RESEARCH ARTICLE

E-government service quality, perceived value, satisfaction, and loyalty: evidence from a newly emerging country

Long Pham[1], Yam B. Limbu[2] , Mai Thi Thu Le[3] and Ngoc Lan Nguyen[4]

[1]Department of Decision Sciences & Economics, College of Business, Texas A&M University, Corpus Christi, TX, USA, [2]Feliciano School of Business, Montclair State University, Montclair, NJ, USA, [3]Faculty of Marketing, National Economics University, Hanoi, Vietnam and [4]School of Trade and International Economics, National Economics University, Hanoi, Vietnam
Corresponding author: Long Pham; Email: long.pham@tamucc.edu

Abstract
This study examines the relationships between e-government service quality, perceived value, satisfaction, and loyalty toward e-government services. Survey data were collected from 340 randomly selected e-government service users in Vietnam. The results reveal that (1) e-government service quality consists of five dimensions: ease of interaction, fulfillment, citizen care, security and privacy, and trustworthiness; (2) among the five dimensions of e-government service quality, only trustworthiness and fulfillment are significantly related to perceived value; however, trustworthiness has a stronger association with perceived value than does fulfillment; and (3) both perceived value and satisfaction are positively associated with loyalty. The results indicate that the e-government can create value for the citizens by improving service quality, which may help satisfy citizens' needs and build their loyalty.

Introduction

The evolution of information and communication technologies, especially as witnessed by the pervasiveness of the Internet, is changing the service delivery processes of organizations (Teo et al. 2008). This is certainly true of government agencies. E-government is characterized by the fact that the provision of services to citizens is carried out through interactions and exchanges between citizens and government websites or information portals (Garad and Qamari 2021). E-government services enable citizens to use the Internet to conduct interactions and exchanges in a fast, simple, and efficient manner. Previously, in the traditional government setting, citizens had to contact government agencies to request services through direct

interactions with government agency employees. In the e-government environment, with a personal computer or mobile device connected to the Internet, citizens can conduct transactions and interactions with government agencies' websites or information portals without being physically present at these agencies' offices.

E-government services benefit not only citizens but also government agencies (Papadomichelaki and Mentzas 2012). For citizens, they can conduct transactions using a personal computer or mobile device connected to the Internet in a convenient and effective manner. Furthermore, e-government services help citizens save time and money. Citizens can enjoy a wide range of online services provided by government agencies without having to contact these agencies by phone or in person. Specifically, services, such as vehicle registration, driving license, tax preparation, passport service, business registration, insurance, customs declaration, or election/voting, to name a few, made available online, allow citizens to make decisions and take actions to satisfy their service needs.

For government agencies, e-government services allow them to save certain costs associated with investments in physical locations and facilities because citizens are not required to be present at the offices of government agencies to request the provision of desired services. E-government services also facilitate government agencies to reach a full citizen base, whether urban or rural, because, with the help of personal computers or mobile devices connected to the Internet, citizens can communicate and exchange information at any time and from any place. Furthermore, through e-government, citizens' participation in contributing ideas to governments' strategies for economic development, social democratization, and political transparency can be enhanced, which can ultimately increase the credibility of governments (Teo et al. 2008; Connolly et al. 2010).

Unfortunately, although government agencies have focused on improving the quality of e-government services, many of them, especially in emerging and developing nations, seem to lag behind citizens' growing needs and expectations. To build and maintain the credibility of governments in the eyes of citizens, it is clear that government agencies must provide citizens with high-quality e-government services to bring about perceived value. Citizen-perceived value can play an important role because it can determine the satisfaction and loyalty of citizens with e-government. It should be noted that creating citizen trust and loyalty toward e-government services is one of the key goals of governments around the world.

Several studies have been carried out to investigate the factors that determine customer loyalty in the e-commerce environment (Bui et al. 2022; Jiang et al. 2015; Kuo et al. 2009; Yang and Peterson 2004). However, in the e-government environment, where citizens engage in interactions and exchanges with government agencies through government websites and information portals, there is a lack of research to examine factors influencing citizens' loyalty toward e-government services. There is a growing consensus that citizens should be seen as customers of businesses and that they deserve the best quality online public services provided by government agencies. The theoretical background on the relationship between service quality, perceived value, customer satisfaction, and customer loyalty in traditional and e-commerce environments can be a useful framework for examining the factors that determine citizens' loyalty towards e-government services.

The relationships among service quality, perceived value, and customer loyalty have been established in the traditional commercial environment (Parasuraman and Grewal 2000). Specifically, service quality is positively associated with perceived value, which in turn positively impacts customer loyalty. These relationships are also validated in an e-commerce environment (Yang and Peterson 2004). Furthermore, empirical studies show that perceived value is positively related to customer satisfaction, which in turn leads to customer loyalty (Bui et al. 2022; Jiang et al. 2015; Kuo et al. 2009). However, a comprehensive review of the literature indicates that while each pair of relationships between these variables was studied discretely, no study has integrated online service quality, perceived value, and customer satisfaction into an integrated model to explain customer loyalty in the traditional and e-commerce environments. Moreover, no studies have been conducted using this theoretical foundation to understand citizen loyalty in the e-government setting.

Although some studies explored the factors constituting e-government service quality, which refers to the extent to which government websites or information portals promote the delivery of public services online to assist citizens in completing transactions, little empirical evidence exists on how e-government service quality attributes affect citizen loyalty through the mediating role of perceived value and citizen satisfaction. In addition, not all e-government service quality attributes have the same degree of influence on perceived value. Therefore, it is necessary to investigate the impacts of various e-government service quality attributes on perceived value and examine the relationships among perceived value, citizen satisfaction, and citizen loyalty.

