



# A combined fuzzy AHP and fuzzy TOPSIS based strategic analysis of electronic service quality in healthcare industry

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## ARTICLE INFO

**Keywords:**  
Healthcare quality  
e-Service quality  
Fuzzy AHP  
Fuzzy TOPSIS

## ABSTRACT

Service sector is under pressure to deliver continuing performance and quality improvement while being customer-focused. In recent terms, there exists web based or electronic service quality (e-sq) concept. With the birth of electronic commerce, it has become important to be able to monitor and enhance e-sq. Therefore, this study will examine the e-sq concept and determine the key components of e-sq. The e-sq framework is employed by the aid of service quality (SERVQUAL) methodology as the theoretical instrument. Finally, proposed e-sq framework is illustrated with a web service performance example of healthcare sector in Turkey by using a combined multiple criteria decision making (MCDM) methodology containing fuzzy analytic hierarchy process (AHP) and fuzzy technique for order performance by similarity to ideal solution (TOPSIS). The work presented in this paper shows the applicability of the e-sq framework in explaining the complexity of aspects observed in the implementation of healthcare services via internet.

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## 1. Introduction

From now on, firms must compete not only with internal firms, but also with external firms in today's global conditions. It is very important to get the whip hand of competition by providing the congruity of the services to the expectations of consumers. It is also important to achieve a desirable, qualified service because quality is achieved when the needs and expectations of the customer are met. By the meaning, the qualities of the services should be measured.

Also in recent terms there exists web based or e-service quality (e-sq) concept. With the birth of electronic commerce (e-commerce), it has become important to be able to monitor and enhance e-sq. So in this study, e-sq concept and the accompanying e-sq of healthcare sector are researched and analyzed. There are many affords to measure e-sq, but service quality (SERVQUAL) methodology (Brown, Churchill, & Peter, 1993; Cronin & Taylor, 1992; Parasuraman, Zeithaml, & Berry, 1985) is chosen because it is the most used and preferred methodology. Our aim is to adapt the SERVQUAL instrument to assess healthcare e-sq. While a significant body of academic literature exists on service quality in healthcare industry (Babakus & Mangold, 1992; Bakar, Akgün, & Al Assaf, 2008; Bowers & Kiefe, 2002; Chae, Kim, Tark, Park, & Ho, 2003; Chang, Hsiao, Huang, & Chang, 2011; Isaac, Zaslavsky, Cleary, & Landon, 2010; Lee, Delene, Bunda, & Kim, 2000; Li, 1997), little is

known about e-sq (Bilsel, Büyüközkan, & Ruan, 2006; Bose, 2003; Chang, 2007; Chou & Chou, 2002; Gruca & Wakefield, 2004; Hadwich, Georgi, Tuzovic, Büttner, & Bruhn, 2010; Provost, Koopalum, Doong, & Martin, 2006).

To effectively evaluate e-sq, both qualitative and quantitative factors must be considered. Thus, e-sq performance measurement is a kind of multiple criteria decision making (MCDM) problem. This study includes a combined fuzzy analytic hierarchy process (AHP) (Saaty, 1980) and fuzzy technique for order performance by similarity to ideal solution (TOPSIS) (Hwang & Yoon, 1981) methods to measure e-sq performance. Fuzzy set theory aids (Zadeh, 1965) in measuring the ambiguity of concepts that are associated with human being's subjective judgment. Since the performance evaluations are done with decision makers' preferences, its evaluation must therefore be conducted in an uncertain, fuzzy environment. Also by applying AHP in obtaining criteria weight and TOPSIS in ranking, the comprehensiveness and reasonableness of the e-sq measurement process is strengthened.

The paper is organized as follows: In the second section, the background of e-sq is examined by literature survey. Then in the third section, e-sq concept is discussed in healthcare industry. After expressing the methodology of the study in section four, section five presents the case study. Finally, the sixth section concludes the paper.

## 2. Web based/electronic service quality concept (e-sq)

With the development of internet commerce the physical business unit has been replaced by a web site (Cristobal, Flavian, & Guinaliu,

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E-mail addresses: [gbuyukozkan2003@yahoo.com](mailto:gbuyukozkan2003@yahoo.com), [gulcin.buyukozkan@gmail.com](mailto:gulcin.buyukozkan@gmail.com) (G. Büyüközkan).

2007). With the increase of web sites and the commercial internet invested in them, assessment of web site quality has highlighted its importance. Business organizations throughout the world invest time and money in order to develop and maintain user-perceived quality web sites. These web sites should provide an effective communication and information channel between companies and their customers (Grigoroudis, Litos, Moustakis, Politis, & Tsironis, 2008).

Measurement of service quality delivery through web sites is in its early stages comparing to traditional service quality (Zeithaml, 2002). The first formal definition of web site service quality, or e-sq was provided by Parasuraman, Zeithaml, and Malhotra (2002). In their terms, e-sq can be defined as the extent to which a web site facilitates efficient and effective shopping, purchasing, and delivery of products and services. As can be observed in this definition, the meaning of service is comprehensive and includes both pre- and post-web site service aspects. In order to deliver a high level of service quality, companies with web presences must first understand how customers perceive and evaluate online customer service. Although low price and web presence were thought to be success drivers, service quality issues cannot be overemphasized.

