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Article

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*Corresponding author: Myra V. De Leon, Decision Sciences and Innovation Department, RRV College of Business, De La Salle University, Manila, Philippines
E-mail: myra_deleon@dlsu.edu.ph

Reviewing editor:
Len Tiu Wright, Faculty of Business and Law, De Montfort University, Leicester, UK

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MARKETING | RESEARCH ARTICLE

Influence of self-service technology (SST) service quality dimensions as a second-order factor on perceived value and customer satisfaction in a mobile banking application

Myra V. De Leon^{1*}, Ringgold P. Atienza² and Daniel Susilo³

Abstract: Banks offer technology-based self-service banking such as mobile banking applications to keep up with technological advancement. The usage of this application requires quality service delivery. However, there is a dearth of literature on post-adoption and service quality assessment of mobile banking applications. Therefore, the main objective of this study is to assess if the Self-Service Technology service quality (SSTQUAL) dimensions influence the perceived value and customer satisfaction in mobile banking applications. The data was gathered from 200 users of mobile banking. Data analysis was carried out with Structural Equation Modelling (SEM) using AMOS. Service quality is a second-order factor composed of seven first-order factors of quality dimensions. The findings of this study reveal that service quality significantly influences the perceived value and customer satisfaction. These findings provide insights for banks and mobile application providers to develop strategies that will enhance customer experience, perceived value, and customer satisfaction.

ABOUT THE AUTHORS

Myra V. De Leon is a Ph.D. Candidate in Business at De La Salle University. She is a Business and Operations Support Manager at a Universal Bank in the Philippines, handling projects for remittance, domestic and overseas products and services. Her research interests include innovation, banking, entrepreneurship, and sustainability.

Ringgold P. Atienza is a Ph.D. Candidate in Business at the De La Salle University through the scholarship grant from the Commission on Higher Education (CHED), Philippines. He is an Assistant Professor at Misamis University, Philippines. As a scholar, his research interests include behavioral finance, organizational behavior, entrepreneurship, and sustainability.

Daniel Susilo, Assistant Professor in School of Communications Science Dr Soetomo University Surabaya. He graduate from joint Program Vrije University- Amsterdam, KITLV, and Leiden University. He serve as Visiting Research Fellow at Graduate School of Asia Pacific Studies, Waseda University in 2019. His research interest on Technology Media and Society.

PUBLIC INTEREST STATEMENT

This study attempts to assess the impact of service quality on customer satisfaction and perceived value in a mobile banking application. Service quality used in the study is composed of the seven SSTQUAL dimensions, namely functionality, enjoyment, security/privacy, assurance, design, convenience, and customization. The proposed model is applied in the Philippines, and findings reveal that service quality has a positive and significant influence on perceived value and customer satisfaction. Thus, banks must concentrate on these factors to meet customer expectations and improve customer satisfaction. Future researchers can use the SSTQUAL dimensions and modify it according to their specific industry and culture.

Subjects: Management of Technology & Innovation; Services Marketing; Relationship Marketing

Keywords: service quality; structural equation modeling; perceived value; customer satisfaction

1. Introduction

Financial institutions are early adopters of innovations that have introduced drastic changes to the service landscape and business models of the multi-channel industry (e.g. offline, online, and phone banking) (Laukkanen, 2007; De Leon, 2019). Mobile banking, a self-service technology (SST), is one of the most innovative mobile technology breakthroughs as it allows financial transactions via their mobile devices (Alalwan et al., 2017; Laukkanen, 2016). Financial transactions anywhere in the world at any time can be performed (Cruz et al., 2010; Laukkanen, 2007).

Modern brick and mortar banks are pressured to reinvent themselves as more pure-play digital banks, and fintech firms join the banking ecosystem (VISA, 2017). Providing a reliable mobile banking service in this competitive environment is crucial to ensuring success in this service delivery process (Shankar et al., 2019).

The emerging financial services industry in this digital economy was highlighted by Bangko Sentral ng Pilipinas (BSP) Governor Benjamin E. Diokno during The Asian Banker's Finance Philippines 2019 Conference. According to Dr. Diokno (2019), banks offering internet and mobile banking have expanded in the Philippines. People are encouraged to make online transactions, which includes paying bills, purchasing retail items, taking advantage of savings, investment, and insurance. By the end of 2018, 48 banks have made their services accessible via the internet, while 26 banks had already made their financial services available via mobile phones.

Marketing studies have highlighted enhancing service quality, perceived value, and customer satisfaction results to corporate achievement and competitive advantage (Wang et al., 2004; Yang & Peterson, 2004). Consequently, studies for enhancing service quality, perceived value, and customer satisfaction in mobile banking should be conducted. However, Shaikh and Karjaluoto (2015) presented that studies on mobile banking have tended to focus on adoption. It is significant to inspect mobile banking from the perspective of marketing relationships, an approach rarely observed in current literature. This study utilized the SSTQUAL scale to analyze the influence of service quality of mobile banking on perceived value and customer satisfaction (J.-S. C. Lin & Hsieh, 2011). The outcome of this study can be a useful basis of information for banks and mobile providers to monitor their services and improve their service quality.

