




Research Article

# The Impact of E-Service Quality on Users' Continuous Usage Intention: The Mediating Roles of E-User Satisfaction and E-User Engagement

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## Abstract

With the rapid development of e-commerce, understanding the factors that influence users' continuous usage intention has become increasingly important for online platforms. Although prior studies have widely examined service quality and user behavior, the underlying mechanisms through which electronic service quality affects users' continued usage intention remain insufficiently explored. Therefore, this study investigates the relationships among e-service quality (ESQ), e-user satisfaction (EUS), e-user engagement (EUE), and continuous usage intention (CUI). A quantitative research approach was adopted, and data were collected through an online questionnaire survey. A total of 297 valid responses were obtained from individuals with prior experience using e-commerce platforms. The proposed research model and hypotheses were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS. The empirical results indicate that ESQ has a significant positive impact on both EUS and EUE. Furthermore, EUS and EUE positively influence CUI. The mediation analysis also reveals that both EUS and EUE play significant mediating roles in the relationship between ESQ and CUI. These findings provide important insights for e-commerce platforms by highlighting the critical role of service quality in enhancing user satisfaction and engagement, which ultimately strengthens users' intention to continue using online services. The study contributes to the existing literature on digital service management and offers practical implications for improving user retention in the e-commerce environment.

## Keywords

E-service Quality, E-user Satisfaction, E-user Engagement, Continuous Usage Intention, PLS-SEM

## 1. Introduction

The rapid evolution of digital technology and widespread internet adoption have made business-to-consumer (B2C) e-commerce platforms a central avenue for consumers to obtain goods and services. Major platforms such as Amazon, Taobao,

and eBay have transformed traditional shopping patterns by providing convenient access, diverse product offerings, and efficient purchasing processes. In today's highly competitive

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online environment, attracting new users is no longer sufficient; retaining existing users and encouraging their continuous engagement have become equally critical for sustainable platform development.

As a result, continuous usage intention (CUI) has emerged as an important research topic in e-commerce studies. CUI refers to a user's intention to continue using a platform after initial adoption and is a key determinant of long-term platform success. Prior research suggests that service-related factors play a crucial role in shaping post-adoption user behavior. Among these, e-service quality (ESQ), which reflects users' overall evaluation of service performance in online environments, has been widely identified as a critical determinant of user perceptions and behavioral intentions.

However, although existing studies have confirmed the significant role of service quality in influencing user satisfaction and continuance intention, the underlying mechanisms through which ESQ affects CUI remain insufficiently explored. In particular, limited research has examined the simultaneous mediating roles of e-user satisfaction (EUS) and e-user engagement (EUE) in explaining how service quality translates into sustained platform usage. Understanding these psychological mechanisms is essential for a more comprehensive explanation of user retention in e-commerce contexts.

To address this gap in the literature, this study develops an integrated research model to investigate the impact of ESQ on CUI in B2C e-commerce. Specifically, the study examines both the direct effect of ESQ on CUI and the indirect effects mediated by EUS and EUE.

This study makes several important contributions. First, it extends the existing literature by incorporating both user satisfaction and user engagement as parallel mediating variables, thereby enriching the application of Expectation Confirmation Theory (ECT) in digital service contexts. Second, it provides empirical evidence on the role of ESQ in shaping users' long-term behavioral intentions. From a practical perspective, the findings offer valuable insights for e-commerce platform managers seeking to enhance service quality and improve user retention.

## 2. Theoretical Foundation and Hypotheses Development

### 2.1. The Direct Effect of ESQ on CUI

ESQ represents a critical determinant of user behavior and platform sustainability in the digital marketplace. It is conceptualized as a multidimensional construct that evaluates the efficiency, fulfillment, and privacy of online interactions [1, 2]. From the perspective of ECT, high-quality digital services constitute a primary source of user validation. When a B2C e-commerce platform delivers reliable information and facilitates seamless transaction processes, it significantly reduces users' cognitive load and perceived risk associated with online

shopping.

