Scientific Journal of Informatics
Vol. 11, No. 2, May 2024
p-ISSN 2407-7658 https://journal.unnes.ac.id/journals/sji/index e-ISSN 2460-0040

Securing Digital Wallet Loyalty: Unveiling the Impact of Privacy and Security

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Abstract.
Purpose: The study investigates the fast-evolving fintech landscape, specifically the impact of digital wallets on the financial industry. It focuses on the competitive digital wallet market in Indonesia, examining how service quality influences user satisfaction and loyalty in a saturated market. By integrating a Security variable into the E-Servqual method, this research aims to offer a new perspective on assessing the effects of digital wallet services on user satisfaction and loyalty.
Methods: This study employs the Modified E-Servqual model with an added Security variable to explore how service quality variables like Site Organization, Efficiency, Personal Needs, Privacy, Reliability, Responsiveness, Security, and User's Friendliness impact customer satisfaction and loyalty in digital transactions. Surveying 287 digital wallet users, mostly GoPay, OVO, ShopeePay and DANA, the research provides a detailed analysis of these variables' effects on E-Customer Satisfaction and E-Customer Loyalty.
Result: The findings show that digital wallet users value certain service quality aspects differently in terms of their impact on satisfaction and loyalty. While variables like Reliability, User's Friendliness, Personal Needs, Privacy, Security, and Efficiency significantly influence user satisfaction, Site Organization and Responsiveness do not. This highlights the importance of security and efficiency in enhancing user satisfaction and loyalty in digital wallets.
Novelty: The study's novel contribution is integrating a Security variable into the E-Servqual method, enhancing the assessment of digital wallets' inherent security risks. This integration provides a detailed analysis of how security impacts user satisfaction and loyalty, alongside other service quality factors. This systematic evaluation offers new insights for improving service quality, benefiting companies in the competitive digital wallet market, and informing future research on customer loyalty and provider success.

Keywords: Digital wallet, Financial technology, Modified E-Servqual model, Security, Service quality
Received March 2024 / **Revised** April 2024 / **Accepted** May 2024

INTRODUCTION

The rapid evolution of financial technology, often referred to as fintech, has significantly transformed various sectors, especially the financial industry. In today's digital age, a notable impact is the widespread adoption of digital wallets, which have become pivotal in facilitating non-cash transactions and enhancing the financial value of enterprises [1]. This integration of technology into finance not only streamlines operations but also addresses financial challenges for SMEs, contributing to their smooth development and value enhancement [2].

Digital wallets, integrated into various applications, play a vital role in modern financial transactions by securely storing and facilitating the use of funds. These wallets simplify the transaction process primarily through two methods: OTP (One-Time Password) codes, which provide a secure transaction authentication system, and QR codes, which consumers scan to validate transactions at the point of sale. The landscape of digital wallets in Indonesia is particularly dynamic, showcasing a diverse range of preferences among consumers, with major players such as OVO, GoPay, ShopeePay, and Dana commanding significant shares of the market [3]. This diversity not only highlights the competitive nature of the market but also reflects the critical role of user experience in influencing consumer choice and sustaining loyalty in the digital payment ecosystem [4].

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DOI: 10.15294/sji.v11i2.2423

However, the rapid growth of digital wallets has indeed spurred market saturation and intense competition among providers. As multiple digital wallet options become available, service providers are compelled to focus not only on maintaining but also on enhancing their service quality to distinguish themselves in the crowded marketplace. A pivotal challenge in this dynamic environment is understanding the connection between user satisfaction and loyalty. Research indicates that user satisfaction significantly influences loyalty, particularly among Generation Z users in Indonesia, who prioritize easy, cashless, and beneficial digital payment solutions [5]. Service performance, including factors such as user-friendliness, application efficiency, and security, is crucial. For instance, enhancing the experience quality of digital wallet services has been shown to improve user satisfaction and, indirectly, loyalty, underscoring the importance of robust service delivery mechanisms [6]. Therefore, digital wallet providers must adopt a nuanced approach that incorporates these variables to foster a loyal customer base effectively.

Moreover, based on those problems, this study introduces a novel adaptation of the E-Servqual method by integrating Security as critical dimensions in the context of digital wallets. The E-Servqual itself is a robust framework for evaluating electronic service quality, systematically measures several key dimensions of digital service provision. These include Site Organization, Efficiency, Personal Needs, Reliability, Responsiveness, Privacy, and User's Friendliness [7]. Therefore, the adjustment in this study recognizes the escalating concerns over digital privacy and security, which are important to user satisfaction and loyalty but often underexplored in traditional E-Servqual applications.

Furthermore, recent applications of the E-Servqual model in the context of digital wallets have not specifically isolated the dimensions of privacy and security as distinct factors influencing user satisfaction and loyalty. For example, Wahyuni et al. [8] focused on the perception of e-wallet users pre- and post-COVID-19 but did not specifically tackle the dimensions of privacy and security. Similarly, Fainusa, Nurcahyo, and Dachyar [9] aimed to identify factors influencing digital wallet satisfaction without highlighting security as standalone dimensions.