2. Literature review

2.1. Service quality of self-service technologies

Self-service technologies (SSTs) permit consumers to access a service where there is no presence of direct service employees (Meuter et al., 2000). Technological advancement, customer experience enhancement, and cost reduction related to employees' expenses are the benefits of SST offered by service providers (Boon-itt, 2015). ATM, online banking, mobile banking, and online shopping are some of the common SSTs (Iqbal et al., 2017).

Previous studies show various measurement scales of service quality (Iqbal et al., 2017). Technical quality, functional quality, and corporate image are the dimensions of service quality, according to Grönroos (1984), while Lehtinen and Lehtinen (1991) provided a three-dimensional model, particularly physical quality, interactive quality, and corporate quality. Parasuraman et al. (1988) presented service quality (SERVQUAL) with reliability, responsiveness, assurance, empathy, and tangibility as dimensions. However, SERVQUAL (Parasuraman et al., 1988) and SERVEPERF (Cronin & Taylor, 1992) examine customer-employee interactions (interactive person) during the

process of delivering service (Iqbal et al., 2018). Parasuraman et al. (2005) developed E-S-QUAL to measure the service quality of online shopping providers. SSTQUAL, suggested by J.-S. C. Lin and Hsieh (2011), was developed specifically to measure the quality of service rendered by SSTs.

Different reliability and validity checks have verified the validation of SSTQUAL through the method of comparison of scales by multiple diverse samples across industries and customer behaviors (Iqbal et al., 2017) such as the studies on work-related services by knowledge workers (Considine & Cormican, 2016), supermarket/grocery store self-checkout system (Demirci Orel & Kara, 2014) and a wide range of SSTs available (Meuter et al., 2000). The SSTQUAL has 20 items with seven dimensions. J.-S. C. Lin and Hsieh (2011) describe the seven dimensions as the following: *functionality* denotes the ease of use, responsiveness, and reliability; *enjoyment* relates to customer's insights on device use, and result; *security/privacy* depicts the safety concerns; *assurance* represents confidence based on reputation and competence associated with the service providers; *design* means the system's overall layout; *convenience* is the availability of the services offered; and lastly, *customization* defines how much an SST can be adjusted to match individual customer expectations.

Based on reviewed studies, only a few have assessed the impact of mobile banking service quality on customer satisfaction and loyalty with their financial institutions (Arcand et al., 2017; Khan et al., 2018; Puriwat & Tripopsakul, 2017; Vasudeva & Singh, 2017). According to Shaikh and Karjaluo (2015), research on mobile banking has inclined to concentrate on factors that impact attitudes toward banking and adoption based on the technology acceptance model. A study on mobile banking from a relationship marketing perspective is significant.

2.2. Perceived value

According to Gronroos (1997), the most widely known concept of perceived value is the benefit of the customer in terms of the core solution and additional sacrifice services (in terms of price and cost of the relationship). The concept compares the advantages of consumer service and the expense of customer engagement between buyer and seller Samudro et al. (2018). It is thus a trade-off because the consumer is only dealing with the expense or economic aspects, without taking into account the social and emotional components (Eggert et al., 2006; Ulaga & Eggert, 2006).

Previous studies in mobile services reveal that service quality is positively related to perceived value, and this is supported by the studies in China and Canada conducted by Wang et al. (2004), and Turel and Serenko (2006) respectively. Parasuraman et al. (2005) measured the service quality of Web sites (walmart.com and amazon.com) via E-S-QUAL dimensions. The study concluded that those dimensions have consistently strong and positive correlations with perceived value. Based on the research of Vasudeva and Singh (2017) on mobile banking users in India, there is a positive relationship between the quality of e-core services and the perceived value of m-banking. Since this study will determine the influence of service quality on perceived value in mobile banking, the first hypothesis is proposed as follows:

H1: Service quality positively influences perceived value in a mobile banking application.

2.3. Customer satisfaction

Customer satisfaction is essential to the business process, according to academics and analysts. (Churchill & Surprenant, 1982; Tse & Wilton, 1988). Satisfaction is the user's response to the degree of satisfaction or frustration or affective performance of cognitive appraisal components (Oliver, 1996).

Based on the expectations disconfirmation theory, customer satisfaction in the e-service environment exists once the consumers' expectations are attained through its e-service experience (Chang & Chen, 2009). In the study of mobile services in Singapore, South Korea, and Canada, service quality has a positive impact on customer satisfaction, according to Tung (2004), Kim et al. (2004), and Turel and

Serenko (2006) respectively. Study of Boon-itt (2015) on the digital banking experience both online and mobile banking by respondents in Thailand, service quality has a positive relationship with e-satisfaction. Lastly, the findings in the study of Sharma and Sharma (2019) on the response of mobile banking users in Omani, the influence of service quality intention to use, and satisfaction are positive. The second hypothesis is proposed to analyze the influence of service quality of mobile banking application on customer satisfaction:

H2: Service quality positively influences customer satisfaction in a mobile banking application.