Furthermore, superior service quality functions as a positive signal of organizational competence. As users experience consistent service excellence such as rapid system response and robust data security, they develop a sense of cognitive lock-in and trust toward the platform [3]. Conversely, technical failures or poor support services generate friction that prompts users to explore alternative platforms, leading to attrition. In competitive e-commerce environments where switching costs are minimal, the superior performance of ESQ becomes a key driver in transforming a one-time transaction into a long-term behavioral habit. Therefore, consistent with the logic that service excellence reinforces user persistence, the following hypothesis is proposed:

H1: ESQ has a significant positive effect on CUI.

### 2.2. The Direct Effect of ESQ on EUS

In the contemporary e-commerce environment, the relationship between ESQ and EUS is of substantial theoretical and practical relevance. Academic literature widely recognizes ESQ as a foundational antecedent of EUS, as the quality of digital interaction directly determines the extent to which actual service performance aligns with user expectations [2, 4]. As a multidimensional construct encompassing functionality, security, fulfillment, and timeliness, ESQ shapes the overall cognitive and affective evaluation of the platform.

Theoretical frameworks such as the ECT suggest that service quality factors, including delivery efficiency and information usability, significantly enhance user attitudes toward e-commerce platforms, thereby fostering higher levels of satisfaction [5]. Empirical evidence across various digital domains further substantiates this link, suggesting that dimensions such as interface usability and responsive support are critical predictors of user satisfaction [6, 7]. When users perceive that a B2C e-commerce platform provides reliable problem-solving and robust privacy protection, their psychological fulfillment increases, reinforcing their overall positive evaluation of the service experience.

Notably, the impact of ESQ on satisfaction extends from general functional attributes, such as order accuracy and delivery speed, to emotional pathways involving personalized support and trust [8]. Collectively, these theoretical and empirical insights indicate that high-quality service delivery plays a crucial role in generating user satisfaction in competitive digital markets. Building upon this consensus, the current study proposes the following hypothesis:

H2: ESQ has a significant positive effect on EUS.

### 2.3. The Direct Effect of ESQ on EUE

EUE represents the degree of cognitive, emotional, and behavioral investment that users dedicate during their interactions with a digital platform [9, 10]. In the B2C e-commerce landscape, ESQ serves as a fundamental catalyst for fostering

such engagement. When a platform excels in core dimensions like system responsiveness, reliability, and technical efficiency, it significantly lowers usage barriers and enhances the perceived value of the interaction [2]. This seamless experience encourages users to transcend passive browsing and transition into a more active state of exploration and participation.

Theoretical perspectives on user engagement suggest that superior service quality fulfills both the functional and emotional needs of the user, thereby motivating deeper platform involvement [11]. For instance, when users perceive that an e-commerce marketplace provides consistent and efficient support, they are more likely to invest sustained attention and develop an emotional connection with the platform interface [3]. Conversely, technical instability or poor service delivery can interrupt the user's flow and discourage engagement.

Empirical studies across various digital service contexts consistently support the role of ESQ as a robust antecedent of EUE. High levels of platform usability and trust, derived from superior service quality, have been shown to facilitate more frequent content interactions and stronger psychological involvement among diverse user segments [6, 7]. By providing a reliable and responsive environment, e-commerce platforms can cultivate a state of vigor and dedication in their users, leading to a more profound and enduring engagement. Based on these insights, the current study proposes the following hypothesis:

H3: ESQ has a significant positive effect on EUE.

## 2.4. The Direct Effect of EUS on CUI

EUS has been widely recognized as a crucial determinant of user behavioral intentions in the digital environment, including loyalty, repurchase intention, and CUI [7]. When users are satisfied with their experiences on e-commerce platforms, they are more likely to develop a positive attitude towards the platform and maintain a long-term usage relationship [3]. Conversely, dissatisfaction may lead users to reconsider their current choices and seek alternative platforms that better meet their expectations, thereby directly reducing their intention to continue using the incumbent service [6].

Previous research has confirmed a significant positive relationship between user satisfaction and CUI in various online service contexts. In the specific context of e-commerce marketplaces, Kim & Yum [3] provided direct empirical evidence with a sample of 311 users, confirming that EUS is a robust predictor of CUI with a statistically significant path coefficient. Similar findings have been reported in cross-cultural e-commerce environments. For instance, satisfaction was found to significantly mediate the path toward behavioral intentions among Vietnamese online shoppers [7]. Furthermore, it was verified that satisfaction positively drives repurchase intention (a core component of CUI) among Generation Z consumers in Vietnam [6]. Collectively, these studies consistently indicate that satisfaction is a key antecedent of continued usage behavior in digital marketplaces. Therefore, based on the existing

literature, this study proposes the following hypothesis regarding the relationship between EUS and CUI in the e-commerce marketplace platform:

H4: EUS has a significant positive effect on CUI.

