

THE MEDIATING ROLE OF CUSTOMER SATISFACTION ON THE IMPACT OF LAST MILE DELIVERY QUALITY ON E-COMMERCE CUSTOMER LOYALTY IN VIETNAM

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Abstract: *This study assesses the impact of last-mile delivery quality on e-commerce customer loyalty, examining the mediating role of customer satisfaction. The authors develop and distribute a questionnaire survey to investigate the extent of the effect of last-mile delivery on e-commerce customer loyalty through e-commerce customer satisfaction in Vietnam. Relying on Logistics Service Quality (LSQ) and Service Quality (SERVQUAL) models, the Partial Least Squares Structural Equation Modeling method (PLS-SEM) is employed to identify the positive direct impacts of five last mile delivery quality dimensions (timeliness, information quality, assurance, responsiveness, and reliability) on e-commerce customer satisfaction. Customer satisfaction, in turn, demonstrates a positive direct relationship with customer loyalty. Importantly, the study identifies e-commerce customer satisfaction as a mediating factor through which the five last-mile delivery quality dimensions indirectly influence customer loyalty. These findings provide evidence and insights for relevant parties, including Vietnam's government and last-mile couriers, to effectively enhance the e-commerce business in Vietnam with a greater focus on last-mile delivery dimensions.*

• Keywords: e-commerce, customer satisfaction, customer loyalty, last mile delivery, partial least squares structural equation modeling.

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1. Introduction

The rapid expansion of Vietnam's business-to-consumer (B2C) e-commerce sector in recent years has fueled the growth of several related industries, particularly e-commerce logistics. Among these, the quality of last-mile delivery (LMD) has emerged as a critical consideration for online shoppers (Vaast, 2017), given its implications for supply chain infrastructure, operational efficiency, and overall business performance (Hoang, 2019).

Customer loyalty plays a vital role in the profitability and long-term growth of e-retailers, with repeat buyers accounting for approximately 40% of sales revenue (Rosen, 2001). Simultaneously, customer satisfaction is widely acknowledged as a key driver of loyalty (Luarn and Lin, 2003). As a result, e-retailers are increasingly leveraging logistics strategies to enhance fulfillment and delivery services, aiming to improve consumer experiences (Xiao, Wang, and Liu, 2018). Importantly, LMD constitutes the only phase in the e-commerce supply chain

involving direct customer interaction, making it a pivotal determinant of how both the logistics service and the retailer's fulfillment capabilities are perceived (Boyer, Prud'homme, and Chung, 2009).

The connection between LMD quality and both e-customer satisfaction (CSAT) and e-customer loyalty (CLOY) has garnered substantial interest from scholars and practitioners across marketing, logistics, and online business disciplines. Prior research confirms that LMD quality positively affects CSAT in the context of e-commerce (Tran et al., 2022; Vakulenko et al., 2019), while also establishing a significant link between LMD and customer loyalty (Hafez, Elakkad, and Gamil, 2021).

This study investigates the impact of LMD quality on e-commerce customer loyalty, mediated by customer satisfaction, within the Vietnamese B2C market. A mixed-methods approach was adopted, including qualitative analysis of prior studies to construct the research model, followed by

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quantitative validation using PLS-SEM to analyze survey data in the final research phase.

2. Research model hypotheses

Mentzer et al. (1999) introduced the Logistics Service Quality (LSQ) model using an integrated logistics approach, identifying nine dimensions. These were later grouped into *technical quality* (timeliness, order quality, order condition, order accuracy, and order release quantities) and *functional quality* (personnel contact, information quality, ordering procedure, and discrepancy handling) (Rafiq and Jaafar, 2007). In parallel, Parasuraman et al. (1988) developed the SERVQUAL model, a foundational framework in service quality assessment, comprising five dimensions: tangibles, reliability, responsiveness, assurance, and empathy.

Drawing on these two models, this study develops an integrated framework to assess the relationships among last-mile delivery (LMD) service quality, e-commerce customer satisfaction (CSAT), and e-commerce customer loyalty (CLOY). LMD quality is measured by five key dimensions - timeliness, information quality, assurance, responsiveness, and reliability - derived from the literature. These are hypothesized to influence CSAT, which in turn affects CLOY (Authors, 2025).

Among LSQ dimensions, *timeliness* is one of the most frequently cited and reliable indicators of service performance (Zailini et al., 2018; Saura et al., 2008). In online B2C contexts, timeliness has a direct effect on satisfaction as customers expect immediate service after payment, unlike offline retail, where purchases are instant (Rao et al., 2011). Given that online customers must wait through fulfillment and delivery processes, the efficiency of last-mile transportation becomes critical in shaping satisfaction and loyalty (Tran et al., 2022).

