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THE IMPACT OF LAST-MILE DELIVERY LOGISTICS SERVICE QUALITY FACTORS ON CUSTOMER LOYALTY: THE CASE OF ONLINE SHOPPING IN THE MEKONG DELTA REGION

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ABSTRACT

Recently, last-mile delivery has become a key component in the expansion of online shopping. This research investigates the impact of logistics service quality (LSQ) on customer loyalty within the online retail sector in the Mekong Delta. It used a mixed-methods approach, including semi-structured interviews with logistics professionals and online shoppers to develop the research model, along with a survey of 414 customers for quantitative analysis. Structural equation modeling with SmartPLS tested the proposed relationships. Results indicate that important LSQ elements—delivery time, reliability, cost, and staff service—positively impact perceived value, which then influences satisfaction and loyalty. Conversely, a higher return rate diminishes perceived value. Interactions with delivery staff had the most significant impact on customer perceptions. This study advances theoretical insights into last-mile service quality and suggests practical measures such as improving customer communication, implementing fair return policies, and forming reliable delivery partnerships to enhance trust and loyalty in a competitive market.

Keywords: *Last-mile delivery; logistics service quality; customer satisfaction; customer loyalty; online shopping*

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1. INTRODUCTION

In recent years, online retail has become one of the business models that has experienced strong growth in Vietnam. The impact of the COVID-19 pandemic has accelerated the development of the online shopping market (Viu-Roig & Alvarez-Palau, 2020). Last-mile delivery is the final stage in the supply chain, which involves transporting goods from the point of production to the consumer. This is one of the key factors contributing to businesses' competitive advantage when e-commerce continues to grow (Boysen et al., 2020). Statistics indicate that the global last-mile delivery market is expected to expand from $170.6 billion in 2025 to $504.8 billion by 2034, at a CAGR of 12.8%. This stage represents 41–53% of total supply chain costs. Improving efficiency in last-mile delivery can greatly boost profit margins, particularly for smaller e-commerce firms, since meeting delivery expectations leads to much higher customer satisfaction (Kumar & Chidambara, 2024; Ha et al., 2023; Demir et al., 2022). The purpose of last-mile delivery is to provide the right products, in the right quantity, at the right location, and at the right time for customers. Therefore, last-mile delivery directly impacts customer satisfaction and loyalty (Sperka et al., 2020). Jacobs et al. (2019) also pointed out that three-quarters of customers are willing to return and pay more for a product if they are satisfied with the delivery services they are using.

The Mekong Delta in Vietnam includes 13 provinces and centrally governed cities. According to 2019 statistics, this region's population is about 17.3 million (accounting for 18% of the country's total population) (Nghi, 2024). Based on the Vietnam E-commerce Index Report 2023, many provinces in the Mekong Delta are consistently ranked high in the development index of e-commerce, with notable examples such as Can Tho ranked 9th out of 58, Long An ranked 25th, Dong Thap ranked 30th, and Ben Tre ranked 34th out of 58 (Ministry of Industry and Trade, 2024). This creates a significant opportunity for last-mile delivery service providers in the Mekong Delta to consider and develop delivery services to improve online customer loyalty (Nguyen, 2022). However, the number of studies on how logistics service quality impacts customer satisfaction and loyalty is limited. Recent studies, such as those by the University of Economics Ho Chi Minh City and Vinh Long University in

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Vietnam, have started exploring this topic, though they are limited in number. One research project by UEH Mekong used the Technology–Organization–Environment (TOE) framework to evaluate logistics service quality and its impact on customer satisfaction and retention in the Mekong Delta. It underscores the region's infrastructural and technological challenges, which restrict logistics growth and research depth. Another focused study investigated e-logistics service quality among Gen Z consumers in the Mekong Delta with a sample of 631 respondents. Although providing valuable insights, its scope is narrow, concentrating on a specific demographic and e-commerce environment. Compared to more developed regions or national studies, the Mekong Delta is still underrepresented in logistics service quality research (Lo et al., 2024; Truong et al., 2023). Therefore, researching the impact of logistics service quality factors on customer loyalty in last-mile delivery for online retail businesses in the Mekong Delta is essential, as it focuses on the last-mile delivery aspect and will help e-commerce companies enhance their competitive capabilities and further promote the development of the online shopping market.