As well as being information providers, web sites are also service providers. Therefore the literature on service quality is relevant to web sites, since information quality will be accompanied by a perception of service quality. The SERVQUAL instrument (Parasuraman et al., 1985) is a well-established model of service quality and has been used for the web based service quality assessment by several authors. Yoo and Donthu (2001) developed a nine-item SITEQUAL scale for measuring site quality on four dimensions: *ease of use, aesthetic design, processing speed, and security*. Parasuraman et al. (2002) identified 11 dimensions about e-sq as *reliability, responsiveness, access, flexibility, ease of navigation, efficiency, assurance/trust, security/privacy, price knowledge, site aesthetics, and customization/personalization*. Then after preliminary scale, sample design, data collection, data analysis; they go to scale reduction because the purpose was to produce a general scale that would be appropriate for assessing service quality of a variety of sites. And it resulted in four dimensions: *efficiency, fulfillment, system availability, privacy*. And lastly, again with the same iterative process, they created an e-ResSQ (e-recovery service quality scale) with three dimensions: *responsiveness* (effective handling of problems and returns through the site), *compensation* (the degree to which the site compensates customers for problems), *contact* (the availability of assistance through telephone or online representatives). As another research, Wolfenbarger and Gilly (2003) used online and offline focus groups, a sorting task, and an online-customer-panel survey to develop a 14-item scale called eTailQ. The scale contains four factors: *web site, reliability/fulfillment, privacy/security, and customer service*. Barnes and Vidgen (2006) developed a completely different scale to measure an organization's e-commerce offering, which they also call WebQual. This scale provides an index of a site's quality (customer perceptions weighted by importance) and has four factors: *usability, information quality, service interaction and overall*. Ladhari (2010) proposed a literature review on developing e-service quality scales and expressed that there is no consensus on the number and the nature of the dimensions in the e-sq construct; but globally six dimensions recur more consistently: *reliability/fulfillment, responsiveness, ease of use/usability, privacy/security, web design, and information quality*. Summary of several works are exist in Table 1 containing the factors for web sites to say that they deliver qualified services.

### 3. e-sq in healthcare industry

Quality assessment and control in healthcare date back to the mid-19th century. Healthcare quality has been one of the major

issues facing healthcare providers, employees, employers, and governmental agencies (Chou & Chou, 2002). As the Internet has increased dramatically, the healthcare industry has recognized the benefits of integrating the Internet to improve their offered services. Hospital web sites are now being seen as appropriate media to facilitate information exchange between patients and providers. Therefore, more and more healthcare institutions are transferring some of their services on the Internet to further their often competing goals of increasing the quality of patient care and controlling costs (Bilsel et al., 2006).

If the healthcare service industry were similar to other industries that provide services for their customers, a patient could choose among many doctors who offer different prices, and provide service that differs in terms of medical technical quality or other service-related dimensions (Lee et al., 2000). However the reality differs in the healthcare sector that doctor choice is often made not by the patients individually. Referral from the patient's primary doctor, from his or her health organization, and/or from friends affects this choice. So, service recipients' perceptions toward service are valuable for improving healthcare service quality. As also ethics dictate that healthcare provider must provide the best and most appropriate care accessible to the patient, it should be endeavoured to have continuous quality improvements such as online service.

Hospital web sites are significantly important to deliver healthcare services to working citizens living in metropolises that might not spare enough time to meet healthcare needs (Bilsel et al., 2006). Nevertheless studies of e-sq remain limited. Researchers Bedell, Agrawal, and Petersen (2004) established criteria for excellence of web sites for diabetes. In their work web site quality evaluation is mainly based on *usability, content, and reliability*. Another research by Provost et al. (2006) represents WebMedQual for quality assessment of health web sites. It consists of dimensions such as *content, authority of source, design, accessibility, links, user support, confidentiality, and e-commerce*. Bilsel et al. (2006) proposed a fuzzy preference-ranking model for a quality evaluation of hospital web sites. *Tangibles, reliability, responsiveness, assurance, empathy, quality of information, and integration of communication* were their evaluation criteria. Chang (2007) studied on e-hospital web site measurement architecture approach and the measurement of website delivery service quality was based on *security, network capacity, data processing, operating performance, and database system* main-criteria. Recently, Patsioura, Kitsiou, and Markos (2009) evaluated the Greek public hospital web sites in their study and they identified two key categories for hospitals' web site evaluation as *information and communication and transaction*. Hadwich et al. (2010) proposed a study focusing on perceived quality of e-health services. They have identified three primary dimensions: *potential, process, and outcome* qualities. These primary dimensions are driven by 13 sub-dimensions: *accessibility, competence, information, usability/user friendliness, security, system integration, trust, individualization, empathy, ethical conduct, degree of performance, reliability, and ability to respond*. In these studies, researchers that develop e-sq scales have taken a combination of traditional sq dimensions, often based on the SERVQUAL instrument, and web interface quality dimensions as a starting point.

### 4. Research design

According to all literature surveys in Sections 2 and 3, our dimensions for evaluating web based healthcare service quality are determined as *tangibles, responsiveness, reliability, information quality, assurance, and empathy*.

In e-sq *tangibles* (Aladwani & Palvia, 2002; Bilsel et al., 2006; Li, Tan, & Xie, 2002) mean physical attributes, animations and

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