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Measuring customer satisfaction in electronic commerce: the impact of e-service quality and user experience

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Abstract

Purpose – The purpose of this study is to explore the interplay between electronic service quality, user experience (UX) and overall customer satisfaction. Additionally, it aims to assess the suitability of E-S-QUAL and UX metrics within the cultural context of Greece.

Design/methodology/approach – Data were collected from 310 Internet users based on their last online purchase from an e-retail website. To evaluate the conceptual model, the authors used partial least squares structural equation modeling (PLS-SEM).

Findings – The findings of this study validate the scales' reliability and validity in the realm of electronic commerce (e-commerce) in Greece. The findings also emphasize the favorable association between e-service quality and UX with overall satisfaction, while indicating that e-service quality plays a partial mediating role in the relationship between UX and customer satisfaction.

Originality/value – The authors' study enhances the existing theory by introducing a new multi-dimensional conceptual framework that illuminates the relative importance of the dimensions within the scales. Additionally, it offers valuable insights into the impacts of e-service quality and UX on overall satisfaction, providing managers and practitioners with a tool to evaluate the quality of their electronic services and make necessary adjustments to meet the needs of their customers.

Keywords Customer satisfaction, PLS-SEM, E-S-QUAL, Electronic commerce, Electronic service quality, User experience (UX)

Paper type Research paper

1. Introduction

Electronic commerce (e-commerce) has been a subject of research and analysis for several years. The evolution of the Internet has created new business opportunities and has transformed the shopping habits of customers worldwide, who have shifted from traditional brick-and-mortar stores to online shopping platforms. The coronavirus disease 2019 (COVID-19) pandemic outbreak has resulted in an unprecedented surge in global online traffic, leading to a significant shift in consumer behavior (UNCTAD, 2020). E-commerce has proven to be a highly effective shopping solution during periods of lockdowns and self-isolation. According to recent statistics, user penetration is projected to increase to 63.1% by 2025 (Statista, 2020a), while online sales are expected to reach $6.54tn by 2022 (Statista, 2020b). A survey conducted

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in Greece has revealed that online purchases witnessed a 100% surge in 2020 compared to 2019, and nearly half of all Internet users in Greece also engage in online shopping (Eltrun and Research Institute of Retail Consumer Goods, 2020).

Recent research has shown that individuals in Greece experienced a heightened sense of uncertainty, fear and anxiety during the COVID-19 pandemic, leading them to purchase double the amount of essential goods. This behavior provided them with a sense of security and perceived control over the situation (Anastasiadou *et al.*, 2020). Despite e-commerce usage in Greece still lagging behind other European countries (Eurostat, 2022), its rapid growth has been coupled with business practices that enable electronic transactions and create a user-friendly digital environment (Tzavlopoulos *et al.*, 2019). However, the satisfaction of Greek online customers could be further improved if perceived quality and responsiveness met their needs and expectations (Tzavlopoulos *et al.*, 2019).

Customer satisfaction is a crucial factor indicating the likelihood of a customer experiencing positive feelings from a particular service (Udo *et al.*, 2010). However, achieving and maintaining customer satisfaction remains a significant challenge in the e-commerce industry (Rita *et al.*, 2019; Cao *et al.*, 2003; Wan Jasni *et al.*, 2020). To establish and retain loyal customers, companies must deliver superior service experiences (Gounaris *et al.*, 2010; Veloso *et al.*, 2020). Customer satisfaction is highly dependent on service quality, and customers are more likely to be pleased when they receive high-quality services (Ou *et al.*, 2011; Suhartanto *et al.*, 2019).

Several theories have been used to explain customer satisfaction. Among these, the Expectancy-Disconfirmation Theory (EDT) has gained wide acceptance as a theoretical framework that accounts for the impact of the perceived discrepancy between expectations and actual experiences on customer satisfaction (Oliver, 1980). When applied to e-commerce, EDT can provide insights into the linkages between service quality, UX and customer satisfaction.

Numerous quality and electronic service quality have been extensively researched in recent years, as they have been found to impact the economic performance of companies (Kim and Lennon, 2017). E-service quality, in particular, has been identified as the most critical factor in the success of e-retailers (Santos, 2003). It is a subjective concept influenced by several factors, such as personal values and culture (Ladhari *et al.*, 2011). Improving the quality of services can reduce the likelihood of dissatisfied customers, which can lead to financial and human costs (Lopes *et al.*, 2019). It also positively affects perceived value and customer satisfaction (Kuo *et al.*, 2009; Tran and Vu, 2019; Tzavlopoulos *et al.*, 2019), leading to purchase and re-purchase intentions (Ataburo *et al.*, 2017). Furthermore, e-service quality allows customers to compare product technical aspects and prices online at no cost (Dhingra *et al.*, 2020). Several scales have been developed to measure e-service quality, with E-S-QUAL by Parasuraman *et al.* (2005) being one of the most popular and widely used.

Another crucial factor affecting customer satisfaction is UX (Zhou *et al.*, 2019). UX refers to all aspects of the user's interaction with a product, service, environment, or facility (Standardization, 2010). Research on UX has increased substantially in recent years (Santoso *et al.*, 2016; Pushparaja *et al.*, 2021) because it is a significant concern in designing a strategic plan for online retailers (Lemon and Verhoef, 2016). UX encompasses the sensations that users acquire while interacting with a product, as well as the satisfaction and pleasure they derive from its use (2015). UX has been identified as one of the most significant research challenges for the future (Institute, 2016).

Although the concept of UX has been studied in many contexts, limited research has been conducted on its application in e-commerce (Ritonummi and Niininen, 2021). Furthermore, to the best of our knowledge, while previous studies have explored the relationship between customer satisfaction and UX (Park, 2019; Poushneh and Vasquez-Parraga, 2017; Pushparaja *et al.*, 2021) and e-service quality (Dalbehera, 2020; Farooq *et al.*, 2018; Wan Jasni *et al.*, 2020), research that examines the combined effect of UX and electronic service quality on customer satisfaction is still in its early stages (Luther *et al.*, 2020). Therefore, the objectives of this paper are.

(1) To examine the relationship between electronic service quality, UX and customer satisfaction.

(2) To investigate the mediation role of electronic service quality in the relationship between UX and customer satisfaction.

Additionally, the study aims to test the E-S-QUAL, UX and customer satisfaction scales in the Greek context during the first COVID-19 lockdown, which resulted in a significant increase in online purchases.

The contribution of our study is threefold. Firstly, it provides a comprehensive and validated multi-dimensional framework to measure customer satisfaction specifically in e-commerce, grounded in the existing literature. As researchers increasingly study the factors that determine electronic satisfaction in e-retailing (Collier and Bienstock, 2006; Nisar and Prabhakar, 2017; Tzavlopoulos *et al.*, 2019), there is a growing need for more research in different cultural environments (Ghosh, 2018). Secondly, our study enriches the literature on the factors affecting overall user satisfaction when purchasing products online by empirically validating a comprehensive model developed for this purpose. Finally, our study supports the validity of scales developed to measure e-service quality, UX and customer satisfaction in the context of the Greek e-retail market. Given that culture and lifestyle can influence the perception of online services (Paschaloudis and Tsourela, 2015) and service quality dimensions differ between countries (Ladhari, 2008), it was important to assess the robustness of the scales in the country of research.

2. Literature review and hypotheses

2.1 Electronic service quality

Numerous studies have discussed the significance of service quality in strategic planning and business success (Tang *et al.*, 2021; Kersten and Koch, 2010; Ngo and O'cass, 2013). In the literature, service quality has been defined differently. According to Lewis and Booms (1983), service quality refers to the degree to which the delivered services meet customers' expectations. Asubonteng *et al.* (1996) interpret service quality as the gap between customers' expected service performance and their perceived service received, while Parasuraman *et al.* (1988) define service quality as an attitude regarding the superiority of service.

To measure service quality, various scales have been developed, with a scale for measuring service quality (SERVQUAL) (Parasuraman *et al.*, 1988) being considered one of the most well-known and frequently used scales in many studies (Zhou *et al.*, 2002; Van der Wal *et al.*, 2002; Cook and Thompson, 2000). Another scale, proposed by Cronin and Taylor (1992), is Service Performance (SERVPERF). Its development originated from their criticism of the conceptual basis of the SERVQUAL scale, as they found it confusing regarding service satisfaction. SERVPERF has also been used in several studies (Landrum *et al.*, 2007; Vanniarajan and Anbazhagan, 2007; Leong *et al.*, 2015).