This paper aims to identify the factors of logistics service quality in last-mile delivery that affect customer loyalty through the mediating variables of perceived value and customer satisfaction. Based on these findings, appropriate solutions are proposed to enhance last-mile delivery service quality, assisting enterprises in refining their policies and strategies for service development in the online retail sector. The study uses the customers' perceived value as the intermediate variable between logistics service quality and customer satisfaction and loyalty. Researchers employ qualitative and quantitative methods to collect data from end-users who have experience in online purchasing to analyze and provide recommendations to help businesses overcome the obstacles. The findings are beneficial not only for online retailers but also for logistics service providers to understand customers' perceived value.

The remaining content of this paper will present the theoretical background and research model, as well as research hypotheses (Section 2). Section 3 details the research methodology applied in the study. Section 4 presents the research findings obtained after conducting the survey and processing the data. Finally, the paper concludes with a discussion of the conclusions and proposed managerial implications of the study.

2. THEORETICAL FOUNDATION AND RESEARCH MODEL

2.1. Definition of last-mile delivery

Last-mile delivery is not a new concept, but it has become crucial in developing the e-commerce market. Some researchers mention that last-mile delivery connects online retailers and the end customer (Munoz-Villamizar et al., 2021). Last-mile delivery refers to the final step in the supply chain process, where products are transported from the distribution center to the end customer. It is characterized by direct interaction with customers and is often considered the most challenging and costly part of logistics (Alidaee, B., et al., 2023; Lamiscarre, B., et al., 2022). Archetti and Bertazzi (2021) stated that last-mile delivery is the final step in delivering products to customers, even at their homes or collection points. This kind of delivery is an age-old activity in exchanging goods and commerce history.

However, it has gained popularity and become particularly important as online retail models continue to grow in recent years (Boysen et al., 2020; Kiba-Janiak et al., 2021). Cortes & Suzuki (2021) explain that last-mile delivery relates directly to customer engagement because shippers will contact and deliver products to buyers. According to Seghezzi & Mangiaracina (2021), customers choose retailers that can provide products faster and cheaper compared to others. Besides that, if retailers deliver the correct and intact goods, it will contribute to retaining their customers. Therefore, the primary goal of last-mile delivery is to provide the right goods in the right quantity, at the right place, and at the right time because it will enhance customer satisfaction and loyalty in online shopping (Aljohani, 2024; Sperka et al., 2020).

2.2. Definition of logistics service quality

Logistics service quality refers to the performance and effectiveness in delivering products to customers. It is the benefit that logistics service providers can offer customers to meet or exceed their expectations, helping them achieve high efficiency throughout the delivery process (Zhang et al., 2023). Sohn et al. (2017) mention that logistics service quality involves managing the transportation of goods to meet customer requirements. Other researchers consider logistics service quality to be the integrating factor that increases customer satisfaction and ensures a competitive advantage for online retailers in delivering products. They explain that logistics service quality has multiple factors contributing to the overall perception of service quality, including timeliness, reliability, costs, flexibility, and responsiveness (Thongkruer & Wanarat, 2020; Michalski & Montes-Botella, 2021). Gupta et al. (2021) recognize that developing the e-commerce market requires online retailers to provide the highest quality of logistics services. It means that retailers deliver products on time, in good condition, and at a reasonable price. It will enhance customer satisfaction and loyalty while improving the supply chain efficiency. However, evaluating service quality in logistics is complicated as customers will have different expectations and perceptions (Balouei Jamkhaneh et al., 2022; Andrejić, 2019).