Another notable point is that most previous studies on e-government service quality were conducted in developed countries. In contrast, the understanding of e-government service quality in newly emerging or developing countries is minimal. Developed countries and international organizations have a noble mission to help transform newly emerging and developing countries into world civilization, and e-government is seen as one of the powerful tools to achieve this goal because e-government can make favorable conditions to enhance transparency in the activities of government agencies, combat corruption, and promote citizen participation in countries' national affairs/events. Among such countries, Vietnam is considered a newly emerging country with economic and social development achievements, with an economic growth rate of 8.02% in 2022 – among a few countries with the highest economic growth rates in the world (Changchit et al. 2023). Therefore, in response to calls for a better understanding of e-government in newly emerging or developing countries, this study was conducted in Vietnam.

This study was carried out to fill the aforementioned research gaps. Specifically, this investigation aims to:

(1) determine the e-government service quality attributes perceived by citizens.
(2) examine the relationships between e-government service quality attributes and perceived value.
(3) investigate the relationships among perceived value, citizen satisfaction, and citizen loyalty.

This study makes a significant contribution to the literature. Firstly, the present study represents an initial effort to integrate two chain models: (1) service quality – perceived

value – loyalty and (2) perceived value – satisfaction – loyalty into an integrated research model in the e-government setting. Secondly, the results from this study will provide the foundation for governments implementing e-government services to develop strategies and policies to make citizens loyal to e-government. Citizen loyalty to e-government can benefit both governments and citizens and promote citizen participation in the full range of affairs and events toward building a civilized, modern, and sustainable nation.

Finally, this study examines the relationships between e-government service quality, citizen-perceived value, citizen satisfaction, and citizen loyalty toward e-government services in Vietnam, an emerging country. The country is strategically located in Southeast Asia and has a population of nearly 100 million people. The Vietnamese government issued Resolution No. 36a/NQ-CP in 2015, focusing on improving the operational capacity of the state administrative apparatus, better-serving people and businesses, promoting administrative procedure reform, creating a favorable environment for production, commerce, and investment, and improving economic competitiveness as Vietnam is integrating deeply and widely into the world economy. According to the United Nations' assessment of e-government development, Vietnam is currently ranked 86th out of 193 countries in the world and 6th in Southeast Asia (TTXVN 2020). In addition, according to the United Nations, Vietnam's online services index was ranked 81st in 2020 (TTXVN 2020). Currently, several information systems of e-government have been put into operation, helping innovate working styles in state agencies and providing online public services to citizens and businesses.

Moreover, launched in the fourth quarter of 2020, the government reporting information system has connected 16 ministries and ministerial-level agencies, including 20 types of reports and 88/200 socio-economic indicators, serving the government and the prime minister's operating activities (VPCP 2020). The digitization of reports from commune, district, province/city, and ministry/sector to the government and prime minister via the integrative information system saves the state budget about VND 460 billion a year. So far, the national public service portal has been integrated, providing 1,000 online public services, more than 58 million hits, 227,000 registered accounts, 14.3 million status sync records, and 246,000 online execution records; receiving and supporting 21,400 calls with 7.4 thousand feedbacks (TTXVN 2020).

Building e-government toward the digital government, economy, society, and sustainable development is the goal of many countries worldwide, not only Vietnam. To achieve this goal, Vietnam needs the determination and efforts of the whole political system to build and implement a new leadership and governance model to take advantage of the strengths and rapid development of digital technology. The findings from this study can provide important insights into the effective implementation of e-government services in Vietnam.

Conceptual framework and hypotheses

Based on the evaluation of previous studies, the research model is presented in Fig. 1, showing the relationships among e-government service quality, perceived value, citizen satisfaction, and citizen loyalty. The rationale for selecting five
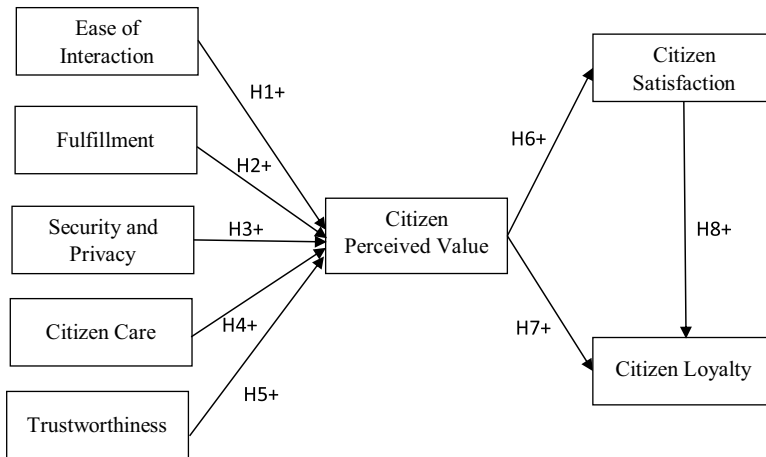
Figure 1. Conceptual model.

dimensions of e-government service quality and the relationships among the constructs in the research model are discussed in the next section.

E-government service quality factors

A recently emerging strategy for improving the quality of e-government services has attracted particular public interest (Papadomichelaki and Mentzas 2012). This strategy is based on the citizen-centered approach, and governments must do their best to satisfy citizens and make them loyal to these services (Connolly et al. 2010). Although there is much debate about what constitutes service quality in different industries and sectors, most scholars and practitioners believe that service quality is determined by differences in customers' expectations and service experience (Thinh et al. 2019).

Parasuraman et al. (1985) proposed ten factors constituting service quality in the traditional commercial environment: intangibles, reliability, responsiveness, competence, courtesy, credibility, security, access, communication, and understanding the customer. Parasuraman et al. (1988) refined these ten factors into five components constituting the SERVQUAL scale: intangibles, responsiveness, reliability, assurance, and empathy. The SERVQUAL scale and its variants have been used to measure service quality in many studies in the traditional commercial environment.

However, it is worth noting that the SERVQUAL scale is only relevant to the traditional commercial environment, which is characterized by interactions between customers and the service provider's employees (Pham et al. 2022). With the remarkable progress of information and communication technology and the Internet, e-commerce and online services are becoming more and more popular, so the SERVQUAL scale is no longer suitable for quality assessment of electronic services characterized by interactions between customers and the service provider's website (Thinh et al. 2019). As a result, much research has been conducted to develop online service quality scales.