## 2.5. The Direct Effect of EUE on CUI

EUE is a critical determinant in shaping users' behavioral intentions and fostering long-term relationships with digital platforms. It encapsulates the degree of psychological involvement, emotional connection, and active participation during online interactions [10]. In the competitive e-commerce landscape, higher engagement levels typically strengthen a user's affective attachment to a platform. When users are deeply engaged, they show sustained attention and active participation, and develop a sense of familiarity and routine. This increases the psychological cost of switching to alternative platforms [11].

Theoretical insights suggest that engagement serves as a precursor to behavioral persistence. As users invest more cognitive and emotional resources into a platform, they move beyond transactional interactions to a state of immersion, which significantly enhances their likelihood of sustained use over time [3]. Conversely, low engagement levels often indicate a lack of interest, weakening the user's motivation to maintain ongoing interactions and ultimately leading to platform abandonment [6].

Empirical research across diverse online settings, including digital services and e-commerce marketplaces, consistently indicates that engaged users exhibit a stronger propensity to persist in using relevant platforms. This relationship is particularly evident in environments where user participation and emotional connection reinforce a user's commitment to the service provider [7]. By cultivating a multidimensional engagement state involving both cognitive absorption and emotional identification, e-commerce platforms can effectively retain users and encourage long-term behavioral habits. Accordingly, this study proposes the following hypothesis:

H5: EUE has a significant positive effect on CUI.

## 2.6. The Mediating Effect of EUS

In digital contexts, EUS is critical to revealing how users convert service performance evaluations into future behavioral intentions. Consumer behavior theories indicate perceived service quality often influences continuance intention indirectly through an evaluative mediation process, where users form affective judgments based on cumulative service interactions that guide their continuance decisions.

High-quality e-commerce platform services confirm user expectations and boost psychological fulfillment; elevated EUS strengthens users' emotional connection with the platform and reduces the cognitive cost of switching to alternatives, while poor service experiences weaken users' continuance motivation by undermining this evaluative basis.

Prior research in online service fields verifies EUS as a key intervening variable linking initial service perceptions to long-term loyalty. In B2C e-commerce, ESQ acts as the external functional stimulus, and EUS serves as the internal psychological response

driving continuance behavior. Accordingly, this study proposes:

H6: EUS positively mediates the relationship between ESQ and CUI.

*Table 1. Sample characteristics.*

Control variables	Category	Frequency	Percentage
Gender	Male	158	53.20%
	Female	139	46.80%
Age Group	Under 20	21	7.07%
	20-29	85	28.62%
	30-39	93	31.31%
	40-49	45	15.15%
	50 and above	53	17.85%
Education	High school	15	5.05%
	College degree	126	42.42%
	Bachelor's degree	140	47.14%
	Master's degree and above	16	5.39%
Occupation	Student	21	7.07%
	Government staff	20	6.73%
	Enterprise employee	114	38.38%
	Individual business owner	69	23.23%
	Freelancer	41	13.80%
	Retired	32	10.77%
Online Shopping Frequency	Almost every day	30	10.10%
	3-6 times a week	42	14.14%
	1-2 times a week	48	16.16%
	1-3 times a month	96	32.32%
	1-2 times a quarter	60	20.20%
	Once every six months or more	21	7.07%

## 2.7. The Mediating Effect of EUE

In digital contexts, EUE is a crucial psychological pathway linking perceived service quality to long-term behavioral intentions, reflecting the intensity of users' cognitive, emotional and behavioral investment in digital service interactions [10]. User immersion logic holds that service quality provides environmental cues for deeper user involvement beyond mere transaction facilitation.

High ESQ (e.g., seamless navigation, responsive support)

drives users from passive usage to active participation, generating a platform "lock-in" effect that integrates the service into their digital routine and strengthens continuance intention. By contrast, poor service experiences reduce user involvement and weaken their psychological attachment to the platform.