2.3. Definition of customer satisfaction

Sezgen et al. (2019) define customer satisfaction as a customer's pleasure or disappointment after consuming a product or service based on their expectations. Customer satisfaction is a condition that businesses need to ensure to satisfy consumer needs, desires, and expectations (Sarkar & Dey, 2023). Kim et al. (2021) mention that customer satisfaction is the perception of happiness or frustration when customers compare the product or service with their expectations. This factor is crucial for businesses as it directly influences customer loyalty and retention. It can be explained that if customers are satisfied with the products or services, they will continuously repurchase and become loyal consumers. According to Bulatnikov & Constantin (2023), customer satisfaction is measured by product quality, price, and convenience when purchasing online. Rosário, A. T. (2023) argues that customer satisfaction is highly relevant for maximizing profits, especially in the context of changing consumer lifestyles and technological advancements. The study highlights the importance of customer satisfaction programs in retail, indicating that effective marketing management can significantly enhance customer experience and satisfaction levels.

2.4. Definition of customer loyalty (LO)

Customer loyalty is the commitment of customers to repurchase or reuse products or services of the companies from time to time (Narvanen et al., 2020). This loyalty is crucial for businesses as it promotes long-term relationships, creates profitability, and offers a competitive advantage in the marketplace. It also proves that companies have a reputation and quality that meet customer satisfaction (Vilkaite-Vaitone & Skackauskiene, 2020). Meyer-Waarden et al. (2023) mention that customer loyalty is built based on three factors, including customer perception, service provider quality, and business environment. The development of customer loyalty starts from the cognition of logical reasons for products or services (for example, high-quality goods, better customer services, on-time delivery, smooth return process); then, customers will shift their emotions and believe in what they use. Finally, they will change their behavior and become a loyal customer despite the competition from other brands (Chen et al., 2023; Saad et al., 2022). While the definition of customer loyalty may not be the same in some studies, it includes the emotional and behavioral aspects of customer interaction with a business (Tomasevic et al., 2020).

2.5. Hypothesis and Research Model

2.5.1. Delivery time (DT)

Harter et al. (2024) define delivery time as the period customers place an order online until they receive it. This is the ability to fulfill an order within consumer expectations or has been promised (Jalili Marand et al., 2019). Delivery time is one of the most important factors service providers bring to online buyers (Raj et al., 2024). Research by Rokoss et al. (2024) indicates that delivery time is one of the key factors influencing customer expectations when shopping online because buyers are always concerned about the timeliness of service delivery and the ease of access to delivery services. The study by Restuputri et al. (2022) also concludes that delivery time affects customers' perceptions and experiences in last-mile delivery. In general, delivery time is a crucial factor in the modern e-commerce and retail industry, with faster delivery times positively impacting customers' perceived value in last-mile delivery.

Hypothesis H1: Delivery time affects customers' perceived value in last-mile delivery.

2.5.2. Reliability (RE)

Reliability reflects that a business can successfully fulfill customers' commitments to meet their demands and gain trust (Tsai & Tiwasing, 2021). In last-mile delivery, this aspect refers to the service provider's ability to deliver on promises, including timely delivery, quality assurance, and the correct quantity of products committed to the customers. Uzir et al. (2021) mention reliability is considered a factor for evaluating whether a company can fulfill customer requirements, such as speed, variety, and specialization in delivery methods. Therefore, Tolooie et al. (2024) consider reliable delivery positively impacts customer expectations regarding last-mile delivery services. Additionally, the study by Kervenoael et al. (2020) suggests that reliability influences customers' perceived quality of last-mile delivery services.

Hypothesis H2: Reliability affects customers' perceived value in last-mile delivery.

2.5.3. Return rate (RR)

This factor assesses the possibility that customers can return purchased products. In addition, it also relates to whether last-mile delivery providers have established clear return policies and comparable fees. Returning items easily and conveniently can enhance customer service quality (Rokonuzzaman et al., 2020). Ain & Siddiqui (2020) state that the extent and feasibility of returning goods significantly influence online shoppers' perceptions of delivery services and the selling entity. The return

level will be evaluated based on the convenience of receiving items, the availability of a clear return policy, and the transparency in calculating return costs (Buldeo Rai et al., 2019; Li et al., 2020).