Loiacono (2000) developed the WebQual scale that includes 12 items to measure online service quality: trust, response time, ease of understanding, information fit-to-task, tailored communications, intuitive operations, visual appeal, innovativeness, emotional appeal, consistent image, relative advantage, and online completeness. Yoo and Donthu (2001) developed the SITEQUAL scale for assessing website quality, consisting of four factors (security, processing speed, ease of use, and aesthetic design). Jun and Cai (2001) proposed 17 factors, grouped into three main groups: online system quality, product service quality, and customer service quality. Zeithaml et al. (2002) developed a framework that can be used to measure online service quality that consists of 11 factors: efficiency, reliability, flexibility, access, ease of navigation, security/privacy, responsiveness, assurance/trust, personalization, site aesthetics, and price knowledge.

Wolfinbarger and Gilly (2003) developed e-TailQ incorporating four factors to evaluate online service quality. They are customer service, website design, security, and reliability. DeLone and McLean (2003) modeled the success of an updated information system with factors determining the success of information systems, such as service quality, system quality, and information quality. Han and Baek (2004) developed a four-factor scale for assessing online service quality: intangibles, reliability, responsiveness, and empathy. Yang et al. (2004) suggested that credibility, security, attentiveness, reliability, access, and ease of use are critical factors in assessing online service quality.

Parasuraman et al. (2005) developed a framework for measuring online service quality, including E-S-Qual as a core online service quality scale (efficiency, privacy, fulfillment, and system availability) and E-RecS-Qual as an online recovery service quality scale (contact, compensation, and responsiveness).

Governments across nations provide e-government services based on the citizen-centered approach (Connolly et al. 2010). In the traditional government service environment, citizens interact with government employees. In contrast, in the e-government service environment, citizens perform interactions or transactions through government websites or portals. The citizen-centered approach means that governments must do their best to provide high-quality e-government services to citizens and keep citizens satisfied with and loyal to the services and the governments. Furthermore, this approach is consistent with the marketing perspective so that the e-service quality measurement foundations in the e-commerce environment can be adapted for measuring e-government service quality.

Shareef et al. (2015) reviewed popular models and scales used to measure the quality of e-services in the e-commerce environment and presented seven factors, namely, website design/content, fulfillment, shipping and handling options, security and privacy, customer care, trustworthiness, and enjoyment. Although the assessment of e-government services can be based on the theoretical foundations used to evaluate e-services in the e-commerce environment, e-government services still have differences compared with electronic services in the e-commerce setting. The first difference is that e-services in the e-commerce environment are provided by businesses that pursue profit goals. In contrast, e-government services are provided by governments that do not pursue the goal of profit but pursue the goal of bringing benefits and welfare to all citizens.

The second difference is that while in e-commerce, e-services have little or no political commitment, e-government services show very high political commitments to the nation, society, and all citizens. Political commitments with the ultimate goal of promoting administrative reforms, strengthening government apparatus, providing the best public services to citizens, motivating citizens' full participation to solve the nation's problems and events, and creating a just, equal, and civilized society. After examining the idiosyncrasies of e-government services, Shareef et al. (2015) adapted seven online service quality factors mentioned above into five e-government service quality factors, which include ease of interaction, fulfillment, security and privacy, customer/citizen care, and trustworthiness.

The present study is consistent with that of Shareef et al. (2015) by using the five factors to assess the quality of e-government services. Specifically, *ease of interaction* represents the degree to which citizens' interactions with a government website or portal are made simple. This abstract variable is related to website design, technology, software, information organization, information retrieval, information collection, and downloading of forms. *Fulfillment* represents the extent to which e-government services meet the expectations and requirements of citizens in terms of public service availability and service delivery.

Security and privacy represent the extent to which citizens perceive government websites or portals as safe for disclosing personal and financial information in interactions and transactions with the government, and these websites and portals are not disclosed or shared with other entities or used for improper purposes. *Customer/citizen care* refers to the extent to which government customer service agents are prompt, effective, efficient, and affectionate in caring for and resolving citizens' problems and disputes. Finally, *trustworthiness* represents the extent to which government websites are capable of providing trust in attitudes, safety, and integrity among citizens.

The influence of e-government service quality factors on citizen-perceived value

Customer-perceived value is based on the theory of equity (Yang and Peterson 2004). Equity refers to the degree to which a customer perceives whether the value received is fair, correct, and worthwhile compared to costs (Bolton and Lemon 1999). In the traditional commercial environment with goods and services trading, perceived value is created on the basis of comparing the customer's output-to-input ratio with the service provider's output-to-input ratio (Oliver and DeSarbo 1988), where output and input are related to benefits and costs, respectively.

Perceived costs consist of monetary and non-monetary costs (Yang and Peterson 2004). Non-monetary costs are related to the time a customer has to spend searching for information about products or services of interest. This information will assist the customer in making purchase decisions about favorite products or services. In addition, non-monetary costs are associated with the stress and frustration of participating in buying and selling goods or services with different transactions or exchanges.

Perceived value is not only studied in the traditional commercial environment but also in the e-commerce environment (Jiang et al. 2015). The traditional

commercial environment is characterized by the interactions between the customers and the service provider's employees. In contrast, the e-commerce environment is characterized by the interactions between the customers and the service provider's website. Both these environments emphasize perceived value as a determinant of the service provider's long-term success and profitability (Pham et al. 2020).

Perceived value is influenced by service quality (Parasuraman and Grewal 2000). As noted earlier, despite considerable debate about what constitutes service quality, there is a tendency to assume that service quality is considered on the basis of the difference between customer service expectations and experiences (Jiang et al. 2015). The SERVQUAL scale is commonly used to evaluate service quality in the traditional service environment. However, several studies in the online service environment show that service quality attributes have different importance in shaping the overall online service quality. For example, Liu and Arnett (2000) contended that system design quality, information quality, system use, and playfulness influence the success of a website in the e-commerce setting. Sohn (2000) argued that interactivity, ease of use, trust, contents of web pages, speed of delivery, and reliability impact the overall quality of online services. Jun and Cai (2001) indicated that reliability, access, and responsiveness are the most important factors influencing the quality of e-banking services.