H1: Timeliness has a positive direct impact on e-commerce CSAT.

Information quality - defined as the clarity and completeness of service/product-related data - affects how customers assess risk and track delivery progress (Park and Kim, 2003; Khan, Liang, and Shahzad, 2015). Seamless information flow between customers, sellers, and delivery providers enhances transparency and customer experience, leading to increased CSAT and CLOY (Tran et al., 2022).

H2: Quality of information has a positive direct impact on e-commerce CSAT.

Assurance, originally linked to the courtesy and competence of service staff (Parasuraman et al., 1988), has been extended in the LMD context to include the professionalism of delivery personnel, data security, and respectful behavior (Yang et al., 2021). Previous research found assurance to be a significant factor influencing trust, satisfaction, and loyalty in delivery services (Pantouvakis and Dimas, 2013; Cho et al., 2021).

H3: Assurance has a positive direct impact on e-commerce CSAT.

Responsiveness relates to timely and helpful communication, issue resolution, and flexibility in delivery arrangements (Gulc, 2020). It plays a crucial role in customer satisfaction, especially in logistics contexts where service recovery and adaptability are essential (Ugboma et al., 2004; Rahim, Voon, and Mahdi, 2015).

H4: Responsiveness has a positive direct impact on e-commerce CSAT.

Reliability, encompassing order accuracy, parcel condition, and timely delivery, is fundamental to LMD quality (Gulc, 2020). E-commerce consumers emphasize both information security and product integrity (Lin et al., 2011), and parcel locker service studies have confirmed the strong influence of reliability on CSAT (Lai et al., 2022). Pantouvakis and Dimas (2013) also argue that reliability and responsiveness together predict customer satisfaction in logistics services.

H5: Reliability has a positive direct impact on e-commerce CSAT.

Finally, *customer satisfaction* is a key driver of *customer loyalty*, defined as repeat purchasing behavior and advocacy (Oliver, 1999). In e-commerce, CSAT is shaped by service quality and plays a decisive role in long-term customer retention (Saura et al., 2008). Positive experiences lead to repurchase intentions and referrals (Waari, 2018; Zhang et al., 2012).

H6: E-commerce CSAT has a positive impact on e-commerce CLOY.

3. Research methodology

3.1. Measure of Constructs

This study developed 31 items across 6 constructs based on prior literature and qualitative research (Tran et al., 2022; Dam and Dam, 2021;

Cho et al., 2021; Gulc, 2020; Zailini et al., 2018; Alemu, 2016; Bouzaabia et al., 2013; Rose et al., 2011; Walsh and Beatty, 2007). A pilot test with 68 Vietnamese B2C e-commerce customers was conducted to refine the questionnaire. Feedback on clarity, wording, and relevance led to revisions, and final calibration was done using Exploratory Factor Analysis (EFA), resulting in 31 finalized items across 6 scales. These aim to measure the mediating role of CSAT in the relationship between LMD quality and CLOY.

3.2. Sampling Method and Data Collection

Convenience sampling was used to gather responses from B2C e-commerce customers in Vietnam. Based on Hair et al. (2006), the minimum sample size required was met. Of 494 collected responses, 462 valid ones remained after filtering out 32 invalid entries, satisfying EFA reliability criteria.

3.3. Data Analysis

PLS-SEM was conducted using SmartPLS 4.0, following Hair et al.'s (2011) two-step approach: first assessing the measurement model, then the structural model. Prior to this, data were screened for quality via normality (skewness, kurtosis), reliability (Cronbach's Alpha), and EFA. Since reflective scales were used, measurement validity was tested for reliability, convergent validity, and discriminant validity (Hair et al., 2014). Finally, bootstrapping was applied to examine the mediating effect of CSAT between LMD quality and CLOY, as this method offers robust and accurate estimates in PLS-SEM (Zhao et al., 2010).

4. Result analysis

In the event of VIF lower than 3, it can be inferred that the model does not experience collinearity (Hair et al., 2019). Table 1 displays the outcomes of assessing the collinearity phenomenon in the model. It can be seen that the VIF values studied do not surpass 3, ensuring the significance of a non-collinearity model.

Table 1. Result of collinearity statistics (VIF)

	VIF
T -> CSAT	1.623
QI -> CSAT	1.486
A -> CSAT	1.692
RP -> CSAT	1.400
RL -> CSAT	1.519
CSAT -> CLOY	1.000

Source: Authors, 2025

Table 2 illustrates the result of hypothesis testing for the structural model, including estimated coefficients, standard deviation, T statistics, and p-value. A hypothesis is statistically significant given that the corresponding p value is less than 0.1 at the 10% significance level, 0.05 at the 5% significance level, and 0.01 at the 1% significance level. (Hair et al., 2014)

H1: Timeliness has a positive direct impact on e-commerce CSAT

The correlation between timeliness and CSAT experiences a β coefficient of 0.231, proving a positive direct impact of such factors. The p-value of the H1a is $0.000 < 0.01$, signifying that this hypothesis is statistically significant at the 1% significance level.