The evolution of the Internet has changed how people work, communicate and behave in their everyday lives. As traditional businesses moved online, academic research shifted towards examining the effects of this transformation. The need to re-examine service quality measures when referring to electronic services led to the development of new definitions and scales. Electronic service quality is defined by Parasuraman *et al.* (2005) as "the extent to which a website facilitates efficient and effective shopping, purchasing, and delivery". In the field of e-commerce, e-service quality is particularly crucial for retaining customers and ensuring their revisits, which eventually ensures customer loyalty (Jeon and Jeong, 2017). Due to its importance, electronic service quality measurement is the most explored area of research in the services marketing field, and various scales have been developed to measure e-service quality in different contexts (Shankar and Datta, 2020). Among the scales deployed

to estimate e-service quality, the most adapted ones include WebQual (Barnes and Vidgen, 2000), SITEQUAL (Yoo and Donthu, 2001), WebQual^{TM} (Loiacono *et al.*, 2002), eTailQ (Wolfinbarger and Gilly, 2003), e-SERVQUAL (Zeithaml *et al.*, 2002), E-S-QUAL (Parasuraman *et al.*, 2005), eTransQual (Bauer *et al.*, 2006), PeSQ (Cristobal *et al.*, 2007) and the hierarchical model (Blut *et al.*, 2015).

WebQual, developed by Barnes and Vidgen (2000), has evolved into WebQual 4.0, which includes three dimensions and five factors: usability, information quality and service interaction quality (Barnes and Vidgen, 2002). However, Parasuraman *et al.* (2005) have argued that WebQual does not provide a comprehensive evaluation of service quality since it does not require respondents to complete a purchase.

SITEQUAL, developed by Yoo and Donthu (2001), measures the perceived quality of an e-commerce website using four dimensions: ease of use, esthetic design, processing speed and security and nine items. However, SITEQUAL has been criticized for possibly excluding important factors due to its narrow set of items (Loiacono *et al.*, 2002) and for not capturing all perspectives of the buying process (Parasuraman *et al.*, 2005).

WebQual^{TM}, another e-service quality scale developed by Loiacono *et al.* (2002) consists of twelve dimensions: informational fit-to-task, tailored communications, response time, ease of understanding, trust, intuitive operations, innovativeness, emotional appeal, consistent image, visual appeal, relative advantage and online completeness. The scale has been criticized, pointing out that it is more relevant to interface design since it is based on the technical quality, rather than on the service quality of a website (Zeithaml *et al.*, 2002; Blut *et al.*, 2015).

eTailQ, developed by Wolfinbarger and Gilly (2003), includes four factors that compute the dimensionality of service quality in e-retailing: reliability/fulfillment, website design, customer service and privacy/security. However, eTailQ has been criticized for eliminating quality items referring to hedonic aspects of Internet shopping (Bauer *et al.*, 2006) and for its dimensionality (Parasuraman *et al.*, 2005).

e-SERVQUAL was the result of Zeithaml *et al.*'s work (2002), trying to create a scale to estimate the perceived service quality delivered by web retailers. Their scale is formed by seven dimensions, i.e. efficiency, compensation, reliability, fulfillment, contact, responsiveness and privacy. The first four dimensions form their core scale, while the remaining are considered silent/recovery ones. Parasuraman *et al.* (2005) later modified E-SERVQUAL to form the final E-S-QUAL scale, along with its e-recovery service quality scale, named E-RecSQUAL.

E-S-QUAL (Parasuraman *et al.*, 2005) measures the service quality delivered by websites and includes four main dimensions (efficiency, fulfillment, system availability and privacy) and twenty-two items. Its subscale E-RecS-QUAL was also developed to handle service problems and inquiries with the website. It includes three main dimensions (responsiveness, compensation and contact) and eleven items.

eTransQual, developed by Bauer *et al.* (2006), captures service quality in Internet shopping and integrates both hedonic and utilitarian e-commerce service quality using five dimensions: enjoyment, functionality/design, process, responsiveness and reliability, and it has been used in some studies (Kim *et al.*, 2012; Ulkhaq *et al.*, 2017). However, it has not gained the same acceptance as other electronic service quality scales.

PeSQ developed by Cristobal *et al.* (2007), includes more aspects of website design. It consists of four dimensions that characterize the perceived quality of websites, namely web design, customer service, order management and responsiveness. PeSQ has been criticized for lacking specific application and validation (Ladhari, 2010).

The hierarchical model established by Blut *et al.* (2015) is one of the most recently developed scales. Their purpose was to create a hierarchical formative measurement approach for measuring e-service quality using meta-analysis. The scale consists of four dimensions: website design, fulfillment, security/privacy, customer service and sixteen attributes. The hierarchical model has already been used in some studies (Blut, 2016; Rita

et al., 2019). Criticism of this scale is based on the fact that it does not include items to measure experiential elements, whereas relational items focus solely on customer service (Alnawas and Al Khateeb, 2022).

Table A1 (in the Appendix) presents each scale's objectives, key components and existing criticism. From the above-mentioned scales for measuring electronic service quality, E-S-QUAL is widely used for the following reason.

(1) It is simple (Sheng and Liu, 2010).

(2) It takes into account all stages of a customer's interactivity with a website (Kim and Kim, 2010).

(3) It relies on the shopping experience of real online customers (Ghosh, 2018).

(4) It measures the quality of the primary service properties (Barnes and Vidgen, 2002).

(5) It provides significant psychometric attributes during its development (Connolly *et al.*, 2010).

(6) It has rigorous conceptualization and testing (Rafiq *et al.*, 2012).

Kang *et al.* (2016) employed the E-S-QUAL scale and integrated it with fuzzy hierarchical Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) to propose a novel approach for evaluating B2C e-commerce websites. Similarly, Mujinga (2020) utilized E-S-QUAL to investigate retail banking customers' perceptions of online banking service quality in South Africa. Dalbehera (2020) tested the effects of E-S-QUAL dimensions on perceived value, e-loyalty and electronic service quality that impact digital library services. Kalia and Paul (2021) utilized E-S-QUAL and E-RecSQUAL scales to distinguish how Indian e-shoppers differentiate between various e-retailers while shopping online.

E-S-QUAL has been tested in various studies, and its validity has been confirmed. Mummalaneni *et al.* (2016) used this scale to assess the relative importance of consumer technology readiness associated with the online retailing context in China and their intent to purchase again in the future. Their results reveal that consumer technology readiness has a positive impact on the E-S-QUAL dimensions. Ghosh (2018) evaluated the applicability of E-S-QUAL in India's e-commerce market and found that the scale's dimensions were significant predictors of perceived value. Santouridis *et al.* (2012) examined the applicability of E-S-QUAL in the Greek e-commerce market and tested the impact of the scale's dimensions on customers' perceived overall quality, value and loyalty, with findings confirming the scale's structure and producing outcomes similar to those of the original research.

Based on the aforementioned literature review, the authors of this paper selected E-S-QUAL to measure e-commerce website electronic service quality and assess its impact on customer satisfaction. According to Parasuraman *et al.* (2005), the E-S-QUAL scale consists of 22 items on four dimensions, as presented in Table 1.

Efficiency is a crucial dimension that pertains to customers' ability to access the website, find the desired product and obtain relevant information with minimal effort (Zeithaml *et al.*, 2002). A website that is simple to navigate and well organized is essential for achieving efficiency. Therefore, assessing efficiency is crucial in measuring the service quality of an e-commerce website.

The fulfillment dimension is concerned with the accuracy of service promises, product availability and prompt delivery (Parasuraman *et al.*, 2005). It represents a key determinant of electronic service quality that customers value when engaging with e-commerce websites.

System availability refers to the technical functionality of a website, particularly the ease of accessibility and proper functioning (Parasuraman *et al.*, 2005). This means that a website

should load instantly, not crash and not freeze when entering order information. Therefore, evaluating system availability is critical to measuring e-service quality.