According to existing studies on the impact of perceived value on customer satisfaction, findings of Tung (2004) and Turel and Serenko (2006) reveal that perceived value has a positive effect on customer satisfaction. The same findings identified in the studies of e-commerce by Yang and Peterson (2004), online shopping websites (Hsu, 2006), and mobile commerce in Taiwan by H. H. Lin and Wang (2006). The study of Boon-itt (2015) on mobile banking discovered that perceived value has a significant effect on e-satisfaction. The third hypothesis is proposed to help the banks determine the effect of perceived value on customer satisfaction in mobile banking application:

H3: Perceived value positively influences customer satisfaction in a mobile banking application.

Based on the above literature, Figure 1 shows the proposed model.

3. Methodology

3.1. Sampling and data collection

A Paper survey was conducted to gather the data. Purposive sampling technique, non-probability sampling was used because it is the most effective when observing other experts (Tongco, 2007). Respondents of this study are mobile banking users of the Universal Bank of the Philippines. This bank is one of the country's leading private universal banks. Asian Banking and Finance Retail Banking Awards 2017 recognized the bank's mobile banking application as the "Digital Banking Initiative of the Year."

This study gathered 200 responses. Hoelter (1983) has suggested that above 200 observations deliver sufficient statistical power for structural equation modeling (SEM) analysis. Table 1 presents the respondents' characteristics.

The most commonly observed category of gender was female ($n = 140, 70.00\%$). The most frequently found group of age was 30–39 ($n = 75, 37.50\%$). The most commonly observed category of marital status was single ($n = 104, 52.00\%$). The most frequently seen class of education level was the bachelor's degree ($n = 178, 87.67\%$). The most commonly found category of occupation was employed ($n = 180, 90.00\%$).

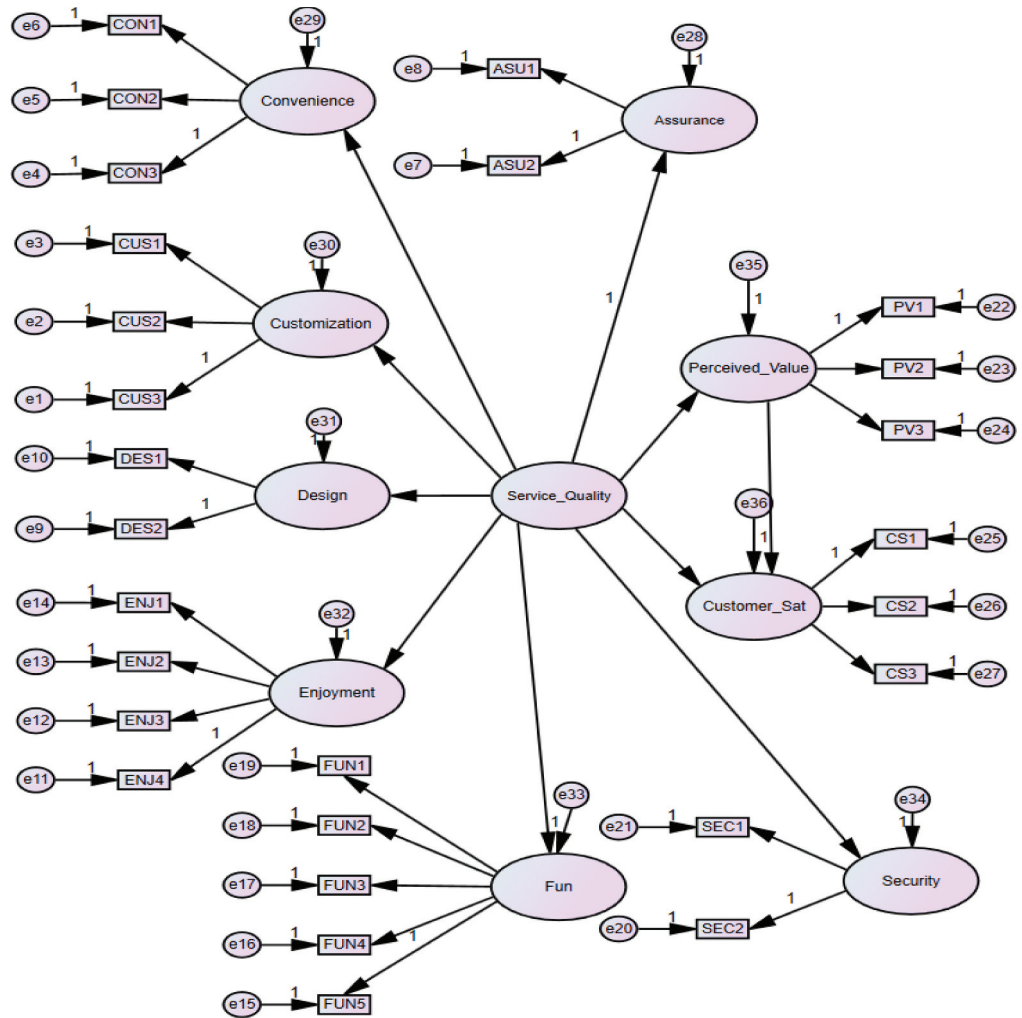
3.2. Measurement scales (Refer to Appendix A)

The measurement scales have been modified from past studies that will be suitable for a mobile banking application. For the service quality, the SSTQUAL (J.-S. C. Lin & Hsieh, 2011) scale was adopted. The item scales for perceived value were adapted from Zeithaml et al. (2001), Shamdassani et al. (2008) and Boon-itt (2015). In order to assess Customer Satisfaction, the three-item American Customer Satisfaction Index (ACSI) scale has been adopted (Fornell et al., 1996). The Likert ratings ranged from 1 (strongly disagree) to 5 (strongly agree).