H2: Quality of information has a positive direct impact on e-commerce CSAT

The positive relation of quality of information and CSAT experience is statistically significant ($\beta = 0.251$, p value = 0.000). Given that other factors remain unchanged, the increase in one unit of quality of information leads to CSAT rising by 0,251 units.

H3: Assurance has a positive direct impact on e-commerce CSAT

It is found that assurance exerts a positive and significant influence on CSAT. Keeping other factors constant, when assurance is increased by one unit, CSAT is directly raised by 0.139 units. Since the p-value of assurance is $0.002 < 0.01$, which secures statistical significance, H3 is accepted.

H4: Responsiveness has a positive direct impact on e-commerce CSAT

The hypothesis H4 is accepted due to its statistical significance at the significance level of 1%. The results present the β coefficient equal to 0.203, which surpasses 0, indicating the positive direct effect of responsiveness on e-commerce CSAT.

H5: Reliability has a positive direct impact on e-commerce CSAT

Provided that the p-value of reliability is less than 0.01, the direct correlation between reliability and CSAT is proven to be significant. With a unit increment of reliability, CSAT shall increase by 0.093 units with other variables staying the same.

H6: E-commerce CSAT has a positive impact on e-commerce CLOY

CSAT is the sole variable to have a direct effect on CLOY, owing to the satisfactory p-value of 0.000. CSAT is demonstrated to be a significant antecedent of CLOY with a β of 0.681. Assuming other factors remain constant, CSAT escalating by one unit shall result in a 0.681 unit increment of CLOY.

Table 2. Result of hypothesis testing for the structural model

Hypothesis	Relationship	Estimated coefficient	T statistics	P values	Result
H1	T -> CSAT	0.231	5.279	0.000***	Accepted
H2	QI -> CSAT	0.251	6.122	0.000***	Accepted
H3	A -> CSAT	0.139	3.093	0.002***	Accepted
H4	RP -> CSAT	0.203	4.940	0.000***	Accepted
H5	RL -> CSAT	0.093	2.310	0.001***	Accepted
H6	CSAT -> CLOY	0.681	23.952	0.000***	Accepted

* , ** , *** represents significance level 10%, 5%, 1%, ns: not significant

Source: Authors, 2025

The coefficient of determination (R^2) represents the explanatory ability of independent variables for a dependent variable (Hair et al., 2014). The R^2 of CLOY and CSAT are, respectively, 0.463 and 0.479. Independent variables can explain 46.3% of the variance of CLOY. Additionally, 47.9% of CSAT's variance shall be explained by independent variables in the model.

Table 3. Result of the coefficient of determination (Adjusted R^2)

	R^2	Adjusted R^2
CLOY	0.463	0.462
CSAT	0.479	0.473

Source: Authors, 2025

The effect size (f^2) is formulated by Chin (1998) to consider the importance of an independent variable on the dependent variable. The majority of LMD quality scales exhibit a minor influence on CSAT, including timeliness, quality of information, assurance, and responsiveness. f^2 coefficient, worth 0,011 for responsiveness, turns it into the sole factor to have a very small impact on CSAT. Besides, e-commerce CSAT ($f^2 = 0,863$) is the single factor to exert a strong influence on CLOY.

Table 4. Result of the effect size (f^2)

Dependent variable	Independent variable	f^2	Effect size
E-commerce customer satisfaction	Timeliness	0.063	Small
	Quality of information	0.082	Small
	Assurance	0.022	Small
	Responsiveness	0.057	Small
	Reliability	0.011	Very small
E-commerce customer loyalty	E-commerce customer satisfaction	0.863	Large

Source: Authors, 2025

The authors adopted a 5.000-resample PLS Bootstrapping approach to examine the indirect

effects of timeliness, information quality, assurance, responsiveness, and reliability on e-commerce customer loyalty (CLOY) through the mediating role of customer satisfaction (CSAT).

E-commerce CSAT mediates the relationship between timeliness and e-commerce CLOY. Timeliness demonstrates a positive indirect effect on CLOY via CSAT, with a path coefficient (β) of 0.157. The corresponding p-value is 0.000, indicating that the mediating relationship is statistically significant at the 1% level.

E-commerce CSAT mediates the relationship between the quality of information and e-commerce CLOY.

CSAT has the most substantial mediating effect in the relationship between information quality and CLOY, with a β coefficient of 0.171. As the p-value equals 0.000, the result confirms a significant positive indirect relationship at the 1% level.