Further, the study by Emilia and Sanjaya [10] applied the E-Servqual in a banking context but emphasized general service quality dimensions, not explicitly addressing the unique challenges posed by security concerns in digital transactions. Other studies, such as those by Ilieva et al. [11] and Liswanty et al. [12], while exploring user attitudes and perceptions towards digital wallets, similarly lacked a focused examination on how privacy and security directly impact user loyalty.

Additionally, research by Ramli and Hamzah [13] reviewed e-wallet adoption in emerging economies but did not delve into security as factors within the E-Servqual framework. Studies like those by Bakar, Rosbi, and Uzaki [14] on e-wallet frameworks also omitted a direct focus on these crucial factors. In contrast, Sharma's [15] work on changing consumer behavior with digital wallets also neglected to analyze the critical role of security as defined within an E-Servqual context.

The absence of these dimensions in previous studies highlights the novelty of this research. By incorporating Security as explicit variables, this study not only addresses a significant gap in the digital wallet literature but also enhances the applicability of the E-Servqual model in assessing service quality in environments where consumer trust is highly sensitive to data protection and cyber threats. This focus is expected to provide deeper insights into the drivers of loyalty in the use of digital wallets, offering valuable contributions to both academia and industry practices.

At last, this research enriches the academic discourse by adapting the E-Servqual model with modification to address the challenges of market saturation and heightened competition within the digital wallet sector. It specifically investigates the nuanced relationships between traditional service quality variables—such as Site Organization, Efficiency, and User Friendliness—and user satisfaction, while introducing Security as a novel variable. This addition is particularly relevant given the increasing concerns over data protection and cyber security in digital financial transactions. By integrating this variable, this study provides crucial insights for companies aiming to enhance service quality and foster user loyalty in the rapidly evolving digital wallet landscape. This approach not only aids businesses in improving customer satisfaction but also contributes to the strategic development of more secure and privacy-conscious service offerings in the competitive market.

METHODS

This research utilizes the E-Servqual model, an established framework for evaluating electronic service quality that assesses dimensions such as Site Organization, Efficiency, Personal Needs, Reliability, Responsiveness, Privacy and User's Friendliness [7]. Moreover, it adds Security as a novel variable, aiming to explore the dynamics of customer satisfaction within digital wallet services. The research hypotheses depicted in Figure 1 structure a systematic approach to analyze the impact of these service quality variables on user satisfaction and loyalty, providing valuable insights for enhancing service delivery in the competitive digital wallet sector. Furthermore, this study employs purposive sampling to select participants who are most likely to provide relevant data for achieving the research objectives, which in this study context are those who have used the digital wallet platforms[16]. Additionally, the Bernoulli process is used to determine the minimum sample size, calculated at 96 but rounded up to 100 to ensure robust statistical analysis [17]. This methodological rigor enhances the reliability of the study's findings, providing a solid foundation for conclusions regarding the integration of the Security dimension into the E-Servqual model.

Moreover, this study also conducts validity and reliability tests to ensure the accuracy and consistency of the measurement instruments used. Validity tests confirm that the scales properly measure the constructs they are intended to measure, while reliability tests assess the consistency of the results across different instances of measurement. These statistical tests are crucial for establishing the trustworthiness of the research findings, enabling the study to provide credible insights into the effects of service quality dimensions on customer satisfaction and loyalty. The application of these tests follows established research methodologies in service quality assessment, ensuring that the data collected can be reliably interpreted and generalized to similar contexts [18], [19].

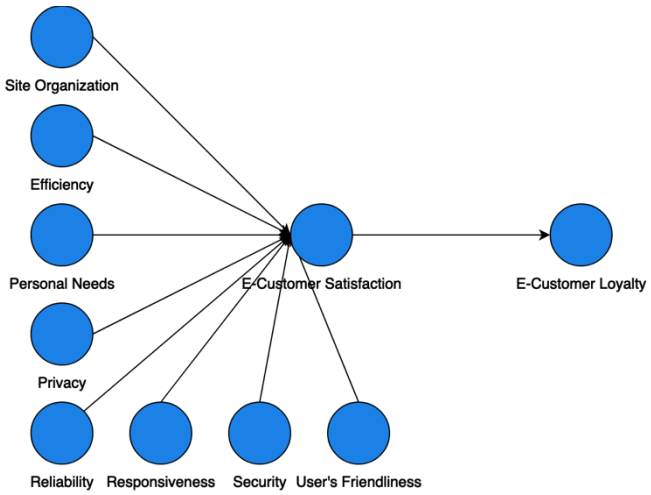

Figure 1. The proposed modified e-servqual model

In the pursuit of comprehensively understanding the intricate dynamics of customer satisfaction within the digital wallet service landscape, several hypotheses are formulated. Each hypothesis is tailored to investigate the significant impact of specific service quality variables on E-satisfaction, ultimately contributing to the broader goal of unraveling the factors influencing user satisfaction and loyalty in the realm of digital financial transactions.

