INJOSE: International Journal of Strategic Enterprise and Economics

Vol. 1, No. 1, 30 April 2026, Page. 32–43

The Influence of Electronic Service Quality and Application Navigation Ease on User Satisfaction and Customer Loyalty, with Online Shopping Experience as a Moderating Variable

Fitri Aditri[1], Hulwatul Adzro[1], Ibrahim Fanji Dipura[1], Muhammad Rizky[1], Regina Aulia Ramadhani[1], Neni Alyani[1,2], M Miftahul Madya[1*]

[1]Lembaga Riset AI Creation (LRAC), Depok, Indonesia
[2]Institut Pemerintahan Dalam Negeri, Sumedang, Indonesia

*corresponding author: mmiftahulm29@gmail.com

Received 2 April 2026; Accepted 6 April 2026; Available Online 30 April 2026

Keywords:
Application Navigation Ease; Customer Loyalty; Electronic Service Quality; Online Shopping Experience; User Satisfaction

Abstract:
The rapid development of digital marketplace platforms has intensified competition and increased the importance of electronic service quality and application usability in influencing user behavior. This study aims to analyze the effect of electronic service quality and application navigation ease on user satisfaction and customer loyalty, with online shopping experience as a moderating variable. A quantitative approach was employed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with data collected from 100 respondents through a Likert scale questionnaire (1–5). The results indicate that most constructs do not meet the required validity and reliability criteria, as several indicators show low and negative outer loadings, as well as insufficient AVE and reliability values. Consequently, the proposed relationships among variables cannot be fully confirmed. These findings suggest that the main limitation lies in the measurement model. Therefore, future research should improve instrument quality and expand the sample size to obtain more robust and reliable results.

Abstrak:
Perkembangan pesat platform marketplace digital telah meningkatkan persaingan dan pentingnya kualitas layanan elektronik serta kemudahan penggunaan aplikasi dalam memengaruhi perilaku pengguna. Penelitian ini bertujuan untuk menganalisis pengaruh kualitas layanan elektronik dan kemudahan navigasi aplikasi terhadap kepuasan pengguna dan loyalitas pelanggan, dengan pengalaman belanja online sebagai variabel moderasi. Penelitian ini menggunakan pendekatan kuantitatif dengan metode Partial Least Squares Structural Equation Modeling (PLS-SEM) terhadap 100 responden melalui kuesioner skala Likert (1–5). Hasil penelitian menunjukkan bahwa sebagian besar konstruk belum memenuhi kriteria validitas dan reliabilitas, ditunjukkan oleh nilai outer loading yang rendah dan negatif serta nilai AVE dan reliabilitas yang belum memadai. Akibatnya, hubungan antar variabel belum dapat dikonfirmasi secara optimal. Temuan ini menunjukkan bahwa keterbatasan utama terletak pada model pengukuran. Oleh karena itu, penelitian selanjutnya disarankan untuk memperbaiki instrumen dan memperluas jumlah sampel.

1. INTRODUCTION

The rapid development of information and communication technology has driven significant transformations in commercial activities, particularly through digital marketplace platforms. This phenomenon has not only changed consumer behavior patterns but also intensified competition among digital service providers in attracting and retaining customers. In this context, electronic service quality (*e-service quality*) becomes a crucial factor influencing user perceptions of a platform. Service quality that is fast, responsive, and effective can enhance user satisfaction and foster long-term relationships with customers [1]. In addition, the ease of application navigation plays a vital role in creating a comfortable user experience, enabling users to easily access product information and complete transactions [2].

User satisfaction is a primary indicator in evaluating the success of digital services. A high level of satisfaction tends to encourage customer loyalty, which is reflected in repeated usage and positive word-of-mouth recommendations. In the marketplace environment, customer loyalty is a strategic asset that determines business sustainability. Therefore, companies need to understand the factors influencing user satisfaction and loyalty, including electronic service quality and application navigation ease. On the other hand, users' online shopping experience can also strengthen or weaken the relationship between these variables, as prior experience shapes user expectations and perceptions of the services provided [3].