Prior information systems research confirms engagement constructs as essential for converting external service stimuli into behavioral persistence [2, 3]. Thus, in e-commerce contexts, EUE acts as an intervening variable reflecting the motivational transition from quality perception to sustained behavior. Accordingly, the following hypothesis is proposed:

H7: EUE positively mediates the relationship between ESQ and CUI.

Figure 1 shows the conceptual model and the hypotheses.

### 3. Methodology

This section presents the research methodology adopted in this study. It explains the research design, measurement instruments, data collection procedure, and statistical techniques applied for empirical analysis. Partial Least Squares Structural Equation Modeling (PLS-SEM) was employed to examine the relationships among the constructs.

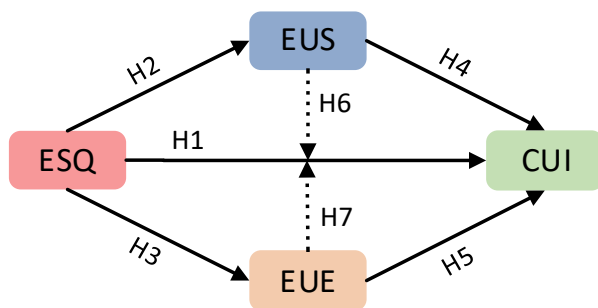


Figure 1. Conceptual model.

#### 3.1. Methodology Design

This research employed PLS-SEM as its primary analytical technique. The objective was to thoroughly investigate the underlying relationships among latent variables using a dataset consisting of 297 responses. PLS-SEM offers considerable benefits over conventional covariance-based SEM, particularly when analyzing intricate theoretical models that involve multiple mediating pathways [12]. Furthermore, this method does not impose the strict requirement of normally distributed data, making it exceptionally well-suited for the predictive objectives of this study concerning user behavior in B2C e-commerce.

For the data analysis, the SmartPLS 4.0 software was utilized throughout the study. The analytical procedure encompassed two main phases. Initially, the measurement model was assessed by computing Cronbach's alpha, composite reliability (CR), and average variance extracted (AVE) to confirm the scale's reliability and validity. Subsequently, the structural model was tested. This involved applying a Bootstrapping algorithm with 5,000 resamples to derive T-statistics and significance levels (p-values) for each hypothesized path based on the sample of 297 respondents. The software's statistical capabilities were also used to describe the sample's demographic distribution, ensuring uniformity and methodological rigor across the entire research process.

#### 3.2. Construct Measurement and Control Variables

The measurement instruments employed in this study were adapted from previously validated scales to ensure content validity and contextual relevance within the B2C e-commerce environment. Minor wording modifications were introduced to align the original measurement items with online shopping scenarios while preserving their conceptual meanings.

ESQ was measured using items adapted from [2, 3, 7], focusing on electronic service performance and online platform quality. These scales were originally developed by Kim & Yum [3], Xiang et al [2], and Tran & Vu [7]. The selected items capture key service dimensions including responsiveness, problem resolution, after-sales support, and privacy protection.

EUE was assessed using items adapted from established research on user engagement in digital platforms. The items reflect users' focused attention, aesthetic appeal, and perceived interactivity during platform usage.

EUS was measured using items derived from established satisfaction scales in digital commerce research, primarily adapted from [2, 3, 7, 13]. These items evaluate users' overall evaluation of platform performance and fulfillment of shopping expectations.

CUI was operationalized using items adapted from [3, 13]. Specifically, these scales were developed by Kim & Yum [3] and Teo et al. [13] to capture users' willingness to continue using and increase purchasing activities through the platform.

Following standard research practice, we included gender, age, education, and online shopping experience as control variables to account for individual differences affecting behavioral intentions. All constructs were measured on a seven-point Likert scale (from 1 = strongly disagree to 7 = strongly agree). This scale captures more nuanced responses and provides greater data variability, thereby improving the sensitivity and robustness of the analysis.

#### 3.3. Data Collection Procedure

This study employed an online questionnaire distributed via "Questionnaire Star" ([www.wjx.com](http://www.wjx.com)), a survey platform widely used for academic research in China. To ensure that participants could provide relevant feedback, the study only included individuals with prior experience using B2C e-commerce platform. After data collection, the dataset underwent a rigorous screening process to maintain high data quality. Responses with missing data, repetitive patterns, or clear inconsistencies were excluded. The remaining valid responses were used in the subsequent empirical analysis.