- H1: Site Organization significantly influences E-satisfaction in digital wallet services.
- H2: Reliability significantly impacts E-satisfaction in digital wallet services.
- H3: Responsiveness significantly influences E-satisfaction in digital wallet services.
- H4: User Friendliness significantly affects E-satisfaction in digital wallet services.
- H5: Personal Needs significantly influences E-satisfaction in digital wallet services.
- H6: Efficiency has a positive effect on E-satisfaction in digital wallet services.
- H7: Privacy significantly impacts E-satisfaction in digital wallet services.
- H8: Security has a significantly positive effect on E-satisfaction in digital wallet services.
- H9: E-satisfaction positively influences E-loyalty in digital wallet services.

RESULT AND DISCUSSION

Respondents characteristics

Survey participants include individuals utilizing digital wallets for their daily transactions, engaging in the study with at least one digital wallet. The research is based on the analysis of 287 customer data obtained through questionnaires. Based on the data obtained, the percentages of the types of digital wallets most commonly used are as follows: ShopeePay with 80 people (27.9%), GoPay with 74 people (25.95%), OVO with 63 people (21.9%), Dana with 60 people (20.5%), and others with 10 people (3.8%). The survey captures relevant demographic information such as gender, age, the type of digital wallet used, occupation, and the most recent transaction conducted using a digital wallet. Respondents' feedback is organized and assessed in alignment with the variables or variables of the modified E-Servqual model. The questionnaire ensures the validity of the collected data by incorporating specific criteria for demographic characteristics and customer behavior related to digital wallet usage.

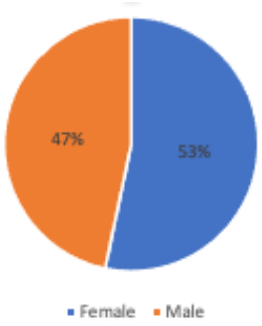

Figure 2. User characteristics by gender

Figure 2 shows that from the analysis of 287 customer datasets, out of the respondents, 153 individuals (53%) identified as female, while 134 respondents (47%) were male. Subsequently, through the distribution of questionnaires to respondents, information regarding age characteristics was obtained from the response data, as detailed in Figure 3.

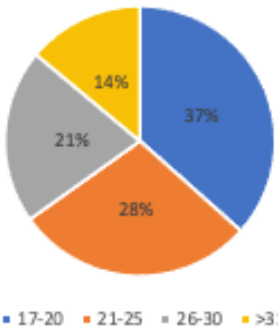

Figure 3. User characteristics by age

Age represents a crucial factor in decision-making regarding the questions posed and the actions taken by customers. Additionally, the age range applied in this study is tailored to the research needs, considering that respondents are required to provide identification when using digital wallet applications. Based on the survey results from 287 customer datasets, the distribution of ages is as follows: 105 individuals (37%) fall within the 17-20 age group, 82 individuals (28%) belong to the 21-25 age group, 60 individuals (21%) are in the 26-30 age range, and 40 individuals (14%) are over 31 years old. In summary, it can be concluded that this study's digital wallet customers are predominantly in the 17-20 age group, constituting 35.4% of the surveyed population.

Following the distribution of questionnaires to customers, insights into customer information based on occupational characteristics were gathered, as presented in Figure 4.

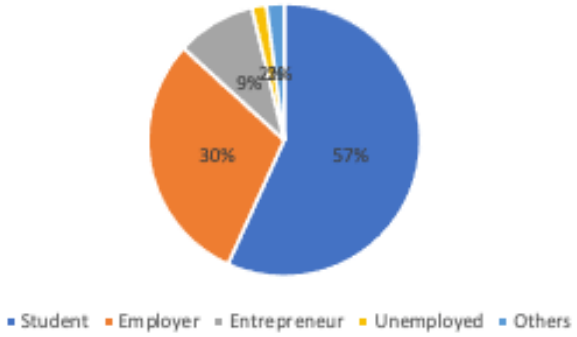

Figure 4. Customers based on occupation

Based on the outcomes from 287 respondent datasets, it is obtained that the distribution of respondents by occupation reveals a breakdown as follows: students or university attendees constitute 163 individuals (57%), employees or staff members account for 86 individuals (30%), entrepreneurs' amount to 27 individuals (9%), unemployed individuals stand at 5 individuals (2%), and others represent 6 individuals (2%). Conclusively, among the various occupational categories of respondents, students or university attendees emerge as a significant consumer group prominently utilizing digital wallets for their transactions.

Evaluation of measurement model (outer model)

The measurement model in this research utilizes the reflective measurement approach within the outer model to elucidate the relationships between indicators and their corresponding latent variables. In this setup, the outer model experiment is crucial for determining the connection between latent variables and their respective indicators, whereby validity and reliability testing are meticulously conducted. Specifically, the model's evaluation hinges on assessing Convergent Validity and Discriminant Validity, critical measures that ensure the accuracy and distinctiveness of the constructs respectively. This rigorous assessment, depicted in Figure 5 as the reflective construct, ensures that the measurement model effectively captures the intricate dynamics of the latent variables. For instance, recent studies have demonstrated the robustness of reflective measurement models in capturing complex interrelations while maintaining high levels of validity [20] [21] [22]. These validations are pivotal for advancing the reliability of conclusions drawn from the model, enabling a more detailed exploration and understanding of factors impacting user satisfaction and loyalty in digital environments.