Hypothesis H3: The return rate affects customers' perceived value in last-mile delivery.

2.5.4. Delivery costs (DC)

Delivery costs refer to the expenses incurred for transporting goods from sellers to the end consumers. Some studies have indicated that delivery costs significantly affect attracting and retaining online customers. Other research has asserted that delivery fees are often considered one of the most important attributes influencing customer perceptions when buying products online and their satisfaction with last-mile delivery services (Lewis et al., 2006; Rao et al., 2011; Koukova et al., 2012). In practice, customers will pay attention to the amount of money they have to pay for delivery services added to the listed price of the goods. Therefore, delivery costs are a crucial factor affecting the perceived value of customers in last-mile delivery (Asendia, 2023; Agatz et al., 2013).

Hypothesis H4: Delivery costs affect customers' perceived value in last-mile delivery.

2.5.5. Delivery staff (DS)

Customers are always concerned about delivery personnel, including how they serve and meet customer needs. To satisfy customers and enhance their loyalty, last-mile delivery service providers have to interact with customers during the delivery process (Seghezzi & Mangiaracina, 2020). The delivery staff reflects how service providers care about their customers, demonstrated through factors such as service capability and empathy (Li et al., 2020). Specifically, in case delivery personnel exhibit appropriate and flexible attitudes, it will enhance customers' perceived value of the delivery service and increase the likelihood of customers returning and choosing to buy products on the online sales platform (Aljohani, 2024; Masorgo et al., 2023).

Hypothesis H5: Delivery staff affects customers' perceived value in last-mile delivery.

2.5.6. Customer perceived value (PV)

Customer perceived value is a crucial determinant of customers' future purchase intentions. It also influences other behaviors, such as the likelihood of repurchase and overall customer loyalty (Kawa & Swiatowiec-Szczepanska, 2021). Retailers consider customer loyalty a primary objective in fostering relationships with their consumers. While service quality plays a significant role in shaping behavioral intentions, considerable evidence highlights the relationship between service quality, perceived value, satisfaction, and loyalty (Barker & Brau, 2020; Aljohani, 2024). Research conducted by Kawa & Zdrenka (2023) finds that perceived value significantly affects customer satisfaction regarding the quality of last-mile delivery services.

Hypothesis H6: Customers' perceived value in last-mile delivery affects customer satisfaction when shopping online.

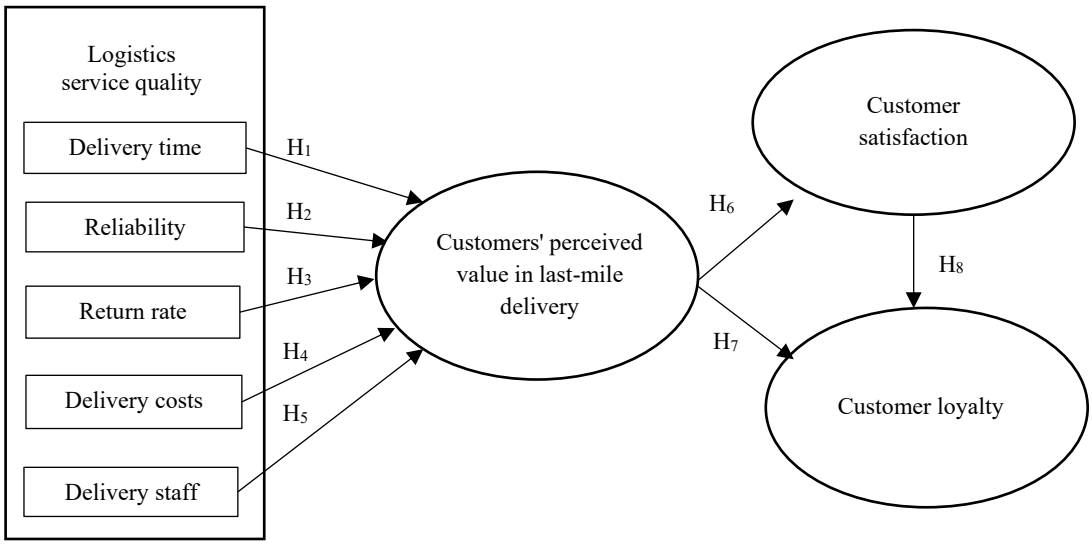
Hypothesis H7: Customers' perceived value in last-mile delivery affects customer loyalty toward online retail businesses in the Mekong Delta region.