Several previous studies have examined the relationship between electronic service quality, user satisfaction, and customer loyalty using the Partial Least Squares Structural Equation Modeling (PLS-SEM) approach, which is considered effective in analyzing complex relationships among latent variables and handling relatively small sample sizes [4]. Empirical findings indicate that electronic service quality has a positive and significant effect on user satisfaction, which subsequently impacts customer loyalty [5], while website design and navigation ease contribute to trust, satisfaction, and e-loyalty formation [6]. In the context of digital technology adoption, PLS-SEM has been widely applied to analyze user acceptance and sustainability of digital systems, as demonstrated in vocational education settings where factors such as communication, ease of use, and effectiveness significantly influence continued technology usage [7]. Similarly, studies in data-driven and AI-based learning environments reveal that perception and knowledge significantly affect

analytical competence, highlighting the robustness of PLS-SEM in validating complex constructs with strong reliability and validity measures [8]. Beyond the education sector, PLS-SEM has also been utilized to examine social and behavioral phenomena, such as the formation of tolerance through sustainable leadership, cultural intelligence, and social adaptation, confirming the method's capability in modeling multidimensional relationships [9]. Furthermore, in applied research contexts, PLS-SEM has demonstrated its effectiveness in analyzing work readiness, where program quality and mentor support significantly influence outcomes, with technological tools acting as moderating variables [10]. In the domain of digital consumer behavior, promotional strategies and social influence have been shown to significantly affect online purchase decisions, both directly and through mediating variables such as convenience [11]. Likewise, service awareness and management quality have been proven to shape user interest and behavioral outcomes, reinforcing the importance of service-related factors in influencing user engagement [12]. Studies on work readiness also highlight that environmental and motivational factors influence competence, which in turn affects readiness outcomes, further validating mediation relationships within SEM-PLS models [13]. In line with the rapid advancement of digital transformation, recent studies emphasize that technology readiness plays a significant role in driving the adoption of AI and improving organizational performance [14]. Other studies highlight that digital capability contributes to enhancing innovation capability and operational efficiency through the utilization of AI technologies, although some indicators still show limitations in validity and reliability [15]. Additionally, perceived ease of use has been identified as a key determinant in technology adoption, particularly in enhancing competitive advantage in digital startups, although variations in adoption levels remain evident among users [16]. Moreover, recent research in the field of chemistry education demonstrates that SEM-PLS is also effective in analyzing cognitive variables related to method validation, where conceptual understanding of validation objectives, parameters such as accuracy and precision, and chemometric knowledge significantly influence the implementation of analytical validation processes, with all constructs meeting validity and reliability criteria [17]. Recent studies in chemometric analysis further reveal that the implementation of simple technologies such as Orange Data Mining improves accessibility but does not necessarily enhance analytical quality without sufficient data literacy, as several indicators fail to meet validity criteria [18]. In

addition, research on spectral preprocessing using the Savitzky–Golay method indicates that although preprocessing accuracy meets reliability standards, limitations in measurement constructs still affect the evaluation of relationships within the SEM-PLS model [19]. Furthermore, other findings show that simple technology implementation can improve basic statistical understanding, yet its effectiveness in more complex analytical tasks such as outlier detection remains limited, emphasizing the importance of strengthening user competencies [20]. Collectively, these findings demonstrate that PLS-SEM is a robust analytical approach capable of explaining complex causal relationships across various domains, including digital services, education, organizational behavior, and technology adoption.