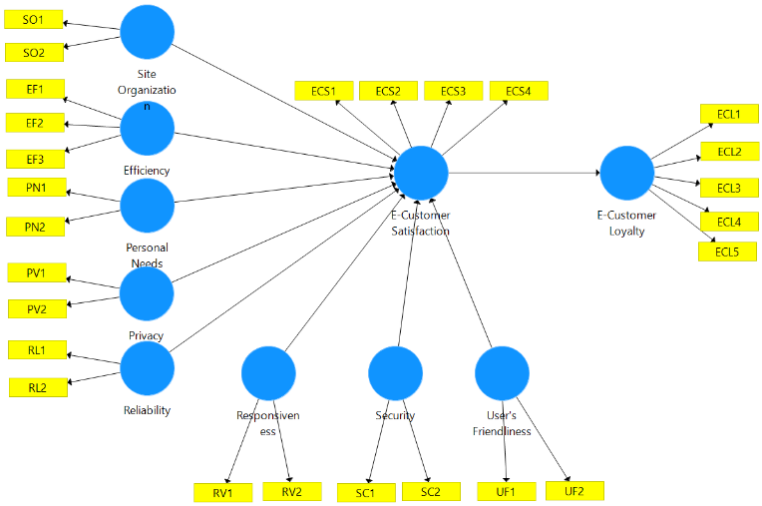

Figure 5. Reflective construct of the proposed model

Convergent validity

Convergent validity in this study is established by ensuring that questions related to each latent variable are understood by respondents as intended by the researcher. In the context of Partial Least Squares (PLS),

convergent validity is assessed by examining the loading factor coefficients of the observed concept indicators. This involves adhering to specific criteria such as outer loading values exceeding 0.7 and Average Variance Extracted (AVE) values surpassing 0.5, where an AVE value above 0.5 is deemed valid and above 0.7 is considered excellent [21], [23], [24]. These metrics are derived after data processing, and their results are detailed in Table 1, demonstrating the robustness of the model's internal consistency and construct validity. Studies emphasize the importance of these thresholds in ensuring that the constructs accurately reflect the variables they are intended to measure, thereby affirming the model's validity.

The outcomes of the data analysis reveal robust validity for various variables within the Modified E-Servqual Model. The Site Organization variable, exemplified by indicators SO1 (0.898) and SO2 (0.882), demonstrates high validity with loading factor values exceeding 0.70. Similarly, the Responsiveness variable, represented by indicators RV1 (0.871) and RV2 (0.888), attains high validity, emphasizing the reliability of this variable in capturing customer perceptions.

Moving on, the Reliability variable, characterized by indicators RL1 (0.864) and RL2 (0.896), exhibits high validity with values surpassing 0.70. Likewise, the User's Friendliness variable records loading factor values exceeding 0.70, with indicators UF1 (0.884) and UF2 (0.889) demonstrating high validity. The Personal Needs variable, with indicators PN1 (0.881) and PN2 (0.875), also achieves validity above 0.70, signifying a high level of consistency and reliability in measuring customer satisfaction.

Furthermore, the Efficiency variable, as represented by indicators EF1 (0.714), EF2 (0.795), and EF3 (0.779), maintains validity above 0.70, indicating its effectiveness in capturing the efficiency aspects of digital wallet services. In addition, the Privacy variable, characterized by indicators PV1 (0.878) and PV2 (0.898), exhibits high validity with loading factor values above 0.70, confirming its reliability in measuring customer perceptions of privacy in digital transactions.

Next, within the security dimension, the SC1 indicator showed a loading factor value of (0.907), while the SC2 indicator had a loading factor value of (0.919). Subsequently, the E-Customer Satisfaction variable, as indicated by ECS1, revealed a loading factor value of (0.795); ECS2 showed (0.757); ECS3 indicated (0.794); and ECS4 demonstrated a loading factor value of (0.770). For E-Customer Loyalty, the values were as follows: ECL1 at (0.790); ECL2 at (0.804); ECL3 at (0.794); ECL4 at (0.781); and the loading factor for ECL5 was (0.792).

Table 1. Convergent validity testing

Variable	Indicator	Loading Factor	AVE
Site Organization	SO1	0.898	0.792
	SO2	0.882	
Responsiveness	RV1	0.871	0.774
	RV2	0.888	
Reliability	RL1	0.864	0.775
	RL2	0.896	
User Friendliness	UF1	0.884	0.785
	UF2	0.889	
Personal Needs	PN1	0.881	0.771
	PN2	0.875	
Efficiency	EF1	0.714	0.583
	EF2	0.795	
	EF3	0.779	

Privacy	PV1	0.878	0.788
	PV2	0.898	
Security	SC1	0.907	0.833
	SC2	0.919	
E-Customer Satisfaction	ECS1	0.795	0.607
	ECS2	0.757	
	ECS3	0.794	
	ECS4	0.770	
E-Customer Loyalty	ECL1	0.790	0.628
	ECL2	0.804	
	ECL3	0.794	
	ECL4	0.781	
	ECL5	0. 792	

In summary, each variable within the modified E-Servqual model demonstrates robust convergent validity, as indicated by Average Variance Extracted (AVE) values exceeding 0.5. This comprehensive validation underscores the efficacy of the measurement model in capturing the nuanced aspects of customer satisfaction and loyalty in the context of digital wallet services.