2.5.7. Customer satisfaction in online shopping (CS)

Loyal customers tend to continue using the products or services offered by a business and may encourage their acquaintances to do the same. Previous studies have argued that for customers to repeat their shopping behavior, they must be satisfied with the products or services provided first (Aljohani, 2024; Kawa & Zdrenka, 2023). The research by Saha & Mukherjee (2022) also indicates that customer satisfaction during the purchasing process and the use of last-mile delivery services is a key factor influencing customer loyalty in online shopping.

Hypothesis H8: Customer satisfaction in online shopping affects customer loyalty toward online retail businesses in the Mekong Delta region.

Figure 1: Proposed Research Model



3. RESEARCH METHODOLOGY

Research design: This study employs a mixed-methods approach, integrating both qualitative and quantitative research techniques. The qualitative research involves collecting and analyzing relevant materials from books, reports, and articles from domestic and international sources to explore last-mile logistics service quality factors that may impact customer loyalty. Following this, quantitative research is used to measure the degree of influence and test the proposed hypotheses. This research design ensures a comprehensive analysis of the issues under study.

Data collection process: Qualitative data were collected through in-depth interviews with experts in logistics and delivery, as well as with some customers in the Mekong Delta region. Ten semi-structured interviews were conducted—five with logistics and e-commerce experts and five with regular online shoppers from the Mekong Delta region. Participants were selected using purposive sampling to ensure they had relevant experience and insights. The interview questions focused on perceptions of last-mile delivery service quality, common challenges, and customer expectations. All interviews were recorded and transcribed verbatim. The information gathered was used to identify the core factors of last-mile service quality that impact customer loyalty, which then informed the development of the research model and corresponding measurement scales. For quantitative data, this was gathered through a survey using a questionnaire. The study employed a 5-point Likert scale, designed based on the identified factors. A pilot survey was conducted with 154 customers who had used last-mile delivery services. Following this, adjustments and enhancements were made for clarity and relevance before launching the official survey both in person and online via Google Forms among customers in the Mekong Delta region. The survey yielded 423 responses, of which 414 valid samples were retained for formal analysis after excluding incomplete responses.

Sampling Method: The study focuses on researching customer subjects in the Mekong Delta region who have experience with online shopping from retail businesses and utilize last-mile delivery services. A random sampling method is employed to ensure representation of the entire research population and to enhance the reliability of the results.

Data analysis method: The study utilizes a combination of SPSS and SmartPLS software to process the collected data. SPSS is employed to perform descriptive statistics (frequency, percentage) for factors such as gender, age, income, and commonly purchased products. Notably, SmartPLS is used to test the research model and analyze the linear structural relationships (PLS-SEM). This method allows for the assessment of the relationships between the quality factors of last-mile logistics services and customer loyalty. Several metrics are evaluated, including average variance extracted (AVE), composite reliability (CR), Cronbach's alpha (CA), factor loadings, and the Heterotrait-Monotrait ratio of correlations (HTMT).

4. RESEARCH RESULTS

4.1. Descriptive Statistics Results

The analysis results from Table 1 show that females constitute the largest proportion of the total survey participants, with 281 individuals (accounting for 67.9%). In contrast, there are 133 males, representing 32.1% of the total sample surveyed. This result indicates a significantly higher ratio of females compared to males, with the number of females being more than twice

that of males. This reflects that among the total sample of respondents, the number of females participating in online shopping is higher than that of males.