Empirical evidence shows that service quality is positively related to perceived value in traditional commerce and e-commerce environments (Chinomona et al. 2014; Jiang et al. 2015). Therefore, the evaluation of the quality of e-government services can be based on the marketing perspective in the sense that citizens should be viewed as customers and that the government must do its best to provide high-quality e-government services efficiently and effectively. Studies in the traditional and e-commerce environments also show that each service quality factor has a different positive influence on customer-perceived value. Therefore, the following hypotheses are proposed:

H1: Ease of interaction is positively related to citizen-perceived value.

H2: Fulfillment is positively related to citizen-perceived value.

H3: Security and privacy are positively related to citizen-perceived value.

H4: Citizen care is positively related to citizen-perceived value.

H5: Trustworthiness is positively related to citizen-perceived value.

Citizen-perceived value and satisfaction

Customer satisfaction can be analyzed through the context of a particular transaction or the context of accumulation (Cronin and Taylor 1992). In a transaction-specific context, customer satisfaction is seen as an assessment of the customer's buying experience (Boulding et al. 1993). However, contrary to the context of a particular transaction, in the context of accumulation, customer satisfaction stems from a comprehensive assessment, which means that such an evaluation is based on all relevant experiences relating to the customer's transactions and interactions (Zeithaml 2009).

Studies in both traditional and online commercial environments show that perceived value is one of the most important factors influencing satisfaction (Yang and Peterson 2004). Consistent with these studies, in the e-government environment, the following hypothesis is proposed:

H6: Citizen-perceived value is positively related to citizen satisfaction.

Citizen-perceived value and loyalty

Customer loyalty refers to the customer's intention to continue or increase the customer's transactions or interactions with the company (Oliver 1999). Furthermore, customer loyalty indicates a tendency to recommend the company to others (Jun et al. 2004). Previous studies have shown that perceived value is a factor that positively affects customer loyalty (Yang and Peterson 2004). In the e-commerce environment, perceived value is one of the most important factors driving customer loyalty (Pham et al. 2020). In the context of both traditional and online banking environments, empirical evidence shows that perceived value influences the loyalty of customers. For example, a bank may offer a high price or fee for a product when it attaches useful services to that product. Therefore, customers may perceive a high value of this product in comparison to the same product offered by the bank's competitors. Consistent with this point of view, in the e-government environment, the following hypothesis is postulated:

H7: Citizen-perceived value is positively related to citizen loyalty.

Citizen satisfaction and loyalty

Customer loyalty is measured through the customer's intention to continue or increase the conduct of purchases of goods or services with the customer's current company (Anderson and Srinivasan 2003). Furthermore, customer loyalty is also measured through the tendency to recommend the company to others (Jun and Cai 2001). This measurement has been shown to be useful in previous studies (Huy et al. 2019). Satisfied customers tend to have a higher level of consumption for a product or service than unsatisfied customers. In addition, satisfied customers tend to have stronger acquisition intentions and recommend products or services to their acquaintances (Pikkarainen et al. 2006). Studies show that in both traditional and online environments, customer satisfaction leads to customer loyalty (Long and Vy 2016). Therefore, the following hypothesis is proposed:

H8: Citizen satisfaction is positively related to citizen loyalty.

Methods

A survey questionnaire was developed for this study based on prior research and adapted to be suitable in the e-government setting as described in the research model development section of this paper. The items used to measure e-government service quality were adapted from Shareef et al. (2015). More specifically, nine items were used to measure ease of interactivity, ten to measure fulfillment, seven to measure security and privacy, five to measure citizen care, and five to measure

trustworthiness. Perceived value scale was adapted from Levesque and McDougall (1996) and Jiang et al. (2015) and consists of five items. Five items and six items were used to measure citizen satisfaction and citizen loyalty, respectively. These items were adapted from Yang and Peterson (2004) and Jiang et al. (2015). Several tests, such as reliability, KMO and Barlett's, common method bias, and factor analysis, were conducted to verify and validate their suitability for the measurement model in this study. These results are described in the data analysis section of this paper.

The questionnaire consisted of 52 items, besides demographic information, with a five-point Likert scale designed to measure subjects' perceptions and the usage of e-government services. To validate the clarity of these questions, three professors and three research assistants were asked to read through the survey questions. For construct improvement and validity, revisions to the survey were made based on the feedback received. The English questionnaire was then translated into Vietnamese by one researcher and then translated back into English by another researcher to check for translation accuracy. The original English questionnaire and the translated questionnaires were found to be equivalent.

Data were collected in Vietnam. Subjects were informed that participation in the survey was voluntary and that their responses would be kept anonymous. The sampling framework of this study included e-government service users. The e-government service in this study is an online car/motorcycle registration service in Hanoi city. Hanoi is the capital of Vietnam, with about 8.5 million people. As of November 2022, Hanoi had about 1,056,423 cars, 6,545,317 motorbikes, and 182,917 electric motorbikes. The number of vehicles circulating in Hanoi is increasing significantly every year. In the first six months of 2022, Hanoi had 145,718 newly registered vehicles, including 41,423 cars, 101,248 motorbikes, and 3,047 electric motorbikes (DCSVN 2022).

In order to create favorable conditions for the registration of new vehicles, the Hanoi Police Department has implemented an electronic vehicle registration service in addition to the traditional vehicle registration service. The implementation of the new electronic vehicle registration service is expected to benefit both citizens and city authorities based on time and cost savings. Furthermore, lessons learned from Hanoi would be a reference for other provinces and cities of Vietnam in terms of online registration of new means of transportation because Hanoi accounts for nearly 30% of the total means of transportation in Vietnam.