Discriminant validity

Discriminant validity is assessed by comparing the square root of the AVE with the correlations between latent variables, ensuring that each construct is distinct. The Fornell-Larcker criterion, a widely used method, asserts that discriminant validity is established when the square root of the AVE for each variable is greater than its correlations with other variables [25], [26]. This criterion provides a robust methodological approach to confirm that constructs measured are indeed unique and not unduly influenced by shared variance with other variables in the model. Studies underscore the importance of this criterion as a reliable test for discriminant validity, validating the distinctiveness of constructs within models applied to various research domains.

Table 2 reveals that the relationships between observed concepts and their indicators exhibit values greater than the correlations with different constructs. This substantiates the notion that each latent variable possesses strong validity. The indicators within each conceptual block outperform those in other blocks, underscoring the robust validity of the latent variables.

Table 2. Discriminant validity testing

	ECL	**ECS**	**EF**	**PN**	**PV**	**RL**	**RV**	**SC**	**SO**	**UF**
ECL	0.792									
ECS	0.775	0.779								
EF	0.513	0.626	0.763							
PN	0.484	0.499	0.421	0.878						
PV	0.520	0.580	0.382	0.392	0.888					
RL	0.377	0.521	0.463	0.375	0.396	0.880				
RV	0.384	0.390	0.299	0.390	0.414	0.391	0.880			
SC	0.455	0.517	0.363	0.320	0.550	0.274	0.343	0.913		
SO	0.373	0.381	0.391	0.279	0.325	0.337	0.187	0.248	0.890	
UF	0.397	0.423	0.342	0.332	0.336	0.255	0.335	0.263	0.236	0.886

Reliability testing

The reliability test assesses the consistency of research instruments when measuring the same phenomena multiple times, aiming to achieve stable measurement outcomes. Cronbach's alpha and composite reliability are key metrics in this reliability test. Values greater than 0.6 are deemed acceptable, whereas values above 0.7 are considered highly reliable [27], [28]. These standards are critical in ensuring the precision and repeatability of the measurements. Table 3 displays the outcomes of these reliability assessments. Research underscores the importance of these reliability measures, highlighting that a high Cronbach's alpha or composite reliability significantly strengthens the credibility of the measurement instruments used in various studies.

Table 3. Reliability testing

Variable	Cronbach's Alpha	Composite Reliability
Site Organization	0.738	0.884
Responsiveness	0.708	0.872
Reliability	0.711	0.873
User's Friendliness	0.727	0.880
Personal Needs	0.703	0.871
Efficiency	0.643	0.807
Privacy	0.732	0.882
Security	0.800	0.909
E-Customer Satisfaction	0.784	0.861
E-Customer Loyalty	0.852	0.894

The data analysis results reveal that all Composite Reliability values for the utilized variables exceed 0.70, indicating excellent reliability across all variables. Additionally, the reliability test using Cronbach's Alpha indicates that the Efficiency variable records a value of 0.643. While this value is below the conventional threshold, considered for reliable testing (>0.60), it is still within the acceptable range, demonstrating that the Efficiency variable remains reliable, as it surpasses the 0.60 threshold [27], [28]. Consequently, all variables obtain Cronbach's Alpha values greater than 0.60, attesting to the overall strong reliability of each variable. This implies that each variable utilized to measure the quality of digital wallet services, as perceived by the public in this study, remains consistently reliable for addressing similar issues.

Evaluation of structural model (inner model)

Upon conducting the outer model test and ensuring that all criteria are met, the subsequent step involves examining the structural model. The inner model test is employed to understand the influence of exogenous variables on endogenous ones. Figure 6 provides an illustration of the inner model in this study. The path values in this research are examined to determine the inter-variable influence.

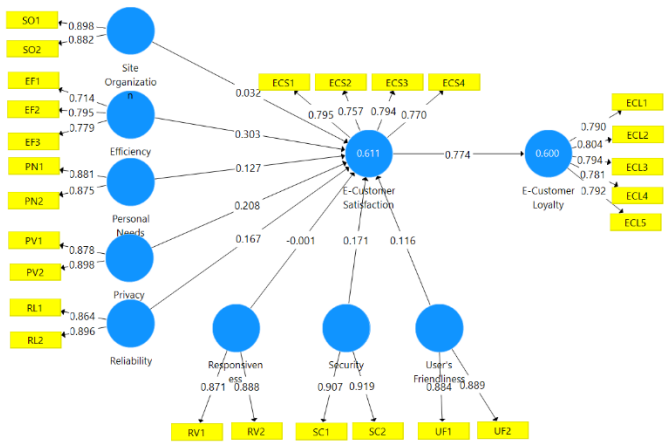

Figure 6. Inner Model

Subsequently, the determination coefficient (R2) is used to assess the model's explanatory power, measuring how strongly independent variables collectively influence the dependent variable. This is indicated by the adjusted R-squared value, which adjusts for the number of predictors in the model. R-

Squared values are categorized into three levels: 0.67 is considered strong, 0.33 is moderate, and 0.19 is weak, as shown in Table 4. The Fornell-Larcker criterion further supports the assessment of discriminant validity, ensuring that constructs are distinct when the square root of the Average Variance Extracted (AVE) for each variable is greater than its correlations with other variables [29], [30]. These assessments ensure the reliability of the model's results by confirming that each construct in the model uniquely contributes to the explanation of variance observed.