3.3. Research design

For this study, data analysis was carried out with SEM using AMOS. The second-order factor of SSTs is integrated into the perceived value and customer satisfaction model, where dimensions of SST service quality as exogenous variables, and perceived value and satisfaction as endogenous

Figure 1. Proposed model.

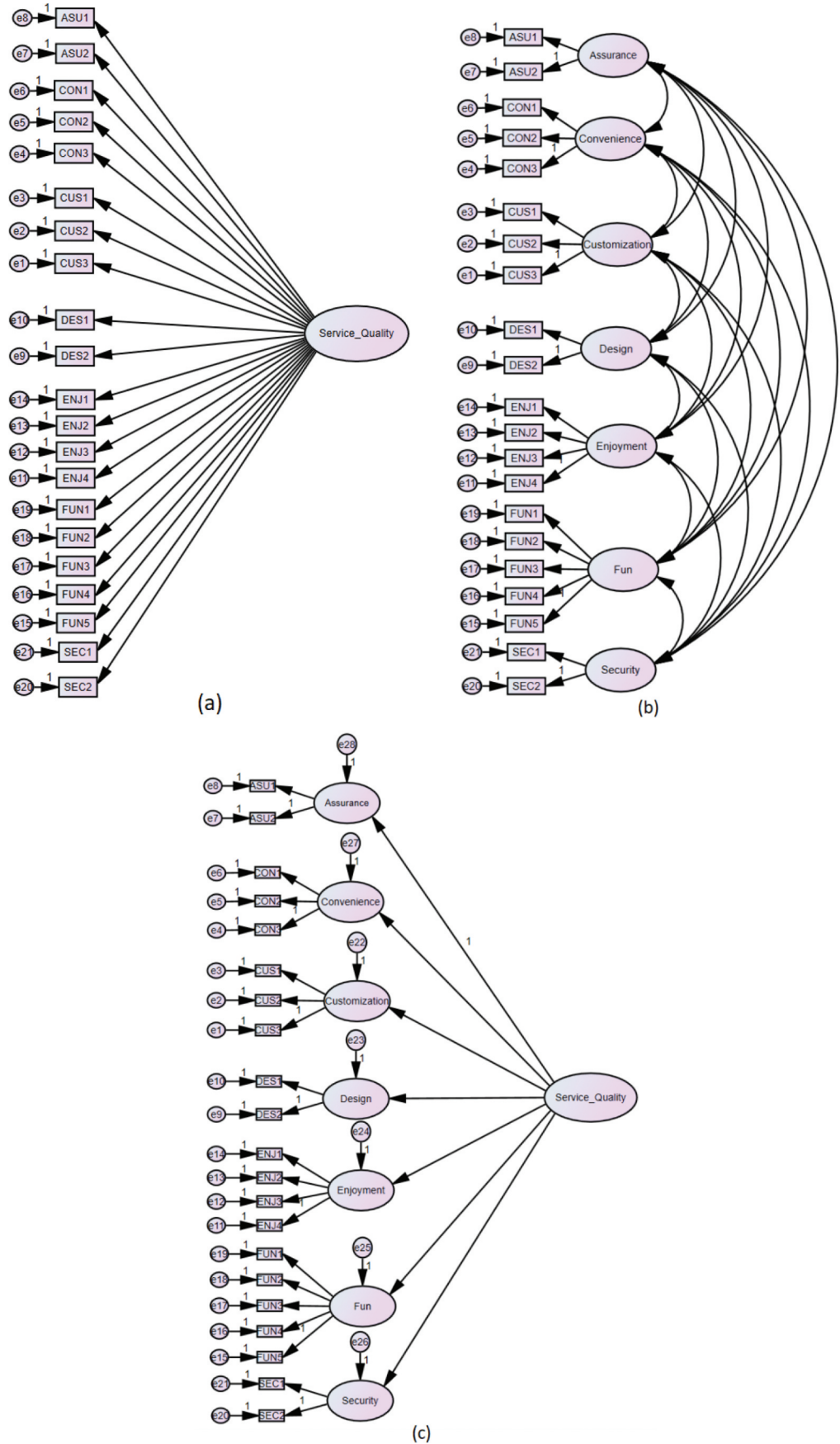


variables. Service quality is a second-order factor composed of seven first-order factors of quality dimensions. The advantages of integrating a second-order factor for the service quality model is confirmed from the study of Nunkoo et al. (2017). A second-order factor model allows the tests of the patterns of relationship between the first-order factors and the second-order factor. Also, it explains the covariance among the first-order constructs parsimoniously. Moreover, it provides a theoretically error-free estimate of specific factors (Chen et al., 2005; Rindskopf & Rose, 1988). Finally, it meaningfully reduces the number of variables that need to be estimated without losing measurement accuracy (Koufteros et al., 2009).