Individual email addresses were collected with the help of a marketing company (which had a database on citizens' online car/motorcycle registration in Hanoi). An email solicitation letter was sent to 2,000 subjects randomly selected from the email list. The letter described the purpose of the study and invited the subjects to participate in the online survey. Respondents were eligible to participate in this study if they had made at least one online government service usage in the last year. There were 646 emails sent back as undeliverable. Out of 409 responses, 69 were excluded because they were incomplete or duplicated. Therefore, the final sample included 340 participants with a response rate of 30.2%. Table 1 presents the subjects' demographics. About 54% of the participants were female. The majority of them (79.7%) were in the age group of 26 and 45. Almost half of the respondents (48.5%) were full-time employed, and one in four of them was unemployed. One-third of them made online purchases 1 to 2 times per month.

Table 1. Sample characteristics ($n = 340$)

Characteristic	Frequency	%
Gender		
Male	158	46.5
Female	182	53.5
Highest Level of Education		
High School	43	12.6
Bachelor's Degree	78	23.0
Master's Degree	112	32.9
Doctoral Degree	66	19.4
Associate Degree	41	12.1
Age (in years)		
18–25	26	7.6
26–35	130	38.2
36–45	141	41.5
46–55	36	10.6
≥ 56	7	2.1
Use Credit Card/Debit Card		
Yes	143	42.1
No	197	57.9
Online Purchases per Month (# of orders)		
None	0	
1–2	113	33.2
3–5	101	29.7
6–9	59	17.4
10–20	38	11.2
More than 20	29	8.5
Online Purchases Last Year (# of orders)		
None	0	0
1–2	177	52.1
3–5	68	20
6–9	43	12.6
10–20	31	9.1
More than 20	21	6.2
Items Regularly Purchased Online		
Books	36	10.6
Software/Apps	21	6.2
Computers/Electronics	140	41.2
Media (Video/Music)	43	12.6
Clothing/Shoes	233	68.5
Food	284	83.5
Health/Beauty	232	68.2
Sports/Outdoors	57	16.8
Industrial/Automotive	21	6.2
Home/Garden	196	57.6
Other	177	52.1
Employment Status		
Full-time	165	48.5
Part-time	88	25.9
Unemployed	87	25.6

Data were analyzed using SPSS 27 and Amos 26 software. Statistical analyses such as descriptive statistics, exploratory factor analysis, reliability, discriminant, convergent validity, and multiple linear regression analyses were performed to test the proposed hypotheses.

Results

Since all the scales used in our study are established in the literature, the scale validity and reliability were assessed by performing exploratory factor analysis (EFA) and confirmatory factor analysis (CFA), respectively. After that, structural equation modeling (SEM) was used to test the proposed model and hypotheses.

Scale assessment

To assess the scales used in this study, we first conducted EFA using Cronbach coefficient alpha. During conducting the EFA and Cronbach's alpha analysis, one item measuring "Security and Privacy," one item measuring "Citizen Perceived Value," and one item measuring "Citizen Care" were removed due to low item-total correlations and/or loaded highly on several factors. The Cronbach's alpha for all the new scales in this study ranged from 0.878 (for Citizen Care) to 0.950 (for satisfaction).

The results of EFA showed good convergent and discriminant validity of the constructs in our study. The estimated loadings for each indicator were examined, and composite reliability (CR) and average variance extracted measure (AVE) were assessed, which are represented in Table 2. The results showed that all factor loadings were significant at $p < 0.01$. All the CRs and AVEs were above the cutoff values of 0.70 and 0.50, respectively (Hair et al. 2014). The lowest CR of 0.835 and the lowest AVE of 0.561 were associated with Citizen Care. Thus, it could be confirmed that convergent validity was met.

Table 3 below shows that most of the correlation coefficients among constructs demonstrate moderately positive relationships, and most of the squared roots of AVE estimates (located diagonal of the matrix) are higher than the corresponding correlation coefficients. Therefore, it can be concluded that discriminant validity was met (Fornell and Larcker 1981; Kline 2005).

After assessing each construct, the full measurement model was analyzed. The full measurement model was constructed, including eight constructs as latent variables (five exogenous variables and three endogenous variables). CFA (using Amos 26) exhibited a good level of fit: $\chi^2 = 1393.518$, $\chi^2/df = 2.188$, $p < 0.001$. Other fit statistics were root mean square error of approximation (RMSEA) $= 0.059$, goodness-of-fit index (GFI) $= 0.821$, comparative fit index (CFI) $= 0.928$, and Tucker-Lewis Index (TLI) $= 0.920$. All *t*-tests of the indicator variables were significant at the .001 level.

The structural equation model and hypothesis testing

The results of the structural equation analysis indicated that the model achieved a reasonable level of fit: $\chi^2 = 1491.756$; $\chi^2/df = 2.320$, $p < 0.01$; GFI $= 0.815$; CFI $= 0.919$; TLI $= 0.911$; and RMSEA $= 0.062$.

The results of estimating the hypothesized relationships are summarized in Table 4. Five of the eight hypothesized paths were statistically significant and in the direction predicted, while three failed to obtain support from the data. Specifically, with regard to the antecedents of citizen perceived value, as expected, fulfillment had a significantly positive effect on citizen perceived value ($\gamma 1 = 0.141$; *t*-value $= 2.567$),

Table 2. Measurement items, factor loadings, composite reliabilities, and average variance extracted