Despite the extensive body of literature examining the relationships among electronic service quality, application usability, user satisfaction, and customer loyalty, several research gaps remain evident. Most prior studies have predominantly focused on direct relationships between service quality and behavioral outcomes, with limited attention to the moderating role of users' prior online shopping experience in shaping these relationships. Furthermore, although previous research has widely applied the PLS-SEM approach across various domains, including digital services, education, and technology adoption, the integration of application navigation ease and online shopping experience within a unified model remains underexplored, particularly in the context of marketplace platforms. In addition, inconsistencies in empirical findings regarding the strength of relationships between usability-related factors and loyalty indicate the need for further investigation using a more comprehensive analytical framework. Therefore, this study aims to analyze the influence of electronic service quality and application navigation ease on user satisfaction and customer loyalty, while examining the moderating role of online shopping experience using the PLS-SEM approach. The findings are expected to contribute to the development of a more integrative model of user behavior in digital marketplaces and provide practical insights for improving service quality and user experience strategies.

2. METHOD

This study employed a quantitative research approach using the Partial Least Squares Structural Equation Modeling (PLS-SEM) method to analyze the relationships among variables. PLS-SEM was selected due to its capability to handle complex models involving multiple latent constructs and its suitability for exploratory and predictive research [21]. This

approach is also appropriate for studies with relatively small sample sizes and does not require strict assumptions of normal data distribution [22]. The research model consists of five main variables: electronic service quality (ESQ), application navigation ease (NAV), online shopping experience (EXP) as a moderating variable, user satisfaction (SAT), and customer loyalty (LOY).

Data were collected through a survey method using a structured questionnaire distributed to 100 respondents who had experience using marketplace applications. The sampling technique applied in this study was purposive sampling, targeting individuals who have engaged in online shopping activities. The questionnaire employed a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) to measure respondents' perceptions of each construct. The indicators used to measure each variable were adapted from relevant literature and are presented in detail in the variable and indicator table.

Table 1 Variable, Definition, and Indicator

Variable	Type	Code	Indicator
Electronic Service Quality (ESQ)	Independent	ESQ 1	Fast response to user requests
		ESQ 2	Effective problem resolution
		ESQ 3	Reliable and consistent online service
Application Navigation Ease (NAV)	Independent	NAV1	Easy to navigate menus and features
		NAV2	Clear and understandable interface
		NAV3	Efficient product search process
Online Shopping Experience (EXP)	Moderating	EXP1	Payment security
		EXP2	Data protection
		EXP3	Privacy protection
User Satisfaction (SAT)	Dependent	SAT1	Satisfaction with service quality
		SAT2	Satisfaction with application features
		SAT3	Overall satisfaction with shopping experience
Customer Loyalty (LOY)	Dependent	LOY1	Intention to reuse the marketplace
		LOY2	Willingness to recommend to others
		LOY3	Commitment to repeat purchases

The data analysis was conducted using the PLS-SEM technique, which involves two main stages: measurement model (outer model) evaluation and structural model (inner model) evaluation. The outer model evaluation aims to assess the validity and reliability of the constructs by examining several criteria, including outer loading, Variance Inflation Factor (VIF), Average Variance Extracted (AVE), Cronbach's Alpha, and composite reliability (rho_c) [21], [23]. These

criteria are essential to ensure that the measurement model meets the required standards for convergent validity, internal consistency, and the absence of multicollinearity.

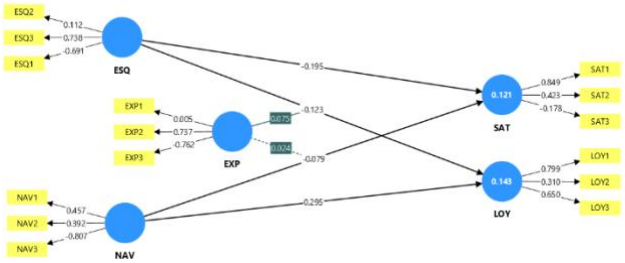

Fig. 1 Model Diagram and Intervariable Relationship

Furthermore, the structural model evaluation was conducted to examine the relationships among latent variables and to test the proposed hypotheses. The moderating effect of online shopping experience (EXP) was analyzed to determine whether it strengthens or weakens the relationship between independent variables (ESQ and NAV) and dependent variables (SAT and LOY). The use of PLS-SEM in this study allows for a comprehensive analysis of both direct and moderating effects, providing a robust framework for understanding user behavior in digital marketplace environments [22], [23].