4. Data analysis and results

Before assessing the structural model, the psychometric properties of the measurement scales of the first-order factors of service quality were estimated. Using the confirmatory factor analysis (CFA), the researchers computed for the (a) single first-order factor model in which all the indicators are loading on service quality, (b) the seven correlated first-order factor in which the seven dimensions of service quality are correlated without the second-order factor, and (c) the seven first-order factor with one second-order factor model of service quality as shown in Figure 2. These second-order models are compared to investigate reliability and validity (Rindskopf & Rose, 1988).

Figure 2. (a) One first-order factor (M1) (b) Seven correlated first-order factors (M2) (c) Seven first-order factors, one second-order factor (M3).



The result on model assessment of first-order factors for service quality is shown in Table 2. Fit indices required follows the model for integrating second-order service quality dimensions to customer satisfaction model (Nunkoo et al., 2017). M1 has the weakest model fit while M2 had slightly better fit indices (CFI = 0.87; TLI = 0.94; RMSEA = 0.09; SRMR = 0.04; $\chi^2/df = 3.63$) than M3 (CFI = 0.85; TLI = 0.83; RMSEA = 0.09; SRMR = 0.49; $\chi^2/df = 3.77$). Both M2 and M3 only slightly below the required model fit cut-off in terms of the comparative fit index (CFI), non-normed fixed index (shown as TLI), and parsimony-adjusted index (shown as RMSEA).

One way to improve the fit indices of the model is to remove items that have weak regression weights (Hooper et al., 2008). For the second iteration, item FUN5 was excluded as it showed the low standardized regression estimate. The results of the model in Table 3 showed a significant improvement from the first iteration. M1 still showed the weakest model with both M2 (CFI = 0.93; TLI = 0.91; RMSEA = 0.07; SRMR = 0.03; $\chi^2/df = 2.05$) and M3 (CFI = 0.92; TLI = 0.90; RMSEA = 0.07; SRMR = 0.04; $\chi^2/df = 2.15$) have good model fit, however, M2 still showed better model fit than M3. This is expected since a model with a second-order factor such as M3 can never produce better fit than a model that proposes correlated first-order factors such as M2. Since M3 produced an acceptable fit and has a theoretical grounding, it is considered in the model (Koufteros et al., 2009; Nunkoo et al., 2017).

The overall measurement model as shown in Figure 3, which included the second-order factor model of service quality, was further tested for its reliability and validity. Table 4 shows that the overall measurement model achieved composite reliability and convergent reliability since the composite

Figure 3. Overall measurement of latent variables construct.