Constructs and Scale Items	Factor Loadings	*α*	CR	AVE
Ease of Interaction		**0.944**	**0.930**	**0.656**
Ease of Interaction 1: It is easy to interact with the website.	0.906			
Ease of Interaction 6: I can easily perform tasks as requested on the website.	0.867			
Ease of Interaction 2: It is easy to use the website.	0.864			
Ease of Interaction 4: The website navigation is easy.	0.849			
Ease of Interaction 3: It is flexible to interact with the website.	0.814			
Ease of Interaction 5: It is clear and easy to understand to interact with the website.	0.802			
Ease of Interaction 7: The website helps me finish the transaction quickly.	0.711			
Ease of Interaction 9: The website has a clear structure.	0.672			
Ease of Interaction 8: I can easily download documents from the website.	0.519			
Fulfillment		**0.938**	**0.879**	**0.592**
Fulfillment 7: The website provides documents I request.	0.838			
Fulfillment 4: The website provides the services as described.	0.789			
Fulfillment 1: All services are available on the website.	0.787			
Fulfillment 3: All required documents are available on the website.	0.773			
Fulfillment 8: The website is relevant to my request.	0.763			
Fulfillment 5: I can finish my task on the website at appropriate time.	0.747			
Fulfillment 9: The website is relevant to how I want to collect information.	0.743			
Fulfillment 10: The website provides more services than when I go to the governmental office.	0.709			
Fulfillment 2: The information on the website is updated frequently.	0.665			
Fulfillment 6: The website provides services quickly.	0.597			
Security and Privacy		**0.894**	**0.854**	**0.597**
Security and Privacy 2: The website has standardized privacy policy.	0.871			
Security and Privacy 1: The website is safe in terms of financial information.	0.869			
Security and Privacy 3: The website protects my credit card information.	0.739			
Security and Privacy 7: The website does not share my information with other agencies.	0.578			
Security and Privacy 6: The website protects the information I provide.	0.567			
Security and Privacy 4: The website's privacy policy is clearly stated.	0.519			
Citizen Care		**0.878**	**0.835**	**0.560**
Citizen Care 5: Online citizen care of the website is very quick.	0.760			
Citizen Care 3: The website responds quickly when I have a problem.	0.759			
Citizen Care 4: Online citizen care of the website is always available.	0.702			
Citizen Care 1: The website recognizes I have used it previously.	0.531			
Trustworthiness		**0.895**	**0.874**	**0.635**
Trustworthiness 4: The government is responsible for any violation of privacy deprivation from transactions on the website.	0.806			
Trustworthiness 5: The technological and legal policies of the website protect me from problems that may occur on the Internet.	0.792			

(*Continued*)

Table 2. (Continued)

Constructs and Scale Items	Factor Loadings	*a*	CR	AVE
Trustworthiness 1: The website is generally trustworthy in providing services.	0.541			
Trustworthiness 2: The transactions I have had on the website are ensured.	0.537			
Trustworthiness 3: I believe in the performance of the website.	0.532			
Citizen Perceived Value		**0.894**	**0.898**	**0.690**
Citizen Perceived Value 5: The website provides me value for money services compared to the fee I have to pay when I go to the government office.	0.811			
Citizen Perceived Value 4: The website provides me value-for-money services compared to the fee I have to pay when I use the website.	0.782			
Citizen Perceived Value 3: The website provides more free services than going to the governmental office.	0.719			
Citizen Perceived Value 1: Using the website is more economical than going to the governmental office.	0.606			
Citizen Satisfaction		**0.950**	**0.950**	**0.793**
Citizen Satisfaction 5: I am satisfied with the online transaction system on the website.	0.938			
Citizen Satisfaction 4: I am satisfied with services provided on the website.	0.863			
Citizen Satisfaction 3: I am satisfied with my transactions.	0.836			
Citizen Satisfaction 2: I am satisfied with my experiences on the website.	0.718			
Citizen Satisfaction 1: The website meets my expectation of services.	0.644			
Citizen Loyalty		**0.926**	**0.919**	**0.740**
Citizen Loyalty 2: I will introduce the website to others who need my advice about online government services.	0.983			
Citizen Loyalty 3: I will encourage my friends and relatives to use the website for their transactions.	0.905			
Citizen Loyalty 1: I share the positive features of using the website with others.	0.866			
Citizen Loyalty 6: I have an intention to interact more with the website in the future.	0.707			
Citizen Loyalty 5: I have an intention to continue using the website in the future.	0.698			
Citizen Loyalty 4: I will write positive messages about the website in online forums.	0.574			

lending support for H2. The results also support H5; trustworthiness was a significant predictor of citizen perceived value ($\gamma 2 = 0.139$; *t*-value $= 4.867$). However, Ease of Interaction, Security and Privacy, and Citizen Care were found to be insignificantly related to citizen perceived value. Thus, the data did not support H1, H3, and H4. The results showed that all the hypothesized paths pertaining to the consequences of citizen perceived value were positively significant. Specifically, citizen perceived value was a significant predictor of citizen satisfaction ($\gamma 3 = 0.049$; *t*-value $= 13.344$), and citizen satisfaction, in turn, was found to have a significant positive effect on citizen loyalty ($\gamma 5 = 0.055$; *t*-value $= 7.043$). Citizen perceived value also had a direct positive effect on citizen loyalty ($\gamma 4 = 0.055$; *t*-value $= 6.768$). Thus, H5, H6, and H7 were supported.

Table 3. Inter-construct correlations and squared root of AVE estimates

Constructs	1	2	3	4	5	6	7	8
Ease of Interaction (1)	0.81	0.754	0.633	0.610	0.692	0.442	0.679	0.489
Fulfillment (2)		0.767	0.700	0.686	0.771	0.574	0.719	0.536
Security and Privacy (3)			0.772	0.696	0.710	0.517	0.621	0.400
Citizen Care (4)				0.749	0.691	0.408	0.651	0.365
Trustworthiness (5)					0.797	0.600	0.771	0.620
Citizen Perceived Value (6)						0.831	0.626	0.651
Citizen Satisfaction (7)							0.890	0.673
Citizen Loyalty (8)								0.860

Note: Diagonal values show square root of AVE.

Table 4. The results of hypothesis testing

Hypotheses	Structural Path	Estimate	Sig.	Results
H1	Ease of Interaction – Citizen Perceived Value	−0.129	0.168	Not supported
H2	Fulfillment – Citizen Perceived Value	0.363	0.010	Supported
H3	Security and Privacy – Citizen Perceived Value	0.188	0.081	Not supported
H4	Citizen Care – Citizen Perceived Value	−0.215	0.018	*Negative and significant – Not supported*
H5	Trustworthiness – Citizen Perceived Value	0.678	0.000	Supported
H6	Citizen Perceived Value – Citizen Satisfaction	0.648	0.000	Supported
H7	Citizen Perceived Value – Citizen Loyalty	0.371	0.000	Supported
H8	Citizen Satisfaction – Citizen Loyalty	0.388	0.000	Supported

In summary, the proposed relationships in the structural model of the research are illustrated in Fig. 2 below.