3. RESULT AND DISCUSSION

The results of the measurement model (outer model) evaluation reveal that the majority of constructs in this study do not meet the recommended criteria for validity and reliability. Based on the outer loading values, many indicators fall below the acceptable threshold of 0.70, and several indicators even exhibit negative loading values, such as NAV3 (-0.807), EXP3 (-0.762), and SAT3 (-0.178). In the context of PLS-SEM, outer loading values below 0.70 indicate that the indicator has weak explanatory power in representing its latent construct, while negative values suggest a potential issue in indicator directionality or conceptual mismatch [24]. This condition implies that the measurement instruments used in this study are not yet capable of accurately capturing the underlying constructs, particularly in reflecting users' perceptions of marketplace service quality, navigation ease, and satisfaction.

A more detailed examination of construct validity further confirms these limitations. The Average Variance Extracted (AVE) values for all constructs are below the recommended threshold of 0.50, indicating that the constructs fail to explain more than half of the variance of their indicators. This suggests a lack of convergent validity, where indicators that are theoretically expected to measure the same construct do not sufficiently correlate with one another [24], [25]. Additionally, the Cronbach's Alpha and composite reliability (rho_c) values are below the acceptable threshold of 0.70 for most constructs, indicating weak internal consistency. This means that the indicators within each construct are not

consistently measuring the same underlying concept, which weakens the reliability of the measurement model and reduces confidence in subsequent structural analysis.

Interestingly, despite the low validity and reliability, the Variance Inflation Factor (VIF) values for all indicators remain below the critical threshold of 5.0. This indicates that multicollinearity is not a significant issue in this study, and the indicators do not exhibit excessive redundancy or high intercorrelation [26]. In other words, each indicator contributes uniquely to the model without overlapping excessively with others. However, the absence of multicollinearity does not compensate for the lack of validity and reliability. A measurement model can be free from multicollinearity yet still fail to adequately represent the constructs if the indicators themselves are weak or poorly specified.

From a theoretical standpoint, the findings of this study diverge from the majority of prior research. Previous studies consistently report that electronic service quality significantly influences user satisfaction and customer loyalty, as high-quality digital services enhance user trust and engagement [5]. Similarly, application navigation ease is widely recognized as a critical determinant of user experience, contributing to higher satisfaction and long-term loyalty [6]. However, in this study, the inability of the ESQ and NAV constructs to achieve validity and reliability suggests that these theoretical relationships cannot be properly tested. This discrepancy may stem from measurement issues rather than the absence of actual relationships among variables.

One possible explanation for these inconsistencies lies in the design of the measurement indicators. Although the indicators were conceptually aligned with previous studies, they may not have been sufficiently adapted to the specific context of the respondents. Differences in user characteristics, such as digital literacy, frequency of marketplace usage, and familiarity with application features, can significantly influence how respondents interpret questionnaire items [27]. For example, users with limited experience in online shopping may have difficulty evaluating aspects such as service responsiveness or navigation efficiency, leading to inconsistent or unreliable responses.

Another important factor to consider is the moderating variable, online shopping experience (EXP). The results show that this variable also fails to meet validity and reliability criteria, as indicated by low and negative outer loading values. This finding is particularly critical because the moderating role of experience is central to the research model. Previous studies suggest that user experience plays a significant

role in shaping perceptions, expectations, and behavioral intentions in digital environments [3], [28]. Experienced users tend to have more stable and consistent evaluations of service quality and usability, which strengthens the relationship between satisfaction and loyalty. However, in this study, the weak measurement of the EXP construct may have prevented it from functioning effectively as a moderating variable.