The final sample size was sufficient for analysis using PLS-SEM. Established methodological guidelines recommend that the number of observations should be at least ten times the largest number of structural paths pointing to any latent variable. The collected sample meets this criterion, thereby ensuring

ing adequate statistical power for model estimation and hypothesis testing.

Prior to launching the main survey, a pilot test was conducted with a small group of e-commerce users to evaluate the clarity and accuracy of the questionnaire items. Based on the feedback received, minor wording adjustments were made to improve comprehension and measurement reliability. The survey was administered anonymously, and all participants were informed of the academic purpose of the study before their participation.

Table 1 summarizes the demographic characteristics of the sample population.

### 3.4. Common Method Variance

Since all constructs in this study were measured using self-reported data collected through a single questionnaire, the potential issue of common method variance (CMV) was carefully assessed through both procedural and statistical remedies.

At the procedural stage, several measures were implemented to minimize potential bias. Respondents were informed that participation was voluntary and anonymous, thereby reducing evaluation apprehension and socially desirable responding. In addition, measurement items were adapted from established studies and arranged in a mixed order to lessen respondents' tendency toward consistent answering patterns.

From a statistical perspective, the full collinearity assessment proposed by Kock [14] was conducted using SmartPLS. Variance inflation factor (VIF) values were calculated for all latent constructs. The results indicated that all VIF values were below the recommended threshold of 3.3, suggesting that common method variance does not pose a serious threat to the validity of the research model.

Therefore, common method bias is unlikely to substantially influence the empirical findings of this study.

## 4. Results and Discussions

### 4.1. Evaluating the Measurement Model

The measurement model was tested for internal consistency reliability, convergent validity and discriminant validity (results in Table 2, and Table 3) to verify the research instrument's reliability and validity.

Cronbach's alpha and CR were used to assess internal consistency reliability. As shown in Table 2, all Cronbach's alpha coefficients ranged from 0.705 (CUI) to 0.834 (EUS), all exceeding the 0.70 threshold [15]; CR values were 0.835 (CUI) to 0.883 (EUS), falling within the ideal 0.70 - 0.95 range, indicating strong internal consistency and high indicator reliability for all constructs.

Factor loadings (FL) and average variance extracted (AVE) were adopted to evaluate convergent validity per Hair et al. (2019) criteria (FL  $\geq$  0.708, AVE  $\geq$  0.50). Table 2 shows all

item FLs ranged from 0.761 (EUS3) to 0.815 (CUI1), above the 0.708 minimum; AVE values of all constructs were 0.602 (EUS) to 0.629 (CUI), exceeding the 0.50 benchmark. This confirms satisfactory convergent validity, as the corresponding latent constructs explain over half the variance of observed indicators.

To assess discriminant validity, which reflects the degree to which a construct is empirically differentiated from other constructs within the model, the Fornell-Larcker criterion was applied [16]. This approach requires that the square root of the AVE for each latent variable be greater than its absolute correlations with all remaining constructs. As shown in Table 3, the diagonal elements (in bold) represent the square roots of the AVEs, varying between 0.776 (EUS) and 0.793 (CUI). These values are consistently higher than the correlations observed between constructs, which range from 0.732 to 0.774. The results therefore provide evidence of discriminant validity, indicating that the constructs are distinct both conceptually and empirically.

In summary, the measurement model meets the requirements of reliability and validity, providing a solid foundation for the subsequent assessment of the structural model and hypothesis testing

### 4.2. Hypotheses Testing by PLS-SEM

After verifying the measurement model's reliability and validity, the structural model was evaluated to test the hypothesized relationships, including assessments of model fit, predictive accuracy ( $R^2$ ), effect size ( $f^2$ ), collinearity, and hypothesis testing.

The Standardized Root Mean Square Residual (SRMR) was used to measure overall model fit. The SRMR values for the saturated and estimated models were 0.062 and 0.074, respectively, both below the 0.08 threshold, indicating the structural model fits the observed data satisfactorily [17].