Discussion

Self-service technologies integrated into government websites or information portals are changing the ways governments interact with and deliver services to citizens (Connolly et al. 2010). With expected benefits to both governments and citizens, it is believed that e-government will continue to be a promising solution for revolutionizing public administration, promoting efficient and effective delivery of goods and services to citizens, and encouraging citizen participation in national affairs (Chan et al. 2021).

Although governments have shown considerable interest and investment in self-service technologies integrated into government websites or information portals, not all citizens are engaged in transactions and exchanges through these platforms (Lee et al. 2011). There are reasons for this fact, and one of the fundamental ones is the quality of e-government services (Alkraiji and Ameen 2021). Despite the substantial growth of e-government, there is a lack of studies investigating the relationships among e-government service quality, perceived value, citizen satisfaction, and citizen loyalty in the setting of a newly emerging or developing country. This study combines two chain models, namely, service quality – perceived value – loyalty and perceived
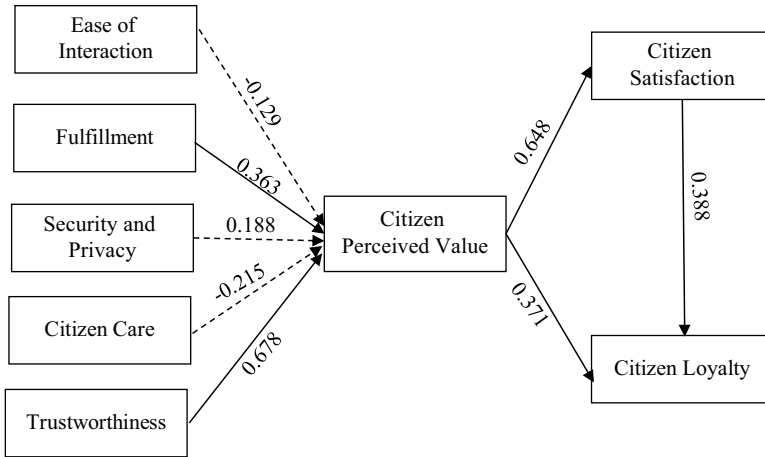
Figure 2. Structural model with coefficients.
Note: Solid lines indicate statistically significant paths and dotted lines indicate not significant paths.

value – satisfaction – loyalty, into an integrated research model to fill the research gaps. The study has significant theoretical and managerial implications.

Theoretical implications

The study shows that e-government service quality includes five attributes: ease of interaction, fulfillment, citizen care, security and privacy, and trustworthiness. These results are consistent with those of Shareef et al. (2015).

This study examined the role of each e-government service quality attribute. The results show that of the five e-government service quality attributes, only fulfillment and trustworthiness are positively associated with citizens' perceived value. These results are compared with those of previous studies in traditional and online service environments. Table 5 presents such relative comparisons. Specifically, in the traditional commercial environment, Parasuraman and Grewal (2000) suggested that five service quality attributes, namely reliability, assurance, intangibles, empathy, and responsiveness, affect customer-perceived value. However, the study of Parasuraman and Grewal (2000) is conceptual in nature. Therefore, there is still no evidence of statistical significance and real influence of these service quality attributes on customer-perceived value.

Table 5 also indicates that in the e-commerce environment, Jiang et al. (2015) identified five service quality attributes: care, reliability, ease of use, security, and product portfolio. These five online service quality attributes have positive influences on customer-perceived value. The order of influence of the factors is ease of use, care, product portfolio, reliability, and security.

It is interesting to see how e-commerce and e-government environments share some similar service quality attributes: ease of interaction (e-government)/ease of use (e-commerce); security and privacy (e-government)/security (e-commerce); and citizen care (e-government)/care (e-commerce). However, their roles in influencing perceived value are different. In the e-government environment, out of the five

Table 5. Service quality attributes and their influence on perceived value in different research settings

Traditional Commerce Setting (Parasuraman and Grewal, 2000)	E-Commerce Setting (Jiang et al., 2015)	E-Government Setting (The current study)
Reliability – Perceived Value (Yes)	Care – Perceived Value (Yes)	Fulfillment – Perceived Value (Yes)
Assurance – Perceived Value (Yes)	Reliability – Perceived Value (Yes)	Trustworthiness – Perceived Value (Yes)
Tangibles – Perceived Value (Yes)	Ease of Use – Perceived Value (Yes)	Ease of Interaction – Perceived Value (No)
Empathy – Perceived Value (Yes)	Security – Perceived Value (Yes)	Security and Privacy – Perceived Value (No)
Responsiveness – Perceived Value (Yes)	Product Portfolio – Perceived Value (Yes)	Citizen Care – Perceived Value (No)

service quality attributes, only fulfillment and trustworthiness have positive effects on citizens' perceived value. This is one of the novel contributions of this study to the literature.

There are possible explanations for the results of this study in the e-government environment. Ease of interaction is one of the five e-government service quality attributes. This means that if using e-government is not easy, citizens may use e-government infrequently or even revert to the traditional government environment. However, if government websites or information portals are easy to use, citizens will not necessarily perceive added value. In other words, the e-government service quality attribute – ease of interaction – is a must, and its display does not necessarily create added value for citizens.

While security is positively related to customer-perceived value in the e-commerce environment, security and privacy have no statistically significant association with citizen-perceived value in the e-government environment. One explanation is that governments are quite different from businesses; they have adequate financial and non-financial resources deployed to ensure a high level of security and privacy of e-government. In other words, there is nothing to worry about when citizens engage in e-government. Again, security and privacy are necessary; however, its visibility does not necessarily create citizen-perceived value.