E-commerce CSAT mediates the relationship between assurance and e-commerce CLOY.

The relationship between assurance and CLOY through CSAT is also significant, with a p-value of 0.004. The β coefficient is 0.095, indicating a positive mediating effect of CSAT between assurance and customer loyalty.

E-commerce CSAT mediates the relationship between responsiveness and e-commerce CLOY.

Responsiveness exhibits a statistically significant indirect effect on CLOY through CSAT ($\beta = 0.138$, $p < 0.01$). This suggests that improvements in responsiveness positively contribute to customer loyalty when mediated by CSAT.

E-commerce CSAT mediates the relationship between reliability and e-commerce CLOY.

Although the weakest among the five dimensions, reliability still shows a significant indirect effect on CLOY through CSAT, with $\beta = 0.064$ and $p = 0.007$. This confirms the mediating role of CSAT in the relationship between reliability and customer loyalty.

Table 5. Evaluation result of the indirect impact of the structural model

Relationship	Estimated coefficient	T statistics	P values	Result
T -> CSAT -> CLOY	0.157	5.149	0.000***	Accepted
QI -> CSAT -> CLOY	0.171	5.992	0.000***	Accepted
A -> CSAT -> CLOY	0.095	2.850	0.004***	Accepted
RP -> CSAT -> CLOY	0.138	4.722	0.000***	Accepted
RL -> CSAT -> CLOY	0.064	2.279	0.007***	Accepted

* , ** , *** represents significance level 10%, 5%, 1%, ns: not significant

Source: Authors, 2025

5. Research findings and discussion

The research findings provide empirical support for the proposed model (see Figure 1.3) and contribute to the literature on e-commerce and last-mile delivery (LMD). The study successfully identifies five LMD quality dimensions - timeliness, information quality, assurance, responsiveness, and reliability - within the context of Vietnam's B2C e-commerce sector. All five dimensions demonstrate a statistically significant positive indirect effect on customer loyalty (CLOY) through the mediating role of customer satisfaction (CSAT), thereby confirming the proposed hypotheses.

Among the examined constructs, information quality emerged as the most influential factor impacting CLOY via CSAT. This aligns with the conclusion of Hafez, Elakkad, and Gamil (2021), but contrasts with Alemu (2016), who emphasized timeliness as the most critical factor. In the current study, timeliness ranks second in indirect influence on CLOY, suggesting that Vietnamese B2C shoppers prioritize the quality of information over delivery speed when forming loyalty perceptions.

Assurance also plays a significant indirect role in driving CLOY, consistent with findings from Tran et al. (2022), particularly in the electronics segment of B2C e-commerce. Responsiveness was similarly found to positively affect CLOY via CSAT, reinforcing earlier conclusions by Gulc (2020). Lastly, while reliability shows a statistically significant indirect influence on CLOY, it ranks lowest among the five LMD dimensions in terms of impact strength, in agreement with research by Lai et al. (2022) and Gulc (2020).

In addition to indirect effects, the study reveals a direct positive relationship between LMD quality and CSAT. This supports the findings of Vakulenko et al. (2019) and Alkhalifah, Alorini, and Alturki (2022), who affirm that high LMD quality is essential not only for customer satisfaction but also for the profitability of B2C e-commerce businesses. These results highlight that for Vietnamese shoppers, final-mile delivery is a core component of overall satisfaction with online shopping platforms.

Moreover, the direct positive relationship between CSAT and CLOY is confirmed, consistent with a wide body of prior research (Hafez, Elakkad, and Gamil, 2021; Murfield et al.,

2017). The data analysis further reinforces Eid's (2011) assertion that CSAT is a strong antecedent of CLOY in B2C contexts. Thus, enhancing CSAT is likely to significantly increase loyalty among Vietnam's e-commerce consumers.

6. Limitations and suggestions for further research

Despite having met the requirement as suggested by Hair et al. (2006), the sample size of this study may not fully represent Vietnam's B2C e-commerce customer base, as the sample size is not considered large enough and includes respondents from certain cities and provinces. Future studies shall approach a larger, more diverse sample across more locations to improve generalizability.

Additionally, the demographic information and shopping habits of B2C e-commerce end users are not taken into consideration, which might remarkably influence perceptions of LMD quality, CSAT, and CLOY. Future research is suggested to explore the degree to which demographics and shopping habits affect these evaluations.

Finally, the authors focus on 5 scales for the LMD quality based on LSQ and SERVQUAL, whereas other studies have examined a broader range of dimensions. Future studies stand in need of more variables to comprehensively assess the drivers of B2C e-commerce clients' perception towards LMD quality, CSAT, and CLOY.

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