Privacy involves ensuring that customer shopping behavior information is protected, personal data are not disclosed to third parties and credit card information is secure (Zeithaml *et al.*, 2002). Customers tend to perceive e-commerce websites as providing better service quality when they offer adequate privacy measures.

Parasuraman *et al.* (2005) reported that the E-S-QUAL scale items are reflective, allowing the intercorrelation of dimensions. Reflective items represent all possible indicators of a construct. In a reflective measurement model, items may be highly correlated with each other because they reflect the same construct (Hair *et al.*, 2011).

2.2 User experience (UX)

Over the last decades, the field of human–computer interaction (HCI) has undergone a significant transformation. Initially, the emphasis was on creating useable systems, and evaluation methods were developed to assess instrumental aspects such as efficiency, effectiveness, and learnability (Lallemand and Koenig, 2017). However, with the advent of ubiquitous technologies and the increasing maturity of users, the term user experience (UX) was introduced to emphasize the need for a more holistic approach to studying the interaction between humans and digital products and services (Bargas-Avila and Hornbæk, 2011).

The concept and field of UX encompass much more than just usability (Ritonummi and Niininen, 2021). Usability is a component of UX and measures the efficiency, ease of learning, memorability, error rate and overall pleasantness of a system (Nielsen, 2012). On the other hand, UX aims to fulfill users' needs by providing valuable experiences that cultivate customer loyalty (Pushparaja *et al.*, 2021). UX emphasizes the subjective, emotional and temporal aspects of the interaction between users and digital systems (Roto *et al.*, 2011) and refers to the experience a user has after using a product, service, or application (Pushparaja *et al.*, 2021).

Since UX is a more complex and holistic approach, established evaluation methods in HCI needed to be re-evaluated, adjusted and/or reformulated, or new ones had to be created to meet the new requirements (Forlizzi and Battarbee, 2004; Swallow *et al.*, 2005). Among the various evaluation methods, questionnaires and scales are the most widely used tools to assess perceived usability and UX. Many standardized questionnaires, such as the System Usability Scale (SUS), are simple and effective self-administered UX evaluation tools (Kocabalil *et al.*, 2018). SUS, developed by Brooke (1996), includes ten items rated on a 5-point scale, ranging from strongly disagree to strongly agree and is most appropriate to assess usability.

However, scales that refer to the holistic aspects of UX are equally important. The AttrakDiff scale (Hassenzahl *et al.*, 2003) provides a subjective assessment of both pragmatic and hedonic system qualities and is based on 28 semantic differentials. It has been used in numerous studies in recent years (Fiebig *et al.*, 2016; Neubert *et al.*, 2018; Drouet and

Dimension	Items	Definition
Efficiency	8	The ease and speed of accessing and using a website
Fulfillment	7	The extent to which the website's promises about order delivery and item availability are fulfilled
System availability	4	The correct technical functioning of a website
Privacy	3	The degree to which the website is safe and protects customer information

Table 1.
E-S-QUAL dimensions

Source(s): Author's own work

Bernhaupt, 2016), but some critique it for placing less emphasis on pragmatic characteristics of product quality (Laugwitz *et al.*, 2008).

The User Experience Questionnaire (UEQ) (Laugwitz *et al.*, 2008) is quite similar to AttrakDiff and focuses on pragmatic and hedonic dimensions. It includes six dimensions and 26 items and is used as part of a usability test to gather quantitative data about a user's impression of a product. The meCUE scale (Minge and Riedel, 2013) provides an evaluation of product perceptions, users' emotions, consequences of use and an overall assessment. It consists of four dimensions and 34 items and has been applied in UX studies on all types of interactive systems (Lallemand and Koenig, 2017; Filippi and Barattin, 2019).

For our empirical study, we used the scale proposed by Laugwitz *et al.* (2008), which assesses UX across six factors: attractiveness, perspicuity, efficiency, dependability, stimulation and novelty. Attractiveness is a pure valence dimension, while perspicuity, efficiency and dependability represent pragmatic/ergonomic quality aspects and stimulation and novelty represent hedonic quality aspects. A basic requirement for our study was to use a scale with a balance between the pragmatic and hedonic qualities of a system. This instrument provided the necessary balance and was therefore chosen for our study.

Previous studies have found a close connection between usability, UX and e-service quality (Ssemugabi and De Villiers, 2016). However, despite their interrelationship, there is a shortage of models that explain the dimensions of these three constructs. Bhattacharya *et al.* (2012) consider usability as a subset of e-service quality. Nevertheless, most researchers in the community view usability as a crucial component of UX, even though these concepts have distinct areas of focus.

For a long time, usability and other critical aspects of UX, such as trust, empathy, attractiveness, reliability/fulfillment and information quality, have been recognized as the primary dimensions of e-service quality (Lee and Lin, 2005; Swaid and Wigand, 2009). UX is considered a vital indicator of service quality that impacts user satisfaction and experience (Pushparaja *et al.*, 2021). In a recent study, Zhou *et al.* (2019) examined e-service quality from a UX perspective and identified a positive association between e-service quality, customer satisfaction and loyalty. The researchers used a UX-related scale to assess e-service quality in the telecom industry, which highlights the close link between UX and e-service quality.

To this end, in our study we formulate the first hypothesis.

H1. UX is positively associated with e-service quality.

2.3 Customer satisfaction

The feeling of pleasure or disappointment resulting from comparing a product's performance to the customer's expectations is known as customer satisfaction (Kotler and Caslione, 2009). Customers experience satisfaction when the performance of a product or service meets or exceeds their initial expectations (Dhingra *et al.*, 2020). Online customer satisfaction, or e-satisfaction, is considered to be of greater significance due to the difficulty of retaining online customers' loyalty (Kadir *et al.*, 2011). Several studies suggest that satisfaction is not a cognitive, but an affective construct (Olsen, 2002).

The EDT posits that customer satisfaction is influenced by the perceived discrepancy between expectations and actual experiences (Oliver, 1980). In other words, if a customer's expectations are met or exceeded, they will be satisfied, while if their expectations are not met, they will be dissatisfied. This theory has been widely applied to many different contexts, including e-commerce (Qazi *et al.*, 2017). The EDT is a useful theoretical framework for understanding the relationship between UX, service quality and customer satisfaction in e-commerce. By identifying and meeting customer expectations, businesses can increase satisfaction and loyalty, which are critical factors for long-term success. Consumers have expectations regarding the aesthetics, usability and functionality of e-commerce websites. If the website looks pleasing, is easy to navigate, loads quickly and provides the necessary information, consumers are more likely to be satisfied.

Moreover, consumers expect timely delivery, accurate order fulfillment and adequate privacy. Failure to meet these expectations can lead to customer dissatisfaction (Zeithaml *et al.*, 2002).

Numerous studies have explored the relationship between service quality and customer satisfaction in the online business environment. Enhancing e-service quality is a promising approach for making online businesses more appealing while improving customer satisfaction and retention rates (Wan Jasni *et al.*, 2020). Kim and Stoel (2004) identified website quality dimensions that significantly predict customer satisfaction, while Udo *et al.* (2010) developed an instrument for measuring web service quality and examined its relationship with customer satisfaction and purchase intentions. Carlson and O'Cass (2010) constructed a conceptual model to test the links between electronic service quality, consumer satisfaction, attitudes and behavioral intentions in an online setting. Bayesian data analysis was employed by Nourikhah and Akbari (2016) to explore the impact of service quality on customer satisfaction, while Farooq *et al.* (2018) investigated the beliefs of Malaysia Airlines' passengers regarding service quality and its effects on customer satisfaction. Dalbehera (2020) aimed to determine research scholars' perceptions of electronic service quality and its contribution to perceived value, user satisfaction and loyalty toward the use of e-library services. Hence, the second hypothesis in our study is.

H2. Electronic service quality is positively associated with customer satisfaction.

Numerous studies have explored the impact of UX on customer satisfaction, as the evaluation of performance is key to user contentment (Pushparaja *et al.*, 2021). For instance, Badran and Al-Haddad (2018) examined the effects of UX variables such as utility, usability, aesthetics, identification and value on customer satisfaction with smartphones in Jordan and found that they do indeed have an impact.

