrastructure (back office organization), the technical infrastructure, and the web portal itself, consisting of user interface, information resources, etc. (Jansen and Ølnes, 2004). Each one of these layers affect the perceived by citizens quality and has been mapped to a corresponding quality layer. The main purpose of an e-government portal is the delivery of public e-services to citizens. Citizens are not aware about the organizational and technical infrastructure used for service delivery. A citizen-centric perspective implies the need to take into account the overall customer's satisfaction, so another very important layer that we have identified is the overall satisfaction one.

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. 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 1.

Many of the literature quality approaches reviewed include quality aspects and factors that are relevant for more than one quality layer. 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

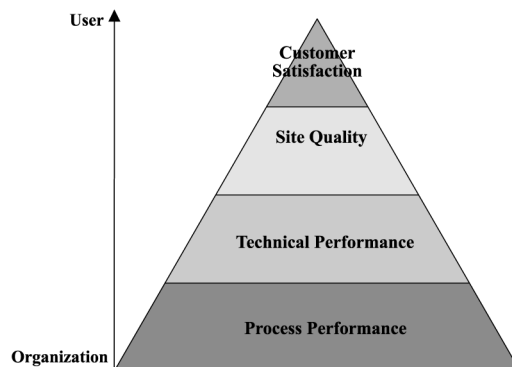


Figure 1.
Layers of quality
assessment

(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, i.e. the quality as it is perceived by the service consumer, while substitute quality is the service provider's perspective, i.e. the quality as it is perceived by the public administration. 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 V.

By reviewing the table, it is apparent that there are specific groups of models. Some of these groups are identical to the three groups that were initially used for the presentation of literature in groups, i.e. 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 VI depicts the categories identified after the three-dimensional classification.

The traditional category includes all the models that have been also categorized 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 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 site's quality aspects. The assessment is substitute, as it is performed by the public

Approach	Processes performance	Objective characteristics System performance	Site quality	Customer satisfaction	Processes performance	Subjective characteristics System performance	Site quality	Customer satisfaction
CAF								S
Balanced scorecard	S			S	S			T
Six sigma	S			S				
ISO	S			S	S			T
Baldrige criteria	S			S				
American customer satisfaction index	S			S				T
Korean g-CSI							T	T
Norwegian public web sites			S				T	T
European Top of the Web							T	T
Interactive e-gov						T	T	T
User satisfaction of e-gov services						T	T	T
e-government in Thailand						T	T	T
E-S-Qual						T	T	T
User-perceived web quality						T	T	T
E-Qual						T	T	T
E-commerce web site quality						T,S	T,S	
Online service quality						T	T	
B2C e-commerce web site quality						T	T	
Quality model for portal data						T	T	
Quality factors in web sites						T	T	
Service quality on the web		S				T	T	
E-service quality						T	T	
Quality aspects in design and use of web						T	T	
Designs of highly-rated web sites		S				T	T	
WebQual						T	T	
Web site quality evaluation						T,S	T,S	
Consumer perspective of e-service quality						T	T	
Web site quality model		S				T	T	
SITEQUAL						T	T	
Portal usage quality						T	T	
IP-Portals						T	T	
MAIS approach		S				T	T	
IBM approach		S				T	T	
Meteor-S approach		S				T	T	
QoS for WS		S				T	T	

Notes: T = True, S = Substitute

Table V.
Classification of literature approaches

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17,4

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Category	Approach
Traditional	CAF Balanced scorecard Six Sigma ISO
Citizen satisfaction	Baldrige criteria 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 web site quality Online service quality B2C e-commerce web site 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

Table VI.
Identified categories

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.

Conclusions and future work

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.

As future work we plan to 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 paper. 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 at section 3 of the paper 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:

- (1) back office process performance layer;
- (2) site technical performance layer;
- (3) site quality layer; and
- (4) 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 V. 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 paper form the basis for the development of a quality model for e-government services.

The quality model that we plan to develop 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. A challenge for the quality model is the development of quality tools that will calculate automatically objective metrics, using data mining techniques to web server's and workflow engine's log.

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About the authors

Christos Halaris is adjunct lecturer at the University of Thessaly, teaching e-commerce and Senior Researcher at the Information Management Unit/National Technical University of Athens (NTUA). He holds a PhD in E-business and Virtual Organizations (2000) and a Diploma Degree in Electrical & Computer Engineering (1995), both from NTUA. He also holds an MBA degree (1999) from NTUA and AUEB (Athens University of Economics and Business). He has worked for more than ten years as Business Consultant and thus acquired solid experience in the areas of Project and Program Management, E-Government service development and Business Planning (development and evaluation). He has also worked on various ESPRIT and IST Research Projects. During his military service he worked at the Hellenic Navy for the development and establishment of an ISO 9001:2000 Quality Management System in Salamis Technical Base.

Babis Magoutas is a PhD candidate and researcher at the Information Management Unit/National Technical University of Athens (NTUA). He holds a Diploma Degree in Electrical and Computer Engineering (2003) and a master in business administration degree (2006), both from NTUA. During 2004-2005 he worked as telecom engineer in the company INTRACOM SA. He is currently working in IST Research Projects and his research interests include the emerging semantic web, quality management, e-Government and semantically adaptive interfaces.

Xenia Papadomichelaki is a PhD candidate and senior researcher at the information Management Unit/National Technical University of Athens (NTUA). She is a Mechanical Engineer and has obtained her master in business administration degree from Canterbury Business School, Great Britain. Since then she has worked in several projects and is currently working as quality manager in Microwave and Fiber Optics Laboratory (MFOL) of NTUA and her research interests include quality management, e-Government and applied multivariate techniques.

Gregoris Mentzas is Professor of Information Technology Management at the School of Electrical and Computer Engineering of the National Technical University of Athens (NTUA) and Director of the Information Management Unit (IMU) a multidisciplinary research unit at the University. His area of expertise is information technology management and his research concerns the integration of knowledge management, semantic web and e-service technologies. He was/is principal investigator in more than 30 international research projects in his areas of expertise and has published 50 research papers in international scientific journals, 60 papers in international conferences and is the lead author of the book *Knowledge Asset Management* published by Springer in the series "Advanced Information and Knowledge Processing". He serves on the editorial board of four journals and has been on the Program Committee of more than 20 international conferences.