Table 4. Coefficient determination testing

Variable	R Square	R Square Adjusted
E-Customer Satisfaction	0.611	0.600
E-Customer Loyalty	0.600	0.598

Table 4 displays the determination coefficient values for the E-Customer Loyalty variable, yielding an R Square of 0.600, and for the E-Customer Satisfaction variable, with an R Square of 0.611. These determination coefficient values indicate that each variable within the E-Servqual Modified model, including Security, can elucidate the E-Customer Loyalty construct at 60%, leaving the remaining 40% influenced by other constructs.
Similarly, the E-Servqual Modified variable can explain the E-Customer Satisfaction construct at 60%, with the remaining 40% influenced by other constructs. Thus, the R-squared values in this study are commendable.

Hypothesis testing

The hypothesis testing in this study employs the bootstrap Partial Least Squares (PLS) technique, which uses resampling to compute T-statistic values for each path and relationship. This approach allows for robust assessment of the statistical significance of hypotheses. A hypothesis is considered accepted if the T-statistic value exceeds 1.645 for a single statement and 1.96 for two statements, coupled with a p-value less than 0.05, indicating statistical significance [23]. Table 5 details the outcomes of this hypothesis testing, showcasing the strength and reliability of the bootstrap PLS method in drawing meaningful conclusions from the data. The use of the bootstrap method is crucial for confirming the robustness of the findings, particularly in complex models where traditional assumptions may not hold [31], [32].

Table 5. Hypothesis testing

H	Hipotesis	*Original Sample*	*T Statistics*	*P Values*	Result
H1	Site Organization → E-Customer Satisfaction	0.033	0.625	0.533	Not Significant
H2	Reliability → E-Customer Satisfaction	0.165	3.504	0.001	Significant
H3	Responsiveness → E-Customer Satisfaction	-0.004	0.076	0.939	Not Significant
H4	User's Friendliness → E-Customer Satisfaction	0.115	2.056	0.040	Significant
H5	Personal Needs → E-Customer Satisfaction	0.127	2.310	0.021	Significant
H6	Efficiency → E-Customer Satisfaction	0.304	5.398	0.001	Significant
H7	Privacy → E-Customer Satisfaction	0.207	3.626	0.001	Significant
H8	Security → E-Customer Satisfaction	0.170	3.187	0.002	Significant
H9	E-Customer Satisfaction → E-Customer Loyalty	0.775	29.318	0.001	Significant

Discussions

This study aims to assess the service quality using the modified E-Servqual model in the context of digital wallet usage, specifically its impact on E-Customer Satisfaction and E-Customer Loyalty. The objective is to measure the levels of customer satisfaction and loyalty when utilizing digital wallets. Nine hypotheses were analyzed using Partial Least Squares-Structural Equation Modeling (PLS-SEM) with a sample of 287 respondents which exceed the minimum sample size of 100 that was calculated using Bernoulli formula.

Discussion of hypothesis testing

1. H1 (Site Organization → E-Customer Satisfaction)

The analysis of the first hypothesis in this study, suggesting that Site Organization does not significantly influence E-Customer Satisfaction in digital wallet services, shows a non-significant relationship with a T-statistic of 0.625 and a P-value of 0.533. This result leads to the rejection of the hypothesis, indicating that within the context of digital wallet services, Site Organization does not play a significant role in influencing E-Customer Satisfaction.

This finding contrasts with other recent studies in similar domains. For example, a study by Nariyari et al. [33] on OVO e-wallet users found that service quality, including dimensions similar to Site Organization, significantly impacts both customer satisfaction and loyalty. Another study by Ajina et al. [34] examining mobile-wallet service quality also supported the importance of various service dimensions, including Site Organization, in influencing customer satisfaction and loyalty.

The discrepancy between this study's findings and others suggests that factors influencing E-Customer Satisfaction may vary significantly depending on contextual elements like the target demographic, regional preferences, and the specific features of the digital wallet platform. Digital wallet providers should consider these aspects and perhaps focus more on other elements that might have a stronger impact on user satisfaction in their specific contexts. Additionally, companies might explore deeper into the qualitative aspects of why site organization seems less impactful, possibly to refine or redefine what aspects of site organization are measured and valued by customers in different settings.