Poushneh and Vasquez-Parraga (2017) conducted research on the effect of augmented reality on the retail UX and its subsequent impact on user satisfaction and willingness to purchase. Among other things, the findings showed that UX subsequently influences user satisfaction and their inclination to buy.

Another recent study (Park, 2019) focused on understanding the structural relationships between UX, user satisfaction and revisitation. The results revealed that UX elements (mainly hedonic aspects) significantly influence customer revisitation through satisfaction.

According to the above, this study suggests the following hypothesis.

H3. UX is positively associated with customer satisfaction.

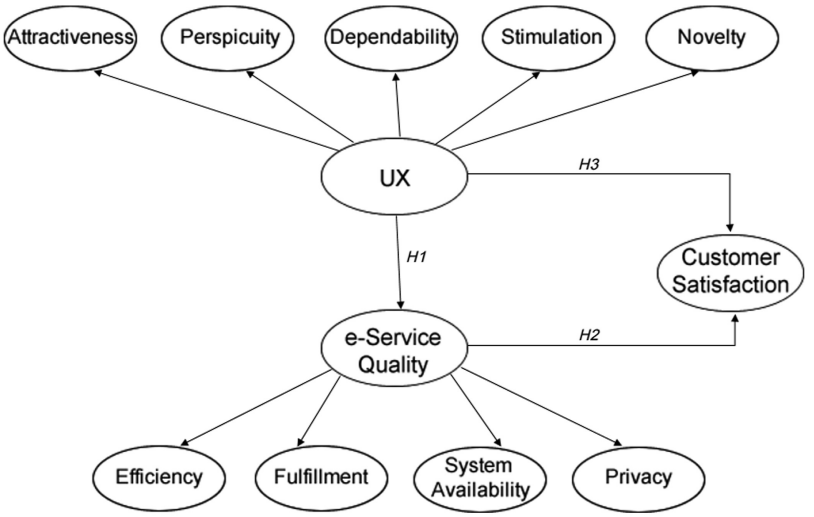
H4. Electronic service quality partly mediates the relationship between UX and customer satisfaction.

In some studies, researchers use a single item to measure overall satisfaction (Selnes and Hansen, 2001), while others employ multiple items (Farooq *et al.*, 2018; Carlson and O'Cass, 2010; Khalifa and Liu, 2002). For this study, we utilized a three-item scale, consistent with other studies (Zhang and Prybutok, 2005; Udo *et al.*, 2010). The items are as follows: "I am satisfied with my last Internet purchase", "I like to make purchases from this website" and "Overall, I am satisfied with the experience provided by this website".

The above-mentioned hypotheses form the foundation of our research model, which is visually represented in Figure 1.

3. Methodology

In order to test all of the hypotheses above, an online survey instrument was created and assessed, using a seven-point Likert scale for all construct components, ranging from 1 (strongly disagree) to 7 (strongly agree). The choice of this particular scale was informed by



Source(s): Author's own work

Figure 1.
The research model

previous research that found that seven-point Likert items are better at measuring respondents' evaluations and are more suitable for unsupervised, electronically distributed questionnaires (Finstad, 2010). Additionally, there is evidence to support that the mean differences for seven-point scales have stronger correlations with observed levels of significance (Lewis, 1993). The survey instrument can be found in the Appendix (Table A2).

To ensure internal validity, the questionnaire was tested by three experienced online shoppers who provided feedback to make certain questions more comprehensible. The final questionnaire was distributed to Greek online users through various social media platforms (Facebook, Instagram, Twitter and LinkedIn) between March and May 2020. This specific period was chosen because it corresponded with Greece's first lockdown, which resulted in a significant increase in the number of online purchases.

A total of 328 online users completed the questionnaire. Of these, 18 responses were excluded from the sample because they either provided identical answers to all questions or were completed within an unusually short period of time. Research has suggested that excessively short response times can indicate low data quality, as they may reflect inadequate attention from the respondents. This is because reading questions and processing information requires time, as highlighted by Tourangeau *et al.* (2000). Consistent with the recommendations of prior studies (Greszki *et al.*, 2014, 2015), we excluded responses that were faster than 50% of the median response rate. A total of 310 complete and valid responses were collected. Participants were asked to answer the questions based on their most recent online purchase during the study period. Responses were limited to purchases made only through the company's website and not through a mobile app.

Table 2 lists the items for each dimension of e-service quality, UX and customer satisfaction that were implemented in this study. The e-service quality scale, which includes four dimensions and 22 items, was adapted from Parasuraman *et al.* (2005) and E-S-QUAL. The UX scale, which includes five dimensions and 22 items, was adapted from Laugwitz *et al.* (2008). The efficiency dimension was excluded from the UX scale because it is already a part of E-S-QUAL. Finally, customer satisfaction, which includes three items, was adapted from Zhang and Prybutok (2005).

4. Data analysis and results

The data analysis was carried out using Statistical Package for the Social Sciences (SPSS) version 22. The demographic profile of the respondents is presented in Table 3.

The data indicate that the sample is distributed almost equally between men (44%) and women (56%), with the majority falling in the age group of 18–45 (87%). In addition, 62% of the respondents are educated users, having at least a bachelor's degree, while 27% have completed postgraduate studies. The occupation of the sample covers the key dimensions of Greek consumers. Furthermore, a significant proportion of the respondents (85%) are frequent online buyers, making purchases at least once a month.

To test the research model depicted in Figure 1, we employed partial least squares structural equation modeling (PLS-SEM). PLS-SEM is a quantitative multivariate statistical technique that is used to investigate relationships between theoretical concepts and to test theories and concepts (Romo-González *et al.*, 2018). This method is recommended for research problems that require the conceptualization of theoretical concepts and investigation of their relationships (Benitez *et al.*, 2020), as it allows the analysis of complex inter-relationships between observed and latent variables (Hair *et al.*, 2011). PLS-SEM supports various types of research, such as confirmatory, explanatory and predictive (Benitez *et al.*, 2020) and is suitable for estimating linear, non-linear, recursive and non-recursive structural models (Dijkstra and Henseler, 2015). Moreover, it can deal with reflective and formative higher-order constructs (Hair *et al.*, 2021). PLS-SEM can handle latent variables, which are inferred from other observed variables through the measurement model (Dash and Paul, 2021). The measurement model is composed of reflective or formative indicator variables, which are represented by single-headed arrows pointing from the latent variable outward to the indicator variables or from the indicator variables outward to the latent construct, respectively.

The measurement model consists of both observed and latent variables. Observed variables are calculated first, and their reliability and validity are tested. Confirmatory factor analysis (CFA) is used to validate the measurement model through SEM (Dash and Paul, 2021). Once the measurement model is validated and the model fit is evaluated, the analysis can proceed to the structural model. The structural model is a representation of the proposed theory and consists of multiple regression equations that are estimated simultaneously (Benitez *et al.*, 2020). These equations represent the hypothesized associations between theoretical concepts.

We chose to use PLS-SEM instead of covariance-based (CB) SEM because it can assess the validity of the model and evaluate the indicators' loadings on constructs, as well as evaluate the causal relationships among the constructs (Hair *et al.*, 2011). PLS-SEM has also been used in numerous related studies (Maghsoodi *et al.*, 2019; Ababneh, 2020; Rita *et al.*, 2019; Oraedu, 2020).

4.1 Measurement model analysis

We utilized SmartPLS version 3.3.2 to assess our measurement model. Initially, we evaluated the validity and reliability of our instruments. We employed Cronbach's alpha to measure the internal consistency reliability of the dimensions, which should be 0.70 or higher according to (Nunnally, 1978). As shown in Table 4, all dimensions in our model were found to be reliable (Cronbach's alpha>0.85).

To test the convergence validity, we examined the factor loadings, average variance extracted (AVE) and composite reliability (CR). Strong evidence of convergent validity is indicated when the factor loadings exceed 0.70 (Bagozzi and Yi, 1988), the AVE is greater than the unexplained variance (i.e. AVE>0.50), and the CR values are not less than 0.60 (Fornell and Larcker, 1981). As can be seen in Tables 4 and 6 (factor loadings in bold), our model satisfied all criteria for internal consistency reliability and convergence validity.