Another difference between e-commerce and e-government is that in the e-commerce environment, customer care leads to customer-perceived value, while in the e-government environment, citizen care is not a significant predictor of citizen-perceived value. This may indicate that the needs of customers are diverse; thus, customer care to provide personalized services plays an important role. However, in the e-government environment, most of the services are standardized, and citizens can find these standardized services on their own. When standardized services are intended to meet fairly similar needs of citizens, citizen care, such as sending e-mails or chat windows, may not generate citizen-perceived value.

This study confirms the relationships between service quality, perceived value, satisfaction, and loyalty in the e-government environment. The results indicate that to create perceived value, it is necessary to enhance service quality, which in turn leads to satisfaction and loyalty.

This study is considered the first to be conducted in a newly emerging country – Vietnam. Vietnam is located in a strategic position in Southeast Asia, with an

economic growth rate of 8.02% in 2022 – one of the few countries with the highest economic growth rates in the world. There are many multinational companies doing business in Vietnam, and Vietnam is also one of the leading addresses for these companies' value chains to choose from. Vietnam can be viewed as a model representing newly emerging or developing countries. Therefore, the results of this study are the basis for further studies on e-government in newly emerging or developing countries that were overlooked by prior studies.

Managerial implications

Among the five e-government service quality attributes (i.e. ease of interaction, fulfillment, security and privacy, customer care, and trustworthiness), only fulfillment and trustworthiness have statistically significant positive relationships with citizen-perceived value. Therefore, the government needs to focus enough resources to enhance fulfillment and trustworthiness.

The results show that e-government services should focus on meeting citizens' expectations and requirements regarding public service availability and delivery because citizens perceive a high quality of e-government services if their needs for e-government services are met. In other words, e-government services are considered and evaluated in breadth and depth. Citizens would prefer a diverse portfolio of e-government services to satisfy diverse needs of their life and work. Citizens will be excited if they can find a complete catalog of e-government services they want when conducting transactions and interactions through e-government websites or information portals. In order to provide good experiences for citizens, besides providing core services, governments should also provide free services to citizens. These core and free services will contribute to the overall high quality of e-government services perceived by citizens.

It should be noted that in transactions and interactions related to economic and social spheres, trust plays a very important role (Ahamed et al. 2020). In other words, successful transactions require trust. Trust is a catalyst that drives expectations of success for interactions and transactions (Van et al. 2021). This is true not only in the traditional commerce environment characterized by interactions between customers and the service provider's employees but also in the e-commerce environment characterized by interactions between customers and the service provider's websites (Bui et al. 2022).

Mobile commerce is a special case of e-commerce where transactions and interactions can be carried out anytime and anywhere through mobile devices connected to the wireless Internet (Bui et al. 2020). However, the risks in the mobile commerce environment are considered higher than in the online commerce environment and the traditional commerce environment because the exchanges and interactions are not limited by space and time (Van et al. 2020). Therefore, trust is a mandatory condition for the success of mobile commerce (Nguyen et al. 2020).

The e-government service environment is no exception. Trust is positively related to citizens' perceived quality of e-government services. Hence, government agencies should be responsible for any violations of privacy deprivation from transactions on their websites. The technological and legal policies of the websites

should be clearly stated. Citizens should have confidence that problems arising in the e-government service environment are resolved quickly and easily.

This study also shows that perceived value has a positive relationship with citizen satisfaction and loyalty. The perceived value represents citizens' assessment of benefits received from interactions and transactions in the e-government service environment that are fair, accurate, and cost-effective. To increase perceived value, governments must develop and implement specific, clear, and transparent guidelines for completing transactions and interactions, the rights of citizens, and the responsibility of government employees in the event of failures of the e-government service system. In addition, governments must build a culture that puts the interests of their citizens first and strengthens the morale and responsibility of government employees in delivering added value to the citizens. Governments must also invest in the most advanced technological infrastructures for providing e-government services to citizens and to ensure that interactions and exchanges between citizens and government websites or information portals are efficient and effective. Moreover, as the citizen-perceived value increases, citizen satisfaction and loyalty will increase.

Finally, citizen satisfaction is an important determining factor of citizen loyalty. Citizen satisfaction is one of the most important goals for governments when undertaking public administration reform and providing e-government services. Governments must first understand citizens' needs and expectations to achieve citizen satisfaction. The necessary actions are then taken to meet these requirements and expectations through a comprehensive portfolio of e-government services. Governments should implement strategies and actions that take care of their citizens. When citizens' needs and expectations are met, citizens will be satisfied, and in turn, citizen satisfaction will bring about citizen loyalty.

Limitations and future research

Although this is the first study to integrate two chain models to examine component factors of e-government service quality and the relationships between e-government service quality, citizen-perceived value, satisfaction, and loyalty in the e-government service environment, some limitations exist. This study used self-reported data from a self-administered survey questionnaire. Future research that focuses on an official survey conducted by governmental agencies would motivate more citizens to participate. Moreover, we examine respondents' opinions about e-government services as a unidimensional variable. Therefore, our results may be limited by the generalization of satisfaction or perceived value for all services as a whole. Future research should consider investigating these proposed relationships in other e-government services for citizens. Besides, the focus of the study was on those who have used e-government services; hence, future studies should consider looking at opinions and attitudes from the perspective of those who have not used e-government services. Finally, this study used a quantitative approach design and a SEM technique. Future investigation could employ various approaches, such as a mixed-method or a qualitative approach, to gain a deeper understanding of the relationships between e-government service quality, perceived value, satisfaction, and loyalty.

Conclusion

This study integrates two chain models, (1) service quality – perceived value – loyalty and (2) perceived value – satisfaction – loyalty, into an extended research model for predicting citizen loyalty in the e-government service setting. The results show that the quality of e-government services is constituted by five factors – ease of interaction, fulfillment, customer/citizen care, security and privacy, and trustworthiness. Among these five e-government service quality factors, fulfillment and trustworthiness have a significant positive relationship with citizen-perceived value. This study also shows that citizen-perceived value has a significant positive relationship with citizen satisfaction and loyalty. In addition, citizen satisfaction has a positive relationship with citizen loyalty. The two chain models are useful frameworks for understanding the relationships between service quality, perceived value, satisfaction, and loyalty in the e-government service environment.

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