The survey results from Table 1 indicate that the age group of 18-28 years makes up the majority of the sample (87.2%). Following this, the age group of 29-39 years accounts for 9.2%; the age group of 40-50 years constitutes 2.7%, and finally, the group over 51 years represents 1.0%. The analysis results reflect that the younger population (aged 18-28) is the primary user group for online shopping services and participates significantly in the last-mile delivery process. Additionally, the results also show a gradual decrease in interest in online shopping as age increases, which aligns with current trends in online shopping among young people.

According to Table 1, the majority of survey participants have an income of less than 5 million VND (accounting for 68.8%). This may reflect that the surveyed population primarily consists of students, young workers, or individuals with low incomes. The group with an income of 5-10 million VND makes up 20.8%; those with an income of 11-15 million VND and above 15 million VND account for 5.6% and 4.8%, respectively. The survey results indicate that the surveyed population is concentrated in the low to middle-income brackets.

The results from Table 1 show that survey participants typically purchase fashion products online, with 258 selections, accounting for 31.0% of the total sample. Following this, cosmetics and personal care products represent 23.4%. Food and beverages also account for a significant share at 14.7%. Books and home appliances/furniture make up 11.0% and 11.7%, respectively. Finally, the category with the lowest percentage of online purchases is high-tech electronics, which constitutes 8.2%. The analysis indicates that the quality of last-mile delivery is particularly emphasized for fashion and cosmetics, reflecting customers' perceptions of the quality of last-mile delivery services. Additionally, items such as electronics require extra considerations regarding safety and careful handling during transportation.

Table 1: Descriptive statistics of survey participants (N = 414)

Variables	Values	Frequency	Percent
Gender	Male	133	32.1
	Female	281	67.9
Age	From 18 to 28 years old	361	87.2
	From 29 to 39 years old	38	9.2
	From 40 to 50 years old	11	2.7
	Over 51 years old	4	1.0
Income	Under 5 million	285	68.8
	From 5 to 10 million	86	20.8
	From 11 to 15 million	23	5.6
	Over 15 million	20	4.8
Products	Fashion	358	31.0
	High-tech electronics	95	8.2
	Books	127	11.0
	Cosmetics and body care	270	23.4
	Food and beverages	170	14.7
	Home appliances/ Furniture	135	11.7
Return experience	Yes	232	56.0
	No	182	44.0
The most recent online purchase	Under 1 month	357	86.2
	Between 1 and 3 months	39	9.4
	From 3 to 6 months	13	3.1
	Over 6 months	5	1.2

Table 1 shows that the number of survey participants with return experience accounts for 56.0% (with 232 selections), while those without return experience total 182, representing 44.0%. This result reflects that among the surveyed participants, the majority have gone through the return process, indicating that dissatisfaction with products purchased online is quite common. However, there remains a significant proportion (44.0%) who have never returned items, which may be due to their positive experiences with online shopping or the assurance of product and service quality. This finding also suggests that businesses need to improve their return processes and enhance service quality to minimize product return rates.

The analysis results (Table 1) indicate that the number of respondents who made their most recent purchase within the last month is 357 people (accounting for 86.2%). This demonstrates that the trend of online shopping is highly popular and occurs frequently. Following this, the number of people who made purchases within the range of 1 to 3 months is 39 (representing 9.4%). A small percentage of shoppers, 3.1%, made purchases between 3 to 6 months ago, while those who purchased more than 6 months ago represent a very small fraction (1.2%). The findings show a strong shift from traditional shopping to online shopping with high frequency in the short term, reflecting the growing convenience, urgent demand, and increasing trust in online shopping methods. Therefore, businesses need to maintain and develop online sales strategies and policies to meet the growing demands of consumers.

4.2. Measurement Model Evaluation

To ensure the reliability and validity of the measurement model in the study, factors such as average variance extracted (AVE), composite reliability (CR), Cronbach's alpha (CA), and the factor loadings of each measure were examined and assessed. According to Hair Jr. et al. (2021), a measurement model is considered valid when the factor loadings are 0.7 or higher, the AVE is greater than 0.5, and both CR and CA values are above 0.7.