Discriminant validity is necessary to ensure that measures that should not be highly correlated are distinct from each other (Campbell, 1960). In simpler terms, discriminant

Dimension	Sub-dimension	Item
e-Service Quality	Efficiency	EFF1: This website makes it easy to find what I want
		EFF2: This website makes it easy to get anywhere on the site
		EFF3: This website lets me complete a transaction quickly
		EFF4: The information on this website is well organized
		EFF5: This website loads its pages fast
		EFF6: This website is simple to use
		EFF7: This website lets me visit it quickly
		EFF8: This website is well organized
	System Availability	SYS1: This website is always available for business
		SYS2: This website launches and runs right away
		SYS3: This website does not crash
		SYS4: Pages at this website do not freeze after I enter my order information
	Fulfillment	FUL1: The company delivers orders when promised from this website
		FUL2: The company makes items available for delivery within a suitable time frame
		FUL3: The company delivers what I order fast
		FUL4: The company sends out the ordered items from this website
		FUL5: The company has in stock the items it claims to have on its website
		FUL6: This website is truthful about its offerings
		FUL7: This website makes accurate promises about the delivery of products
	Privacy	PRI1: This website protects information about my Web-shopping behavior
		PRI2: This website does not disclose my personal information to other parties
		PRI3: This website safeguards information about my credit card
UX	Attractiveness	ATT1: The website was enjoyable
		ATT2: The website was good
		ATT3: The website was pleasing
		ATT4: The website was pleasant
		ATT5: The website was attractive
		ATT6: The website was friendly
	Perspicuity	PER1: The navigation on the website was understandable
		PER2: The navigation on the website was easy to learn
		PER3: The navigation on the website was easy
		PER4: The navigation on the website was clear
	Dependability	DEP1: The navigation on the website was predictable
		DEP2: The navigation on the website was supportive
		DEP3: The navigation on the website was safe
		DEP4: The navigation on the website met my expectations
	Stimulation	STI1: The website was valuable
		STI2: The website was exciting
		STI3: The website was interesting
		STI4: The website was motivating
	Novelty	NOV1: The design of the website was creative
		NOV2: The design of the website was inventive
		NOV3: The design of the website was leading-edge
		NOV4: The design of the website was innovative
Satisfaction		SAT1: I am satisfied with my last Internet purchase
		SAT2: I like to make purchases from this website
		SAT3: Overall, I am satisfied with the experience provided by this website

Source(s): Author's own work

Table 2. Dimensions and items of e-service quality, UX and customer satisfaction

Feature	Distribution	Frequency	Percent(%)
Gender	Male	136	44
	Female	174	56
Age	18–30	195	63
	31–45	74	24
	46–55	34	11
	Above 55	6	2
Education	High school	118	38
	Bachelor's degree	109	35
	Master's degree	78	25
	PhD degree	6	2
Occupation	Student	112	36
	Private employee	96	31
	Public employee	56	18
	Self - employed	40	13
	Academic	6	2
Frequency of online purchases	1 or more times per week	87	28
	1–3 times per month	177	57
	1 time per quarter	47	15

Table 3. Demographic profile of sample respondents (N = 310)

Source(s): Author's own work

	Cronbach's alpha	CR	AVE	Loadings
Attractiveness	0.944	0.956	0.783	0.947
Dependability	0.895	0.927	0.761	0.892
Efficiency	0.957	0.963	0.767	0.887
Fulfillment	0.951	0.960	0.773	0.880
Novelty	0.931	0.951	0.829	0.864
Perspicuity	.938	0.956	0.844	0.831
Privacy	0.899	0.937	0.832	0.856
Quality	0.970	0.972	0.613	–
Satisfaction	0.918	0.948	0.859	–
Stimulation	0.930	0.950	0.827	0.900
System availability	0.925	0.947	0.816	0.883
UX	0.973	0.975	0.641	–

Table 4. Cronbach's alpha, average variance extracted (AVE), composite reliability (CR) and loadings

Source(s): Author's own work

validity determines whether the measurement model of a construct is free from redundant items. To assess discriminant validity in our study, we employed three methods: the Fornell–Larcker criterion, cross-loadings and the heterotrait-monotrait (HTMT) ratio of correlations criterion. The Fornell–Larcker criterion compares the square root of the AVE with the correlation of latent variables. Discriminant validity is established if the square root of each item's AVE is greater than the correlations with other latent items (Fornell and Larcker, 1981). Table 5 displays the results indicating that our model is consistent with the Fornell–Larcker criterion.

We also tested our model for discriminant validity using cross-loadings, which require each indicator loading to be higher than all cross-loadings (Chin, 1998). Table 6 shows that our model meets this criterion as well.

The final measure of discriminant validity was the HTMT ratio of correlations. According to this criterion discriminant validity is established if the HTMT value between two reflective

constructs is below 0.90 (Henseler *et al.*, 2015). As presented in the appendix Table A3, all constructs had HTMT values below the threshold of 0.90 and thus, the discriminant validity of the measurement model was established.

Since all the indicators of our outer model are reflective, there was no need to assess multicollinearity by calculating the variance inflation factor (VIF) (Hair *et al.*, 2011). Specifically, e-service quality and UX are second-order reflective constructs, while customer satisfaction is a first-order reflective construct. Nevertheless, we conducted a test on the inner model constructs. A VIF value of 5 or higher in PLS-SEM suggests potential multicollinearity issues and problematic indicators should be removed. The test results (Table 7) showed no evidence of multicollinearity concerns.

4.2 Structural model results

We employed the PLS-SEM approach, along with the bootstrapping technique, which involved 5,000 iterations of re-sampling and 95% bias-corrected confidence intervals, to assess our model's hypotheses (Hair *et al.*, 2011). The findings from the analysis indicate that all of our hypotheses positing a direct effect (H1, H2 and H3) were upheld, as presented in Table 8 and Figure 2.

Furthermore, we hypothesized that electronic service quality acts as a partial mediator in the relationship between UX and customer satisfaction. The indirect effect of UX on customer satisfaction through electronic service quality was found to be significant as the 95% bias-corrected confidence interval did not include zero (Preacher and Hayes, 2008). The criterion for partial mediation is that both direct and indirect effects are significant (Nitzl *et al.*, 2016). Therefore, our fourth hypothesis is supported, as displayed in Table 9.

Our model was assessed through R^2 and Q^2 values to examine the overall explanatory power of the constructs. Q^2 test was used for assessing the predictive relevance of our structural model, since supporting a model only based on r-squared values is not enough (Hair *et al.*, 2016). Values of Q^2 below zero indicate a lack of predictive relevance. The conceptual model explained 56.8% of the variation in electronic service quality with predictive relevance Q^2 of 0.338 and 65.2% of the variation in customer satisfaction with predictive relevance Q^2 of 0.552, which suggests that the model has large predictive relevance.

Our model was also tested for overall model fit. According to (Hair *et al.*, 2016) the value of Standardized Root Mean Square Residual (SRMR) should be less than 0.08. In our model, the SRMR value is 0.077, which suggests a good model fit.