The coefficient of determination ( $R^2$ ) was adopted to assess explanatory capacity (Table 4). The  $R^2$  values for EUE, EUS and CUI were 0.590, 0.599 and 0.666, respectively, all exceeding the 0.50 benchmark for substantial explanatory strength [15]. ESQ explained 59.0% of the variance in EUE and 59.9% in EUS, while ESQ, EUS and EUE together accounted for 66.6% of the variance in CUI, demonstrating the model's strong explanatory power for endogenous variables.

$f^2$  were used to evaluate the practical significance of path coefficients (Table 4). The  $f^2$  value of ESQ on EUE (1.442) and ESQ on EUS (1.494) both exceeded 0.35, indicating a large effect [15]. By contrast, the  $f^2$  values of ESQ on CUI (0.075) and EUE on CUI (0.056) fell within the 0.02–0.15 range (small effect), and EUS on CUI (0.141) was slightly below the 0.15 cutoff for moderate effect (near-moderate). Overall, ESQ exerts a strong practical impact on EUE and EUS, while the effects of ESQ, EUE and EUS on CUI are relatively minor (small to near-moderate). Fourth, multicollinearity

among latent constructs was examined using the VIF. As indicated by the results, all inner model VIF values ranged from 1.000 to 3.084. These figures are well below the conservative threshold of 3.30, confirming that multicollinearity is not a concern [14, 15]. Furthermore, the absence of high collinearity (all VIFs < 3.3) also serves as a robust indicator that CMV does not threaten the study's internal validity.

Finally, the study employed a bootstrapping technique with

5,000 resamples to test the proposed hypotheses. This procedure generated robust t-statistics, corresponding p-values, and bias-corrected 95% confidence intervals (CIs). Consistent with the recommendations of Hair et al., a hypothesis was deemed supported if the 95% CI for its path coefficient did not include zero and the absolute t-value was greater than 1.960 ( $p < 0.05$ ) or 2.576 ( $p < 0.01$ ). The outcomes of the hypothesis tests, detailed in Table 5, show that all hypotheses concerning direct effects received support.

**Table 2.** Measurement of construct.

Construct	Item	FL	CR	AVE	$\alpha$
ESQ	ESQ1	0.784	0.868	0.622	0.798
	ESQ2	0.789			
	ESQ3	0.796			
	ESQ4	0.786			
EUE	EUE1	0.786	0.868	0.621	0.797
	EUE2	0.776			
	EUE3	0.800			
	EUE4	0.790			
EUS	EUS1	0.804	0.883	0.602	0.834
	EUS2	0.763			
	EUS3	0.761			
	EUS4	0.784			
	EUS5	0.766			
CUI	CUI1	0.815	0.835	0.629	0.705
	CUI2	0.792			
	CUI3	0.771			

Note: FL = Factor loadings, CR = Composite reliability, AVE = Average variance extracted,  $\alpha$  = Cronbach's alpha.

**Table 3.** Result of discriminant validity measures.

	CUI	ESQ	EUE	EUS
CUI	0.793			
ESQ	0.748	0.789		
EUE	0.732	0.768	0.788	
EUS	0.768	0.774	0.760	0.776

Note: Discriminant validity is established if the square root of AVE for each construct is greater than the inter-construct correlations.

### 4.3. Mediation Analysis

To further examine the mediating effects in the proposed model, a bootstrapping procedure with 5,000 resamples was conducted using SmartPLS. The results were used to assess the indirect effects of ESQ on CUI through EUS and EUE.

The results indicated that the indirect effect of ESQ on CUI through EUS is significant ( $\beta = 0.290$ ,  $t = 6.017$ ,  $p < 0.05$ ), supporting the mediating role of EUS. Similarly, the indirect effect of ESQ on CUI through EUE is also significant ( $\beta = 0.179$ ,  $t = 2.988$ ,  $p < 0.05$ ), confirming the mediating role of EUE.

The mediation effect of EUS indicates that ESQ influences CUI indirectly through users' post-consumption evaluations. High-quality services enhance users' satisfaction, which in turn increases their likelihood of continued usage.

Meanwhile, the mediating role of EUE suggests that service quality also promotes continuance intention by enhancing users' involvement and interaction with the platform. Increased engagement strengthens users' attachment, thereby encouraging sustained usage behavior.

Overall, these findings demonstrate that ESQ affects CUI not only directly but also through multiple psychological mechanisms, providing a more comprehensive explanation of user behavior in e-commerce contexts.