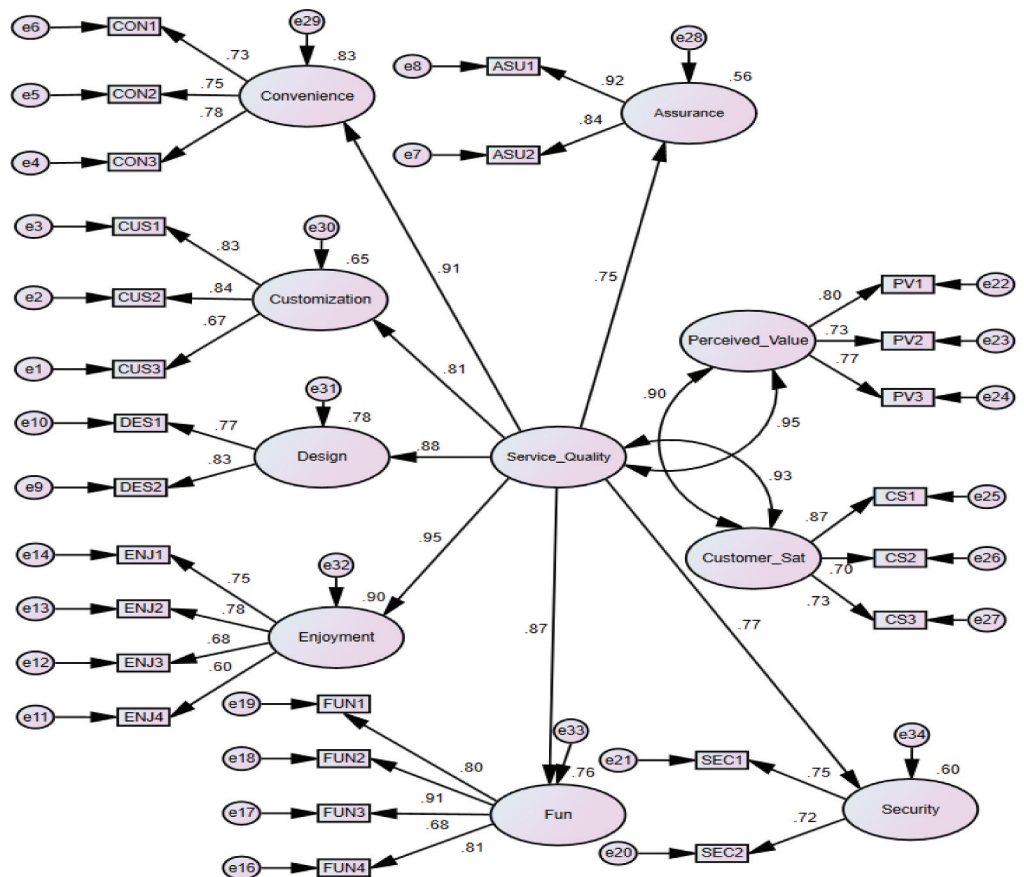


Table 1. Demographic characteristics

Variable	n	%
Gender		
Female	140	70.00
Male	60	30.00
Age		
18–19	2	1.00
20–29	72	36.00
30–39	75	37.50
40 and above	51	25.50
Marital Status		
Single	104	52.00
Married	96	48.00
Education Level		
High School or below	6	3.99
Bachelor’s Degree	178	87.67
Postgraduate Degree	16	8.31
Occupation		
Student	3	1.50
Employed	180	90.00
Self-employed	14	7.00
Retired	3	1.50

Due to rounding errors, percentages may not equal 100%.

Table 2. Model comparison (First iteration)

Fit indices	One first-order factor (M1)	Seven correlated first-order factors (M2)	Seven first-order factors, one second-order factor (M3)
χ^2	1056.751	611.209	687.165
CFI	.756	.875	.858
TLI	.729	.844	.836
RMSEA	.124	.094	.096
SRMR	.051	.047	.049
χ^2/df	5.591	3.638	3.776
AIC	1140.751	737.209	785.165
BCC	1147.422	747.216	792.949

CFI: Comparative fit index; TLI: Tucker–Lewis index; IFI: Incremental fit index; RMSEA: Root mean square error of approximation; SRMR: Standardized root mean square residual; AIC: Akaike information criterion; BCC: Browne–Cudeck criterion

reliability (C.R.) values are higher than 0.70 and the average variance extracted (AVE) values are higher than 0.50 (Hair, Black, et al., 2006).

The discriminant validity of the model was done by comparing the constrained and unconstrained correlation model of the hypotheses (Anderson & Gerbing, 1988). Under the constrained model, the correlation between the constructs is set at one. On the other hand, the parameter is set at a free estimation for the unconstrained model. Table 5 showed that the condition of discriminant validity was achieved.

Table 3. Model comparison (Second iteration)

Fit indices	One first-order factor (M1)	Seven correlated first-order factors (M2)	Seven first-order factors, one second-order factor (M3)
χ^2	649.051	306.013	351.983
CFI	.797	.933	.920
TLI	.773	.915	.906
RMSEA	.119	.073	.077
SRMR	.052	.037	.043
χ^2/df	3.818	2.054	2.159
AIC	729.051	428.013	445.983
BCC	738.542	442.487	457.135

CFI: Comparative fit index; TLI: Tucker–Lewis index; IFI: Incremental fit index; RMSEA: Root mean square error of approximation; SRMR: Standardized root mean square residual; AIC: Akaike information criterion; BCC: Browne–Cudeck criterion.

Table 4. Properties of the overall measurement model

Variables and their indicators	S.L.	t-values	CR	AVE
Service Quality (second-order factor model)			0.948	0.724
Assurance	.745	-		
Convenience	.913	8.564		
Customization	.808	7.210		
Design	.881	8.662		
Enjoyment	.947	7.194		
Fun	.871	8.570		
Security	.771	6.977		
Perceived Value			0.809	0.586
PV1	.798			
PV2	.727	10.911		
PV3	.770	11.723		
Customer Satisfaction			0.811	0.591
CS1	.870	-		
CS2	.701	11.160		
CS3	.725	11.718		

S.L.: Standardized loadings; C.R.: Composite reliability; AVE: Average variance extracted.