	ATT	DEP	EFF	FUL	NOV	PER	PRI	STI	SYS
Attractiveness	*0.885*								
Dependability	0.785	*0.872*							
Efficiency	0.666	0.694	*0.876*						
Fulfillment	0.609	0.634	0.657	*0.879*					
Novelty	0.786	0.655	0.506	0.512	*0.910*				
Perspicuity	0.759	0.829	0.756	0.597	0.525	*0.919*			
Privacy	0.561	0.615	0.637	0.710	0.499	0.579	*0.912*		
Stimulation	0.813	0.723	0.574	0.579	0.880	0.587	0.531	*0.909*	
System Availability	0.576	0.587	0.811	0.682	0.382	0.657	0.667	0.475	*0.903*

Note(s): ATT: Attractiveness; DEP: Dependability; EFF: Efficiency; FUL: Fulfillment; NOV: Novelty; PER: Perspicuity; PRI: Privacy; STI: Stimulation; SYS: System availability
Source(s): Author's own work

Table 5. Fornell-Larcker criterion

	ATT	DEP	EFF	FUL	NOV	PER	PRI	SAT	STI	SYS
ATT1	*0.887*	0.679	0.551	0.542	0.745	0.633	0.518	0.617	0.763	0.491
ATT2	*0.838*	0.729	0.655	0.591	0.638	0.748	0.518	0.628	0.671	0.572
ATT3	*0.918*	0.718	0.602	0.554	0.698	0.665	0.493	0.614	0.719	0.521
ATT4	*0.895*	0.638	0.504	0.489	0.726	0.604	0.443	0.559	0.726	0.441
ATT5	*0.900*	0.649	0.568	0.536	0.724	0.635	0.492	0.565	0.745	0.487
ATT6	*0.869*	0.753	0.655	0.517	0.641	0.744	0.511	0.597	0.693	0.542
DEP1	0.659	*0.866*	0.591	0.489	0.498	0.705	0.467	0.429	0.566	0.497
DEP2	0.712	*0.877*	0.625	0.551	0.618	0.716	0.512	0.569	0.665	0.518
DEP3	0.668	*0.887*	0.581	0.527	0.556	0.724	0.540	0.509	0.622	0.481
DEP4	0.697	*0.860*	0.621	0.638	0.607	0.745	0.619	0.642	0.663	0.549
EFF1	0.565	0.617	*0.877*	0.533	0.439	0.661	0.545	0.543	0.495	0.647
EFF2	0.612	0.623	*0.891*	0.566	0.457	0.713	0.567	0.579	0.523	0.683
EFF3	0.591	0.587	*0.868*	0.563	0.463	0.684	0.528	0.561	0.521	0.723
EFF4	0.592	0.638	*0.882*	0.602	0.493	0.684	0.620	0.588	0.566	0.701
EFF5	0.577	0.597	*0.870*	0.539	0.413	0.634	0.498	0.538	0.470	0.733
EFF6	0.585	0.592	*0.886*	0.553	0.431	0.657	0.561	0.577	0.482	0.701
EFF7	0.546	0.556	*0.869*	0.599	0.376	0.612	0.550	0.565	0.451	0.763
EFF8	0.598	0.647	*0.860*	0.640	0.473	0.649	0.591	0.634	0.508	0.724
FUL1	0.516	0.547	0.522	*0.878*	0.423	0.474	0.538	0.612	0.476	0.549
FUL2	0.525	0.518	0.540	*0.890*	0.445	0.489	0.595	0.636	0.504	0.551
FUL3	0.523	0.496	0.490	*0.870*	0.500	0.436	0.568	0.568	0.523	0.492
FUL4	0.544	0.603	0.668	*0.882*	0.450	0.586	0.708	0.719	0.526	0.703
FUL5	0.553	0.563	0.598	*0.864*	0.444	0.564	0.675	0.673	0.531	0.645
FUL6	0.551	0.595	0.630	*0.876*	0.450	0.579	0.668	0.683	0.511	0.662
FUL7	0.526	0.561	0.568	*0.894*	0.439	0.526	0.591	0.651	0.487	0.564
NOV1	0.739	0.606	0.473	0.509	*0.922*	0.493	0.454	0.563	0.841	0.367
NOV2	0.680	0.574	0.425	0.434	*0.905*	0.423	0.436	0.451	0.809	0.327
NOV3	0.725	0.607	0.485	0.466	*0.900*	0.510	0.466	0.524	0.765	0.381
NOV4	0.717	0.596	0.460	0.452	*0.913*	0.485	0.462	0.490	0.788	0.314
PER1	0.699	0.768	0.695	0.518	0.484	*0.902*	0.515	0.522	0.537	0.624
PER2	0.716	0.785	0.708	0.551	0.496	*0.927*	0.521	0.564	0.560	0.600
PER3	0.694	0.730	0.683	0.556	0.478	*0.924*	0.552	0.547	0.525	0.585
PER4	0.678	0.762	0.691	0.570	0.472	*0.921*	0.540	0.535	0.534	0.604
PRI1	0.520	0.557	0.613	0.673	0.463	0.534	*0.918*	0.644	0.487	0.633
PRI2	0.517	0.595	0.593	0.662	0.440	0.565	*0.911*	0.656	0.487	0.625
PRI3	0.495	0.527	0.534	0.603	0.464	0.482	*0.906*	0.598	0.479	0.562
SAT1	0.614	0.566	0.634	0.745	0.501	0.561	0.663	*0.928*	0.543	0.670
SAT2	0.632	0.570	0.580	0.655	0.541	0.539	0.629	*0.917*	0.592	0.585
SAT3	0.630	0.585	0.606	0.659	0.512	0.541	0.638	*0.937*	0.553	0.645
STI1	0.742	0.727	0.578	0.580	0.764	0.604	0.544	0.614	*0.900*	0.477
STI2	0.751	0.623	0.502	0.487	0.816	0.508	0.428	0.513	*0.913*	0.409
STI3	0.748	0.633	0.508	0.524	0.813	0.523	0.476	0.532	*0.924*	0.426
STI4	0.717	0.644	0.496	0.513	0.808	0.496	0.481	0.544	*0.901*	0.413
SYS1	0.488	0.499	0.718	0.592	0.311	0.588	0.591	0.577	0.389	*0.894*
SYS2	0.542	0.564	0.735	0.637	0.357	0.620	0.600	0.625	0.452	*0.907*
SYS3	0.514	0.513	0.734	0.605	0.334	0.568	0.564	0.632	0.411	*0.915*
SYS4	0.534	0.543	0.742	0.629	0.376	0.597	0.653	0.638	0.463	*0.897*

Note(s): ATT: Attractiveness; DEP: Dependability; EFF: Efficiency; FUL: Fulfillment; NOV: Novelty; PER: Perspicuity; PRI: Privacy; STI: Stimulation; SYS: System availability; SAT: Satisfaction
Factor loadings in italic
Source(s): Author's own work

Table 6.
Cross-loadings

5. Discussion

This study aimed to investigate the relationship between electronic service quality, UX and customer satisfaction in the context of e-commerce and to explore the mediating role of electronic service quality between UX and customer satisfaction. The proposed model

	Quality	UX	Satisfaction
Quality			2.314
UX	1.000		
Satisfaction		2.314	

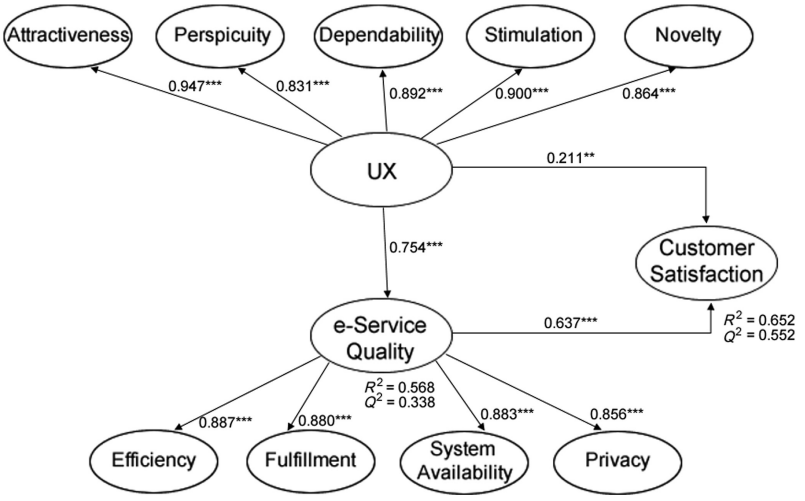
Source(s): Author's own work

Table 7. Construct collinearity assessment (VIF)

Hypotheses	Path coefficient	S.E.	t	Sig	Decision
H1. UX → Quality	0.754	0.044	17.058	0.000	Supported
H2. Quality → Satisfaction	0.637	0.070	9.154	0.000	Supported
H3. UX → Satisfaction	0.211	0.075	2.791	0.005	Supported

Source(s): Author's own work

Table 8. Hypotheses testing results for direct effects



Note(s): ***$p < 0.001$; **$p < 0.01$

Source(s): Author's own work

Figure 2. Analysis results

Hypotheses	Indirect effect	Direct effect	Total effect	Lower bound	Upper bound	Sig	Decision
H4. UX → Quality → Satisfaction	0.480	0.211	0.690	0.360	0.580	0.000	Supported

Source(s): Author's own work

Table 9. Hypotheses testing results for indirect effects

was tested in Greece, in line with previous studies that suggest evaluating e-service quality measures in various national and cultural settings (Gounaris *et al.*, 2010; Ghosh, 2018).