## 5. Implications, Limitations and Future Work

### 5.1. Theoretical Implications

The confirmation of H1 - H3 underscores ESQ's pivotal role in promoting CUI and enhancing EUS and EUE, consistent with ECT. ESQ influences CUI through two pathways: directly reducing cognitive load and perceived risk, and indirectly via EUS and EUE, which are key to long-term user commitment. The validation of H4 and H5 shows that EUS and EUE have positive effects on CUI. This result is consistent with the findings of Kim & Yum [3]. It highlights the synergistic mechanism of ESQ, EUS, and EUE for user retention in competitive e-commerce.

The mediating roles of EUS and EUE in H6 - H7 align with ECT's focus on psychological validation. The total indirect effect of ESQ on CUI (0.469) exceeds the direct effect (0.278), emphasizing EUS and EUE as core transmission channels. This enriches ECT by revealing that service quality primarily shapes continuance intention through users' emotional evaluations (satisfaction) and motivational engagement.

**Table 4.** Model fit, explanatory power and effect size.

Assessment type	Indicator	Value	Criterion	Criterion
SRMR	Saturated model	0.062	< 0.08	Excellent
	Estimated model	0.074	< 0.08	Good
$R^2$	EUE	0.590	> 0.50 = High explanatory power	High
	EUS	0.599	> 0.50 = High explanatory power	High
	CUI	0.666	> 0.50 = High explanatory power	Excellent
$f^2$	ESQ → EUE	1.442	> 0.35 = Large effect	Large
	ESQ → EUS	1.494	> 0.35 = Large effect	Large
	ESQ → CUI	0.075	0.02 – 0.15 = Small effect	Small
	EUE → CUI	0.056	0.02 – 0.15 = Small effect	Small
	EUS → CUI	0.141	Close to 0.15 = Near-moderate effect	Near-moderate

Note: Bootstrap samples = 5000 for all structural model tests.

The mediating roles of EUS and EUE proposed in H6 and H7 further enrich the application of ECT [18, 19]. The total indirect effect of ESQ on CUI (0.469) is stronger than the direct effect (0.278), indicating that EUS and EUE serve as key psychological channels. In other words, ESQ mainly promotes CUI by improving users' emotional evaluation (satisfaction) and motivational state (engagement).

Consistent with theoretical predictions, EUS ( $\beta = 0.290$ ) and EUE ( $\beta = 0.179$ ) act as parallel mediators, with EUS exerting a stronger effect: satisfaction reflects immediate expectation confirmation, while engagement requires deeper cognitive-emotional investment. This underscores the need for e-commerce platforms to adopt a dual-focused strategy based on the ECT framework.

Notably, the model explains 66.6% of CUI variance ( $R^2 = 0.666$ ), validating its conceptual soundness and advancing prior single-mediator studies [2]. Empirical support for the ESQ-EUS/EUE-CUI pathway among Chinese users reinforces cross-cultural applicability, enhancing ECT’s generalizability across diverse sociocultural contexts.

In summary, the findings advance e-commerce user behavior research by uncovering parallel mediating mechanisms and confirming cross-cultural validity, offering a nuanced understanding of how ESQ fosters long-term user loyalty through the lens of ECT.

### 5.2. Practical Implications

The empirical results provide actionable insights for B2C e-commerce platform, operational teams, and regulators to enhance user loyalty and sustainable development.

In the competitive landscape of B2C e-commerce, operators must place a high priority on ESQ and EUS as well as EUE to ensure customer retention. Kim & Yum [3] indicate that ESQ influences CUI through two pathways: a direct effect by lowering perceived risk, and an indirect effect mediated by EUS and EUE. Notably, the total indirect impact (0.469) is greater than the direct effect (0.278), underscoring ESQ’s fundamental role in maintaining a user base. To achieve this, companies should concentrate their investments on essential assets such as enhancing digital infrastructure (for instance, improving system speed), reinforcing data privacy measures, and streamlining after-sales support. Implementing solutions like AI-driven customer support and advanced security systems can directly enhance EUS and EUE, thereby justifying strategic

resource investment aimed at fostering long-term loyalty.