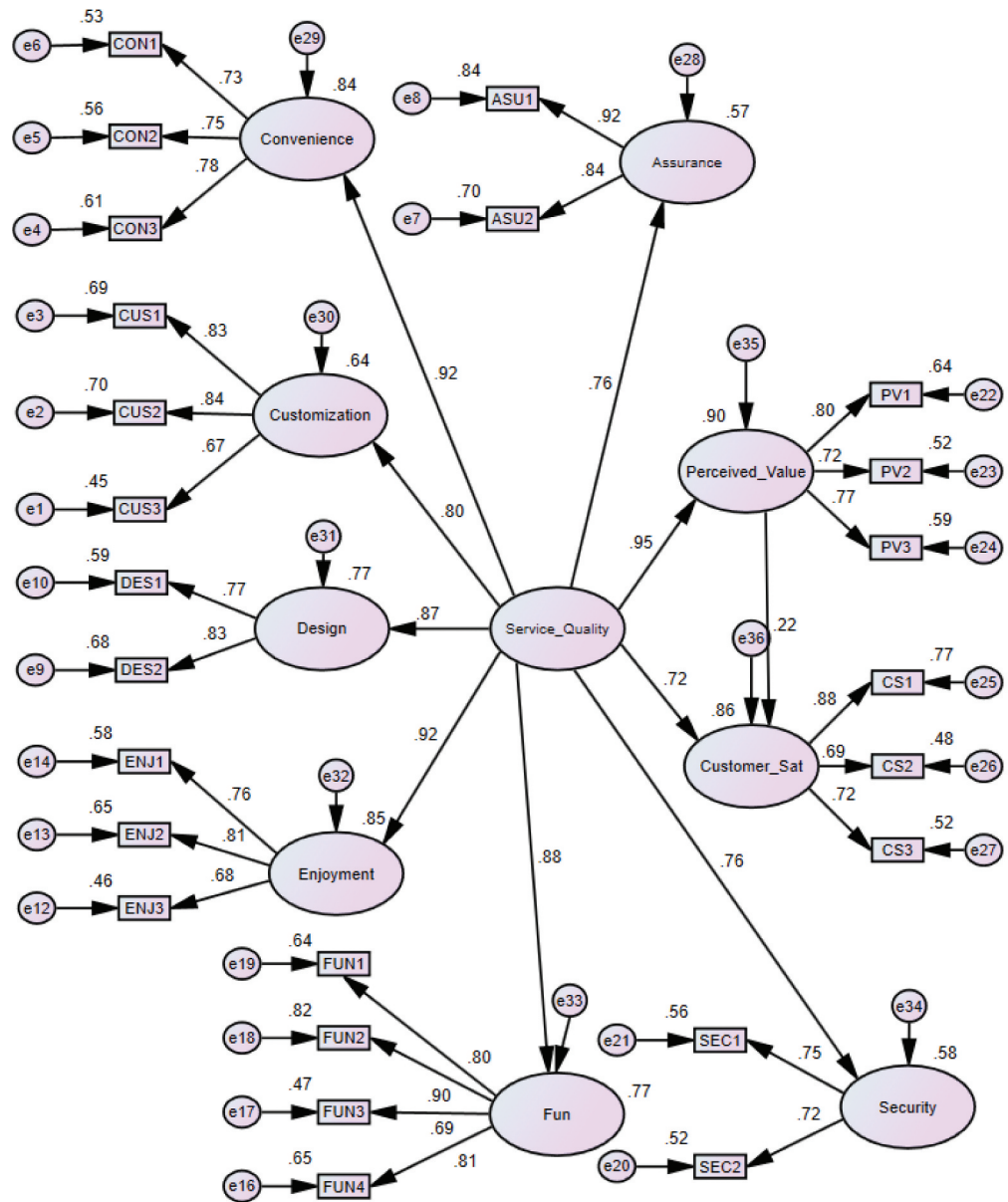
The measurement model was able to established its reliability and validity; hence, the structural model shown in Figure 4 was tested. As shown in Table 6, the fit indices were within the acceptable range (CFI = 0.91; TLI = 0.90; RMSEA = 0.07; SRMR = 0.03; χ^2/df = 2.06).

Table 7 provides the statistical significance of the relationships of service quality, perceived value and customer satisfaction. The H1 of this study was confirmed. The result of the structural model indicated that service quality positively influences perceived value in the mobile banking application (β = 1.044; S.E. = 0.117; $p < 0.001$). The path between service quality and customer satisfaction

Table 5. Discriminant validity results

Comparisons	Constrained Model		Unconstrained Model		Chi-square difference		Discriminant Validity
	χ^2	df	χ^2	df	$\Delta\chi^2$	Δdf	
Service Quality	561.817	223	485.947	222	75.87	1	Yes
	528.888	223	483.767	222	45.121	1	Yes
Perceived Value	83.789	9	36.815	8	46.974	1	Yes

Figure 4. The Tested Structural Equation Model.



($\beta = 0.885$; S.E. = 0.369; $p = 0.016$) is found to be significantly positive, thus supporting H2. Lastly, perceived value has no significant effect on customer satisfaction (H3).

5. Discussion and conclusion

Structural equation modeling results reveal the positive and significant influence of SSTs service quality on perceived value in a mobile banking application. The results emphasized that if service quality offered by mobile banking is higher, the more it would increase the perceived value. The findings agree with the results of Wang et al. (2004), Turel and Serenko (2006), and Parasuraman (2005). Similarly, Vasudeva and Singh (2017) concluded that E-S-QUAL dimensions have a positive influence on customer satisfaction.

Table 6. Fit indices of the overall measurement and structural models

Model	χ^2	df	CFI	TLI	RMSEA	SRMR	χ^2/df
Overall Measurement Model	547.359	265	.912	.900	.073	.038	2.066

Findings also confirm that SSTs service quality has a positive and significant influence on customer satisfaction in a mobile banking application. These findings are parallel with previous studies that confirmed the positive relationship between service quality and customer satisfaction (Chang & Chen, 2009; Kim et al., 2004; Tung, 2004; Turel & Serenko, 2006). The results are consistent with Boon-itt (2015), who found the positive influence of the five selected SSTQUAL service quality dimensions on customer satisfaction. The results are also consistent with Sharma and Sharma (2019). They concluded that customer satisfaction could be influenced by service quality based on the DeLone and McLean information systems (D&M IS) success model.