5.1 Hypothesis validation

Our research findings provide evidence for a positive relationship between UX and e-service quality ($\beta = 0.754$, $p < 0.001$), supporting H1. These results are consistent with previous studies (Zhou *et al.*, 2019; Putri and Ginting, 2021) and suggest that UX plays a crucial role in determining the quality of electronic services.

Furthermore, our results show that e-service quality has a positive impact on overall customer satisfaction ($\beta = 0.637$, $p < 0.001$), supporting H2. These findings align with prior research indicating that good service quality is a precondition for consumer satisfaction (Ping Zhang, 2001; Singh, 2019) and that providing excellent service quality enhances customer satisfaction (Rita *et al.*, 2019; Alkraiji and Ameen, 2021; Wan Jasni *et al.*, 2020).

Additionally, our study reveals that UX positively influences customer satisfaction ($\beta = 0.211$, $p < 0.01$), which is in line with previous literature (Badran and Al-Haddad, 2018). An enhanced UX in an e-commerce website results in increased electronic service quality and overall satisfaction. Therefore, H3 is supported.

This study is the first to investigate the mediation role of e-service quality on the relationship between UX and customer satisfaction. Previous research has demonstrated the close relationship between UX and e-service quality (Ssemugabi and De Villiers, 2016) and that UX has a positive effect on overall user satisfaction (Zhou *et al.*, 2019). Our findings confirm the partial mediating effect of e-service quality on the relationship between UX and customer satisfaction, supporting H4.

5.2 Measurement model discussion

We proposed a research model that consisted of two second-order reflective scales designed to measure e-service quality and UX, respectively. Validating these scales in the context of Greek e-commerce websites during the COVID-19 pandemic was crucial to ensure their suitability for our study.

Our results demonstrated that all dimensions of e-service quality suggested in the E-S-QUAL model were validated and consistent with previous studies (Santouridis *et al.*, 2012; Ghosh, 2018; Mummalaneni *et al.*, 2016). Efficiency was found to have the strongest relationship with e-service quality, followed by system availability and the extent to which the e-commerce website offers and delivers promised goods. Security and privacy provided were the next most important dimensions. These findings are in line with previous studies and demonstrate that users highly value the ease, speed and reliability of accessing an e-commerce website. These results provide evidence that the E-S-QUAL scale is highly suitable for measuring the electronic service quality of an e-commerce website.

Our investigation also confirmed the validity of all dimensions of the UX scale suggested by Laugwitz *et al.* (2008). This scale was chosen for our study because it balances the hedonic and pragmatic qualities of an interactive system and is suitable for measuring the UX of e-commerce websites. Our findings indicated that attractiveness was the most important dimension of UX, followed by stimulation and dependability. Novelty was the fourth most important dimension, while perspicuity was the least important. These results are justified since Greek web users are already familiar with using e-commerce websites and prioritize the overall impression they get from the website, along with its interesting and secure features.

5.3 Research implications

Previous research has primarily focused on investigating the connection between electronic service quality and customer satisfaction, disregarding UX (VO *et al.*, 2020; Suhartanto *et al.*, 2019). Our study is one of the few that examines the relationship between UX, e-service quality and customer satisfaction, thereby contributing to the literature. Although there is evidence that customer satisfaction is influenced by UX (Park, 2019; Poushneh and Vasquez-Parraga, 2017) and e-service quality (Dalbehera, 2020; Wan Jasni *et al.*, 2020) and that UX is positively correlated with e-service quality (Zhou *et al.*, 2019; Pushparaja *et al.*, 2021), few studies have attempted to integrate these three constructs into a research model (Putri and Ginting, 2021). Our research bridges this gap and adds to the literature by creating and validating a conceptual model that includes all three dimensions. The findings demonstrate that both UX and e-service quality positively affect overall customer satisfaction, while e-service quality partially mediates the relationship between the other two dimensions.

5.4 Practical and managerial implications

The findings of our study provide insight for electronic vendors to better understand the effects of e-service quality and UX on overall customer satisfaction. Past research has proven that highly satisfied customers become loyal (Kaya *et al.*, 2019), have increased repurchasing intention (Park *et al.*, 2010), tend to revisit the same e-commerce website and give positive feedback to other possible users through word-of-mouth (Rita *et al.*, 2019). Consequently, customer satisfaction is very important in e-commerce success and e-vendors should make efforts in implementing the relevant e-service quality and UX features on their e-commerce websites.

In times of limited in-store purchases, due to pandemics and lockdowns, it becomes crucial for retail companies to consider transitioning to online or hybrid formats if they want to survive. However, the online and physical formats have some key differences in terms of the quality matrix and UX. In a physical store, the quality matrix includes factors such as store ambiance, cleanliness and layout. In contrast, for online shopping, the quality matrix focuses on website functionality, visual design and security. Hybrid formats aim to combine the best of both worlds by providing customers with a seamless experience between online and physical shopping.

When transitioning from one format to another, companies should adjust their quality matrix accordingly. For example, if a company transitions from a physical store to an online format, it needs to focus more on website functionality, visual design and security, while ensuring that the shopping experience is as seamless as possible. On the other hand, if a company transitions from an online format to a physical store, it needs to focus on factors such as store ambiance, cleanliness and layout to create a welcoming and inviting environment.

Practitioners can use the results of our study to evaluate the quality of their offered electronic services and the elements of UX and make necessary adjustments to improve their customers' satisfaction. Companies should provide attractive websites, which are enjoyable, friendly, pleasant and creatively designed. E-commerce websites should be interesting, exciting and motivating, simple and easy to use. Their use should be predictable, secure and easy to learn. Moreover, managers should ensure that their website is running fast, is easily accessible and functions without technical difficulties. They should also guarantee their customers' data security and privacy and take necessary measures to fulfill order delivery and item availability promises. Ultimately, companies need to understand the unique features and requirements of each format to ensure they provide their customers with the best possible shopping experience.

5.5 Limitations and future research

Our study yields valuable findings that complement existing research and can assist e-commerce practitioners. Nevertheless, future studies could consider certain aspects to further enhance this work. To start with, the sample size could be increased to yield even more dependable results. Although the current sample size is appropriate for our analysis, the inclusion of even more web users could aid in validating our model.

In addition, our conceptual model could be improved by including concepts related to customer satisfaction, such as loyalty, word-of-mouth, repurchase intention and trust. These aspects have been previously studied (Kaya *et al.*, 2019; Rita *et al.*, 2019; Kim, 2014) and could add more value to our model.

Moreover, our framework could be tested in other countries to provide insights into its validity and reliability in different cultural contexts. Cross-country investigations could be conducted in future studies.

Lastly, the moderating effects of factors such as familiarity with web use, age, gender and culture, which have been examined in other research (Chen *et al.*, 2015), could be explored in future studies to determine if they could influence the effects of e-service quality and UX on customer satisfaction.

6. Conclusion

This research was based on the EDT and aimed to examine the relationship between electronic service quality, UX and customer satisfaction in the context of e-commerce and to investigate the mediating role of electronic service quality between UX and customer satisfaction. The study was conducted in Greece, a unique cultural setting, following suggestions from prior studies that e-service quality measures should be evaluated in different national and cultural environments (Ghosh, 2018).

The results of this research provide strong support for the positive relationship between UX and e-service quality, indicating that UX is a predictor of electronic service quality. This finding is consistent with previous studies (Putri and Ginting, 2021) and suggests that providing a positive UX is essential in ensuring high-quality electronic services.

The study also found a positive association between e-service quality and overall customer satisfaction, indicating that electronic service quality is an important precondition for consumer satisfaction. This finding supports prior research (Singh, 2019) and emphasizes the importance of providing good service quality in enhancing customer satisfaction.

Additionally, the study found that UX has a positive impact on customer satisfaction, indicating that advanced UX in an e-commerce website can increase electronic service quality and overall satisfaction. These findings align with previous literature (Badran and Al-Haddad, 2018) and further emphasize the importance of providing a positive UX in ensuring customer satisfaction.