2. H2 (Reliability → E-Customer Satisfaction)

The analysis results for the second hypothesis, which asserts that Reliability significantly impacts E-Customer Satisfaction in digital wallet services, indicate a substantial effect with a T-statistic of 3.504 and a P-value of 0.001. This outcome supports the acceptance of the hypothesis, suggesting that Reliability is a critical factor in enhancing E-Customer Satisfaction within the realm of digital wallet services.

This finding aligns with recent studies in the field, emphasizing the pivotal role of reliability in digital financial services. For instance, a study by Hammoud, Bizri, and El Baba [35] in the Lebanese banking sector found that reliability, along with other service quality dimensions, significantly impacts customer satisfaction, highlighting its importance across different contexts of e-services. Similarly, a study by Argimbayeva et al. [36] on ADNOC's e-wallet services demonstrated a strong relationship between service reliability and customer satisfaction, further validating the importance of dependable service delivery.

The significant impact of reliability on E-Customer Satisfaction suggests that digital wallet providers should prioritize consistent and dependable service delivery to enhance customer satisfaction and loyalty. By focusing on reliability, companies can improve user trust and perceived value, which are crucial for retaining customers in the competitive market of digital wallet services.

3. H3 (Responsiveness → E-Customer Satisfaction)

The results for the third hypothesis in this study reveal that Responsiveness does not significantly influence E-Customer Satisfaction in digital wallet services, as evidenced by the original sample value for Responsiveness being -0.004, with a T-Statistic of 0.076 and a p-value of 0.939. This leads to the rejection of the hypothesis, given that the T-statistic value is below the commonly accepted threshold of 1.645 and the p-value is above the significant level of 0.05.

This finding is noteworthy as it diverges from other recent research in the field, which generally supports the significance of responsiveness in influencing customer satisfaction. For instance, a study by Sharma et al. [37] highlights that responsiveness positively impacts customer satisfaction, cross-buying behavior, and referral behavior in retail settings, suggesting that responsiveness is a crucial factor in customer engagement

and satisfaction strategies. Additionally, another study by Ajina et al. [34] on mobile-wallet services found that service dimensions, including responsiveness, play a significant role in enhancing customer loyalty through improved satisfaction.

The lack of a significant relationship between responsiveness and E-Customer Satisfaction in this specific context suggests that digital wallet users might prioritize other factors such as security, convenience, or financial incentives over responsiveness. It implies that digital wallet providers should perhaps reconsider the allocation of resources or focus on enhancing other aspects that are more critical to their user base. This finding also prompts a reassessment of customer service strategies, potentially shifting focus towards more impactful areas as perceived by users.

4. H4 (User's Friendliness → E-Customer Satisfaction)

The analysis for the fourth hypothesis demonstrates that User Friendliness significantly affects E-Customer Satisfaction in digital wallet services. This is evidenced by a T-statistic of 2.056 and a P-value of 0.040, which leads to the acceptance of the hypothesis. This result underscores the critical role of user-friendliness in enhancing customer satisfaction, suggesting that an intuitive and easy-to-navigate user interface contributes significantly to positive user experiences in digital wallet services.

This finding aligns with the research conducted by Muhtasim et al. [38], which also emphasized the importance of user interface design, including aspects such as transaction speed and authentication mechanisms, in influencing customer satisfaction with digital wallet services. Additionally, a study by Fainusa et al. [9] found that user satisfaction with digital wallets is heavily influenced by how well the service meets personal needs and expectations, which are directly related to the user-friendliness of the service.

These results suggest that digital wallet providers should prioritize improvements in the user interface to enhance ease of use, which can lead to higher satisfaction and potentially greater customer retention and loyalty. Providers should focus on simplifying the user experience and ensuring that their platforms are accessible and straightforward to navigate, thereby addressing user needs effectively and enhancing overall satisfaction.

5. H5 (Personal Needs → E-Customer Satisfaction)

The analysis for the fifth hypothesis demonstrates that Personal Needs significantly influence E-Customer Satisfaction in digital wallet services, with a T-statistic of 2.310 and a P-value of 0.021, leading to the acceptance of this hypothesis. This finding emphasizes the importance of addressing personal needs effectively within digital wallet services to enhance customer satisfaction.

This result is consistent with recent studies highlighting the impact of personal needs on digital wallet satisfaction. A study by Sharma et al. [37] explores how personalized experiences in digital wallet usage positively affect customer satisfaction, noting the crucial role of tailored services in enhancing user engagement and satisfaction. Additionally, research by Argimbayeva et al. [36] on ADNOC's e-wallet service found that addressing personal needs through customized services significantly boosts customer satisfaction.

These findings suggest that digital wallet providers should focus on enhancing personalization features such as customizable interfaces and personalized promotions to meet individual user preferences and needs. By doing so, they can improve customer satisfaction, which is likely to lead to increased customer retention and loyalty in the competitive digital wallet market.

6. H6 (Efficiency → E-Customer Satisfaction)

The analysis conducted for the sixth hypothesis indicates that Efficiency significantly impacts E-Customer Satisfaction in digital wallet services, as evidenced by a T-statistic of 5.398 and a P-value of 0.001. This confirms the hypothesis and highlights the critical importance of efficiency in enhancing customer satisfaction within the realm of digital wallets.