However, this study revealed that perceived value has no significant impact on customer satisfaction in a mobile banking application. This finding is against the prior studies that concluded that the relationship between perceived value and customer satisfaction and had stated comparable results (H. H. Lin & Wang, 2006; Hsu, 2006; Tung, 2004; Turel & Serenko, 2006; Yang & Peterson, 2004). Hence, the result in the study of mobile banking in the Philippines differs from the study of Boon-itt (2015) that found that perceived value has a positive association with customer satisfaction in digital banking (both online and mobile banking) in Thailand.

5.1. Theoretical implications

This study proved that the SSTQUAL model could measure service quality on a mobile banking application. With the methodological development and changes, this study showed that SEM using AMOS and service quality as a second-order factor composed of seven first-order factors of quality dimensions might be used for the examination between the service quality dimensions and other constructs. Further, the dimensions of SSTQUAL could also be a reliable measure for perceived value and customer satisfaction in the case of a mobile banking application.

This study may provide the foundation of studies on determining the factors in mobile banking usage. In addition, this study will extend the service quality literature in mobile banking and other self-service technologies.

5.2. Practical and managerial implications

The results of the study are beneficial in formulating an appropriate approach to attract more account holders to use mobile banking. This study may suggest some guidelines that will progress the overall quality of the system on assurance, convenience, customization, design, enjoyment, fun, and security. Such service quality dimensions enhance perceived service quality, and therefore optimize the satisfaction of consumers and make them loyal afterward. Hence, decision-makers for mobile banking applications or other mobile applications may find the results relevant to have a deeper understanding of users' perceptions of mobile banking use and to develop a smart and effective policy customer retention.

5.3. Limitations and future research directions

The results were obtained from mobile banking application users. Using SSTQUAL dimensions for service quality across other banks' self-service technologies may provide valuable results. Second, future studies may include individual characteristics like personality traits and socio-demographic variables that may have a possible influence on the model. Lastly, longitudinal studies may be conducted in the future to determine the difference in the perception between

Table 7. Regression weights and its significance

Test	Construct	Direct Effect	Construct	Estimate	S.E.	C.R.	P-value	Supported
H1	Perceived Value	<—	Service Quality	1.044	.117	8.940	***	Yes
H2	Customer Satisfaction	<—	Service Quality	.885	.369	2.401	.016	Yes
H3	Customer Satisfaction	<—	Perceived Value	.258	.333	.774	.258	No

***Significance at $p < .001$.

early adopters and users for a period. The proposed study may contribute to developing strategies for encouraging customers to register for mobile banking applications and retaining mobile banking users.

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Author details

Myra V. De Leon¹

E-mail: myra_deleon@dlsu.edu.ph

ORCID ID: <http://orcid.org/0000-0001-7270-0151>

Ringgold P. Atienza²

E-mail: ringgoldatienza@yahoo.com

ORCID ID: <http://orcid.org/0000-0001-6561-6541>

Daniel Susilo³

E-mail: daniel.susilo@unitomo.ac.id

ORCID ID: <http://orcid.org/0000-0001-8713-2011>

¹ Decision Sciences and Innovation Department, De La Salle University, Manila, Philippines.

² College of Business and Management, Misamis University, Misamis Occidental, Philippines.

³ School of Communications Science, Dr Soetomo University, Surabaya, East Java, Indonesia.

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Appendix A.

Table A1. Survey questionnaire

Assurance

ASU1. The bank providing the mobile banking application is well-known.

ASU2. The bank providing the mobile banking application has a good reputation.

Convenience

CON1. The mobile banking application has operating hours convenient to customers.

CON2. It is easy and convenient to reach the firm's mobile banking application.

CON3. It is easy and convenient to use the mobile banking application.

Customization

CUS1. The mobile banking application understands my specific needs.

CUS2. The mobile banking application has my best interests at heart.

CUS3. The mobile banking application has features that are personalized for me.

Design

DES1. The layout of the mobile banking application is aesthetically appealing.

DES2. The mobile banking application appears to use up-to-date technology.

Enjoyment

ENJ1. The operation of the mobile banking application is interesting.

ENJ2. I feel good being able to use the mobile banking application.

ENJ3. The mobile banking application has interesting additional functions.

ENJ4. The mobile banking application provides me with all relevant information.

Fun

FUN1. I can get my service done with the mobile banking application in a short time.

FUN2. The service process of the mobile banking application is clear.

FUN3. Using the mobile banking application requires little effort.

FUN4. I can get service done smoothly with the mobile banking application.

FUN5. Each service item/function of the mobile banking application is error-free.

Security

SEC1. I feel safe in my transactions with the mobile banking application.

SEC2. A clear privacy policy is stated when I use the mobile banking application.

Customer Satisfaction

CS1. Overall, I am satisfied with the mobile banking application offered by the bank.

CS2. The mobile banking application offered by the bank exceeds my expectations.

CS3. The mobile banking application offered by the bank is close to my idea.

Perceived Value

PV1. In general, the overall value I get from using this mobile banking application is worth my time and effort.

PV2. What I gained from bank's mobile banking application is more than what I have to give up.

PV3. I value mobile banking application greatly.



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