This study is the first to examine the mediating role of e-service quality on the relationship between UX and customer satisfaction. The results confirm the partial mediating effect of electronic service quality on the relationship between UX and customer satisfaction, indicating that electronic service quality plays a significant role in enhancing customer satisfaction.

The research also validated the suitability of the E-S-QUAL model for measuring e-service quality and the UX scale suggested by Laugwitz *et al.* (2008) for measuring UX in the context of e-commerce websites. The findings indicate that the efficiency of accessing an e-commerce website is the most important dimension of electronic service quality, followed by system availability, delivering promised goods and security and privacy. Attractiveness was found to be the most important dimension of UX, followed by stimulation and dependability.

Overall, this research enriches the literature on the relationship between electronic service quality, UX and customer satisfaction in the context of e-commerce. By including these three constructs in a research model, the study provides insights into the complex interplay between these factors and their effects on customer satisfaction. The findings of this research have important implications for e-commerce businesses looking to improve their service quality and enhance customer satisfaction.

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Appendix

Electronic service quality scales	Objective	Key components	Criticism
WebQual (Barnes and Vidgen, 2002)	A method for assessing the quality of Web sites	3 dimensions: usability, information quality, service interaction quality 5 factors: usability, design, information, trust and empathy 22 items	It cannot evaluate the service quality of a website comprehensively, since it does not require the respondent to complete a purchase (Parasuraman *et al.*, 2005)
SITEQUAL (Yoo and Donthu, 2001)	To measure the perceived quality of an e-commerce website	4 dimensions: ease of use, esthetic design, processing speed and security 9 items	It excludes some key factors, due to its narrowly based set of items (Loiacono *et al.*, 2002). It does not apprehend all perspectives of the buying process (Parasuraman *et al.*, 2005)
WebQual™ (Loiacono *et al.*, 2002)	A measure of Web site quality that predicts consumer reuse of the site	12 dimensions: informational fit-to-task, tailored communications, response time, ease of understanding, trust, intuitive operations, innovativeness, emotional appeal, consistent image, visual appeal, relative advantage and on-line completeness 36 items	It is more relevant to interface design since it is based on the technical quality, rather than on the service quality of a website (Zeithaml *et al.*, 2002; Blut *et al.*, 2015)
eTailQ (Wolfinbarger and Gilly, 2003)	To compute the dimensionality of service quality in e− retailing	4 factors: reliability/ fulfillment, website design, customer service and privacy/security 14 items	It eliminates quality items referring to hedonic aspects of Internet shopping (Bauer *et al.*, 2006). Some of the dimensions and items need further testing (Parasuraman *et al.*, 2005)
e-SERVQUAL (Zeithaml *et al.*, 2002)	To estimate the perceived service quality delivered by web retailers	7 dimensions: efficiency, compensation, reliability, fulfillment, contact, responsiveness and privacy 26 items	It was a preliminary study (Parasuraman *et al.*, 2005)
E-S-QUAL (Parasuraman *et al.*, 2005)	To measure the service quality delivered by websites	4 dimensions: efficiency, fulfillment, system availability and privacy 22 items	It cannot suitably explain customer dissatisfaction and their switching to other online stores (Blut, 2016)
eTransQual (Bauer *et al.*, 2006)	To capture service quality in Internet shopping and to integrate both hedonic and utilitarian e-commerce service quality	5 dimensions: enjoyment, functionality/design, process, responsiveness, and reliability 25 items	It does not have distinct factors. Some reliability and validity tests did not give proper results (Bauer *et al.*, 2006)

(*continued*)

Table A1. Electronic service quality scales, their key components and criticism

Electronic service quality scales	Objective	Key components	Criticism
PeSQ (Cristobal *et al.*, 2007)	To measure electronic service quality	4 dimensions: web design, customer service, order management and responsiveness 18 items	It lacks specific application and validation (Ladhari, 2010)
The hierarchical model (Blut *et al.*, 2015)	To measure e-service quality using meta-analysis	4 dimensions: website design, fulfillment, security/privacy and customer service 16 items	It does not include items to measure experiential elements. The relational items focus solely on customer service (Alnawas and Al Khateeb, 2022)

Table A1.

Source(s): Authors' own work

	Strongly disagree						Strongly agree
The website was enjoyable	1	2	3	4	5	6	7
The website was good	1	2	3	4	5	6	7
The website was pleasing	1	2	3	4	5	6	7
The website was pleasant	1	2	3	4	5	6	7
The website was attractive	1	2	3	4	5	6	7
The website was friendly	1	2	3	4	5	6	7
The navigation on the website was understandable	1	2	3	4	5	6	7
The navigation on the website was easy to learn	1	2	3	4	5	6	7
The navigation on the website was easy	1	2	3	4	5	6	7
The navigation on the website was clear	1	2	3	4	5	6	7
The navigation on the website was predictable	1	2	3	4	5	6	7
The navigation on the website was supportive	1	2	3	4	5	6	7
The navigation on the website was safe	1	2	3	4	5	6	7
The navigation on the website met my expectations	1	2	3	4	5	6	7
The website was valuable	1	2	3	4	5	6	7
The website was exciting	1	2	3	4	5	6	7
The website was interesting	1	2	3	4	5	6	7
The website was motivating	1	2	3	4	5	6	7
The design of the website was creative	1	2	3	4	5	6	7
The design of the website was inventive	1	2	3	4	5	6	7
The design of the website was leading-edge	1	2	3	4	5	6	7
The design of the website was innovative	1	2	3	4	5	6	7
This website makes it easy to find what I want	1	2	3	4	5	6	7
This website makes it easy to get anywhere on the site	1	2	3	4	5	6	7
This website lets me complete a transaction quickly	1	2	3	4	5	6	7
The information on this website is well organized	1	2	3	4	5	6	7
This website loads its pages fast	1	2	3	4	5	6	7
This website is simple to use	1	2	3	4	5	6	7
This website lets me visit it quickly	1	2	3	4	5	6	7
This website is well organized	1	2	3	4	5	6	7
This website is always available for business	1	2	3	4	5	6	7
This website launches and runs right away	1	2	3	4	5	6	7
This website does not crash	1	2	3	4	5	6	7

Table A2.
Survey instrument

(*continued*)

	Strongly disagree						Strongly agree
Pages at this website do not freeze after I enter my order information	1	2	3	4	5	6	7
The company delivers orders when promised from this website	1	2	3	4	5	6	7
The company makes items available for delivery within a suitable time frame	1	2	3	4	5	6	7
The company delivers what I order fast	1	2	3	4	5	6	7
The company sends out the ordered items from this website	1	2	3	4	5	6	7
The company has in stock the items it claims to have on its website	1	2	3	4	5	6	7
This website is truthful about its offerings	1	2	3	4	5	6	7
This website makes accurate promises about the delivery of products	1	2	3	4	5	6	7
This website protects information about my Web-shopping behavior	1	2	3	4	5	6	7
This website does not disclose my personal information to other parties	1	2	3	4	5	6	7
This website safeguards information about my credit card	1	2	3	4	5	6	7
I am satisfied with my last Internet purchase	1	2	3	4	5	6	7
I like to make purchases from this website	1	2	3	4	5	6	7
Overall, I am satisfied with the experience provided by this website	1	2	3	4	5	6	7

Source(s): Authors' own work

Table A2.

	ATT	DEP	EFF	FUL	NOV	PER	PRI	STI
Attractiveness								
Dependability	0.853							
Efficiency	0.701	0.749						
Fulfillment	0.641	0.682	0.683					
Novelty	0.838	0.715	0.536	0.543				
Perspicuity	0.806	0.903	0.798	0.629	0.561			
Privacy	0.608	0.682	0.685	0.762	0.546	0.629		
Stimulation	0.868	0.790	0.607	0.614	0.846	0.627	0.580	
System availability	0.615	0.644	0.861	0.721	0.411	0.705	0.729	0.511

Note(s): ATT: Attractiveness; DEP: Dependability; EFF: Efficiency; FUL: Fulfillment; NOV: Novelty; PER: Perspicuity; PRI: Privacy; STI: Stimulation

Source(s): Author's own work

Table A3.
Heterotrait-monotrait (HTMT) ratio

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