This result is corroborated by recent research that underscores the influence of operational efficiency on customer satisfaction. For instance, a study by Agarwal et al. [39] examining digital wallet efficiency

determined that enhancements in transaction speed and user interface fluidity directly correlate with higher levels of customer satisfaction, reinforcing the need for efficient service delivery. Similarly, a study on virtual banking by Olasanmi [40] revealed that enhancements in operational efficiency through AI integration significantly improved customer satisfaction by offering more responsive and personalized banking experiences.

These results suggest that digital wallet providers should focus on optimizing their operational efficiencies, focusing on reducing transaction times and enhancing the responsiveness of their systems. By improving efficiency, digital wallet companies can not only enhance customer satisfaction but also increase the likelihood of continued usage and loyalty, which are crucial for maintaining competitiveness in the rapidly evolving digital payment landscape.

7. H7 (Privacy → E-Customer Satisfaction)

The analysis for the seventh hypothesis demonstrates that Privacy significantly impacts E-Customer Satisfaction in digital wallet services. This is evidenced by a T-statistic of 3.626 and a P-value of 0.001, strongly validating this hypothesis. This finding highlights the critical role of privacy in influencing customer satisfaction, suggesting that users place high importance on the protection of their personal information within digital wallet platforms.

This result aligns with recent studies which also emphasize the significance of privacy in digital financial services. A study by Muhtasim et al. [38] found that privacy details are among the crucial factors affecting customer satisfaction in digital wallet services, pointing to the need for robust privacy measures to enhance user satisfaction. Moreover, research by Stefanus Rumangkit et al. [41] showed that privacy awareness significantly influences e-wallet user satisfaction, reinforcing the necessity for digital wallet providers to prioritize user data protection.

These findings suggest that digital wallet providers should prioritize privacy as a key aspect of their service delivery. Implementing stringent data protection measures and transparent privacy policies can significantly improve customer satisfaction. This focus on privacy not only meets customer expectations but also builds trust, which is essential for retaining users in the highly competitive digital wallet market.

8. H8 (Security → E-Customer Satisfaction)

The analysis for the eighth hypothesis shows that Security significantly and positively influences E-Customer Satisfaction in digital wallet services, as evidenced by a T-statistic of 3.187 and a P-value of 0.002. This finding emphasizes the importance of robust security measures in enhancing user satisfaction, highlighting that users value the assurance that their financial transactions and personal data are secure.

Supporting this, a study by Angusamy et al. [42] on e-banking highlighted that security and privacy are key drivers of e-banking customer satisfaction. Their research indicated that enhanced security features lead to higher customer satisfaction levels by providing users with a sense of safety and trust in digital banking platforms. Additionally, research by Hammoud et al. [35] found that security and privacy have a significant impact on customer satisfaction in the Lebanese banking sector, further emphasizing the critical role of secure service delivery in achieving high customer satisfaction.

These results suggest that digital wallet providers should invest heavily in advanced security technologies and maintain high standards of data protection to enhance user satisfaction. By prioritizing security, digital wallet companies can not only improve customer satisfaction but also build trust, which is essential for retaining customers and promoting loyalty in the competitive digital payment landscape.

9. H9 (E-Customer Satisfaction → E-Customer Loyalty)

The analysis for the ninth hypothesis reveals that E-Customer Satisfaction positively influences E-Customer Loyalty in digital wallet services, as indicated by a T-statistic value of 29.318 and a P-value of 0.001. This robust validation of the hypothesis emphasizes the strong linkage between customer satisfaction and the likelihood of continued loyalty and patronage within the context of digital wallet services.

This relationship is well-supported by current research in similar areas of digital services. For example, a study by Beshir and Zelalem [43] on e-banking service quality demonstrated that customer satisfaction

significantly impacts customer loyalty, reinforcing the importance of satisfying customers to ensure their continued loyalty in the digital financial sector. Additionally, a study by Kristanto et al. [44] in the e-commerce sector in Indonesia found that customer satisfaction has a significant impact on customer loyalty, further substantiating the direct effect of satisfaction on loyalty in digital commerce environments.

These findings highlight the critical need for digital wallet providers to prioritize customer satisfaction through improved service quality, enhanced user experience, and responsive customer support. By doing so, they can significantly increase customer loyalty, which is crucial for maintaining a competitive advantage and achieving long-term success in the dynamic market of digital wallet services.

CONCLUSION

This research underscores the significant influence of service quality dimensions such as Reliability, User Friendliness, Personal Needs, Efficiency, Privacy, and Security on customer satisfaction and loyalty in the digital wallet sector, with a particular emphasis on the critical role of Security. The inclusion of Security in the modified E-Servqual model marks a significant finding, stressing security's crucial role amid increasing data protection concerns in digital transactions. The study also confirms that high customer satisfaction directly enhances loyalty, highlighting the importance of these variables in maintaining and increasing customer base in a competitive market. Additionally, examining the integration of emerging technologies like artificial intelligence and blockchain in the future works could yield further advancements in service quality.

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