Furthermore, the findings related to user satisfaction (SAT) and customer loyalty (LOY) also indicate measurement weaknesses. Although a few indicators, such as SAT1, LOY1, and LOY3, meet the validity threshold, the overall constructs remain unreliable due to inconsistent indicator performance. This suggests that respondents may have differing interpretations of satisfaction and loyalty, or that these constructs are influenced by additional factors not captured in the current model. In digital marketplace contexts, satisfaction and loyalty are often shaped by a combination of service quality, price competitiveness, promotional strategies, and social influence [11], which may not have been fully accounted for in this study. From a methodological perspective, these findings highlight the importance of rigorous instrument development in SEM-PLS research. The quality of the measurement model is a prerequisite for meaningful structural analysis, as invalid or unreliable constructs can lead to biased or inconclusive results [24]. Therefore, the inability to achieve adequate measurement quality in this study limits the interpretation of causal relationships among variables and prevents further hypothesis testing in the inner model.

To address these limitations, several improvements are recommended for future research. First, researchers should refine the measurement indicators by ensuring clearer wording, better contextual relevance, and stronger alignment with theoretical constructs. Conducting a pilot study prior to the main data collection can help identify problematic indicators and improve instrument reliability. Second, increasing the sample size beyond 100 respondents may enhance the stability of parameter estimates and improve the generalizability of findings. Third, incorporating additional variables, such as trust, perceived value, or system quality, may provide a more comprehensive understanding of user behavior in digital marketplaces.

Construct & Indicator	Loading Factor	AVE	Cronbach's Alpha	rho_c	VIF
ESQ		**0.345**	**0.054**	**0.013**	
ESQ1	-0.691				**1.001**
ESQ2	0.112				1.013
ESQ3	0.738				1.012
NAV		**0.338**	**-0.093**	**0.001**	

NAV1	0.457				**1.002**
NAV2	0.392				**1.007**
NAV3	-0.807				**1.007**
EXP		**0.375**	**-0.277**	**0.000**	
EXP1	0.005				1.013
EXP2	0.737				1.017
EXP3	-0.762				1.030
SAT		**0.310**	**0.301**	**0.366**	
SAT1	0.849				1.040
SAT2	0.423				1.016
SAT3	-0.178				1.048
LOY		**0.386**	**0.292**	**0.627**	
LOY1	0.799				1.037
LOY2	0.310				1.043
LOY3	0.650				1.015
EXP x ESQ	1.000				1.000
EXP x NAV	1.000				1.000

Construct & Indicator	Description
ESQ	**Not valid and not reliable**
ESQ1	Not valid
ESQ2	Not valid
ESQ3	Valid
NAV	**Not valid and not reliable**
NAV1	Not valid
NAV2	Not valid
NAV3	Not valid
EXP	**Not valid and not reliable**
EXP1	Not valid
EXP2	Valid
EXP3	Not valid
SAT	**Not valid and not reliable**
SAT1	Valid
SAT2	Not valid
SAT3	Not valid
LOY	**Not valid and not reliable**
LOY1	Valid
LOY2	Not valid
LOY3	Valid

In conclusion, while this study adopts a robust analytical approach using PLS-SEM, the findings indicate that the measurement model requires significant improvement. The lack of validity and reliability across most constructs suggests that the current model is not yet adequate for explaining the relationships between electronic service quality, application navigation ease, user satisfaction, and customer loyalty. Nevertheless, this study provides valuable insights into the challenges of measuring user perceptions in digital environments and highlights the need for more refined and contextually appropriate research instruments in future studies.

4. CONCLUSION

This study aimed to analyze the influence of electronic service quality and application navigation ease on user satisfaction and customer loyalty, with online shopping experience as a moderating variable using the PLS-SEM approach. The findings reveal that the measurement model does not meet the required criteria for validity and reliability, as most indicators show low and inconsistent values. As a result, the proposed relationships among variables cannot be fully confirmed. These results indicate that the main limitation of this study lies in the measurement instrument rather than the conceptual framework. Therefore, future research is recommended to refine the indicators, improve data quality, and expand the sample size to obtain more reliable and valid results. Despite these limitations, this study provides initial insights into the challenges of measuring user perceptions in digital marketplace contexts and highlights the

importance of robust instrument development in SEM-PLS research.

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