For operational teams and frontline staff, EUS (mediating effect = 0.290) and EUE (0.179) require targeted alignment. Teams need training in user-centric communication (proactive problem-solving, empathetic feedback) to elevate satisfaction. Additionally, design concise engagement initiatives (personalized recommendations, interactive feedback channels) to deepen users’ cognitive and emotional involvement, supporting sustained retention.

For regulators, establishing standardized ESQ evaluation frameworks (covering responsiveness, privacy, after-sales) can guide platform service standardization. Initiatives like funding user-centric service tech research and incentivizing high ESQ ratings (e.g., policy preferences) will drive industry progress. Promoting industry-academia collaboration to share best practices ensures e-commerce growth aligns with consumer rights protection and market order.

### 5.3. Limitations and Future Work

This study enhances the understanding of how ESQ contributes to CUI through the parallel mediation of EUS and EUE, based on ECT, and provides theoretical and empirical insights to refine e-commerce service practices for improved user retention. However, it should be noted that the results may differ due to regional cultural differences, data collection characteristics, and methodological choices. This study also has limitations, such as relying solely on cross-sectional data from Chinese B2C e-commerce users, which may restrict the generalizability of the findings.

*Table 5. Hypotheses testing and mediation analysis.*

Path	$\beta$	SD	t-value	p-value	LLCI	ULCI	Results
<i>Direct effects</i>							
H1: ESQ→CUI	0.278	0.069	4.006	0.000***	0.145	0.419	Accept
H2: ESQ→EUS	0.774	0.023	33.084	0.000***	0.726	0.818	Accept
H3: ESQ→EUE	0.768	0.026	29.668	0.000***	0.716	0.817	Accept
H4: EUS→CUI	0.375	0.062	6.007	0.000***	0.251	0.495	Accept
H5: EUE→CUI	0.233	0.076	3.046	0.002**	0.082	0.385	Accept
<i>Indirect effects</i>							
H6: ESQ→EUS→CUI	0.290	0.048	6.017	0.000***	0.195	0.386	Accept
H7: ESQ→EUE→CUI	0.179	0.060	2.988	0.003**	0.062	0.299	Accept
<i>Total indirect effect</i>							
ESQ→CUI	0.469	0.059	7.929	0.000***	0.355	0.585	Accept

Note: \*\*\* means  $p < 0.001$  (two-tailed,  $t > 3.291$ ), \*\* means  $p < 0.01$  (two-tailed,  $t > 2.576$ ).  $\beta$  = Standardized path coefficient, SD = Standard deviation, t = t-value, p = p-value, LLCI = Lower limit of 95% confidence interval, ULCI = Upper limit of 95% confidence interval. All confidence intervals exclude zero, confirming significant effects.

Future research will investigate the ESQ-CUI mechanism in varied cultural and regional contexts, employ longitudinal datasets to capture long-term dynamic changes in user behavior, and assess the model using mixed methodological approaches (e.g., case studies, quantitative replication) for cross-validation. Furthermore, besides the current parallel mediation framework, future studies could explore potential moderating variables (e.g., user age, platform type, online shopping experience) and investigate potential side effects (e.g., excessive service interactions leading to user fatigue), thereby enhancing the completeness, validity, and generalizability of the findings.

## Abbreviations

AVE	Average Variance Extracted
B2C	Business-to-consumer
CIs	Confidence Intervals
CMV	Common Method Variance
CR	Composite Reliability
CUI	Continuous Usage Intention
ECT	Expectation Confirmation Theory
ESQ	E-Service Quality
EUE	E-User Engagement
EUS	E-User Satisfaction
$f^2$	Effect Size
FL	Factor Loadings
LLCI	Lower Limit of Confidence Interval
PLS-SEM	Partial Least Squares Structural Equation Modeling
$R^2$	Coefficient of Determination
SRMR	Standardized Root Mean Square Residual
ULCI	Upper Limit of Confidence Interval
VIF	Variance Inflation Factor
$\alpha$	Cronbach's $\alpha$

## Author Contributions

**Haoyang Lv:** Writing – original draft, Data curation, Formal analysis, Investigation, Methodology, Validation, Visualization

**Xinyang Xiao:** Project administration, Visualization, Writing – review & editing

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## Data Availability Statement

The data which support the findings of this study can be found at: <https://doi.org/10.6084/m9.figshare.31991193>

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## Conflicts of Interest

The authors declare no conflicts of interest.

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