The summary results from Table 2 indicate that the factor loadings range from 0.722 to 0.957 after removing the variables RR1, RR3, and LO5, which had factor loadings lower than 0.7. Among them, some variables such as RR2 (value of 0.722), DT5 (value of 0.770), and LO4 (value of 0.775) have lower loadings compared to other indicators within the same variable, but still remain above the acceptable level. This indicates that the degree of association between the indicators and the observed variables is appropriate.

In addition, Table 2 also indicates that the values of CA and CR are both greater than 0.7 (with CA values ranging from 0.844 to 0.920 and CR values ranging from 0.894 to 0.944), which meets the reliability criteria. Some variables, such as "Reliability" and "Perceived Value," have very high CR values of 0.944 and 0.939, respectively, indicating that the indicators within each variable are measured consistently.

Regarding the AVE values, the results (Table 2) show that all variables have AVE values above 0.5, demonstrating that the indicators of each variable effectively explain the latent variable they measure. Specifically, the AVE for the "Reliability" factor reaches 0.809, which is well above the minimum threshold, indicating good convergence.

Table 2: Measurement model evaluation

Variables	Indicators	Factor Loading	Cronbach's Alpha	Composite Reliability (CR)	Average Variance Extracted (AVE)
Delivery Time	DT1	0.886			
	DT2	0.860			
	DT3	0.864	0.903	0.929	0.723
	DT4	0.866			
	DT5	0.770			
Reliability	RE1	0.834			
	RE2	0.932	0.920	0.944	0.809
	RE3	0.930			
	RE4	0.898			
Return Rate	RR2	0.722			
	RR4	0.884	0.844	0.894	0.739
	RR5	0.957			
Delivery Cost	DC1	0.875			
	DC2	0.866	0.885	0.920	0.743
	DC3	0.902			
	DC4	0.802			
Delivery Staff	DS1	0.788			
	DS2	0.902	0.894	0.926	0.760
	DS3	0.894			
	DS4	0.897			
Perceived Value	PV1	0.900			
	PV2	0.878	0.914	0.939	0.795
	PV3	0.909			
	PV4	0.880			
Customer Satisfaction	CS1	0.743			
	CS2	0.916	0.883	0.920	0.743
	CS3	0.882			
	CS4	0.896			
Loyalty	LO1	0.888			
	LO2	0.898	0.888	0.923	0.750
	LO3	0.897			
	LO4	0.775			

Supplementary analysis was conducted to assess the discriminant validity of the measurement model. Discriminant validity was evaluated using the Heterotrait-Monotrait ratio of correlations (HTMT). According to Henseler et al. (2015), a measurement model achieves discriminant validity when the calculated HTMT values are less than 0.9. The analysis results from Table 3 show that all HTMT values are below the threshold of 0.9, with correlation values ranging from 0.047 to 0.895. This comprehensive testing process reinforces the robustness of the measurement model, ensuring that the constructs are

clearly distinguished and measured accurately. These results significantly enhance the reliability of the findings in the study, providing a solid foundation for subsequent analyses and strengthening the methodological rigor of the research.

Table 3: Discriminant Validity Assessment using Heterotrait-Monotrait Ratio (HTMT) of Factors

	CS	DC	DS	DT	LO	PV	RE	RR
CS	**0.862**	0.895	0.726	0.164	0.877	0.692	0.664	0.037
DC	0.797	**0.862**	0.631	0.159	0.688	0.630	0.608	0.046
DS	0.643	0.573	**0.872**	0.389	0.716	0.897	0.759	0.049
DT	0.150	0.132	0.356	**0.850**	0.142	0.401	0.294	0.105
LO	0.776	0.616	0.634	0.129	**0.866**	0.656	0.616	-0.020
PV	0.622	0.575	0.812	0.366	0.591	**0.892**	0.684	-0.082
RE	0.599	0.561	0.691	0.271	0.556	0.629	**0.899**	0.035
RR	0.029	0.032	-0.003	0.080	-0.020	-0.082	0.035	**0.860**

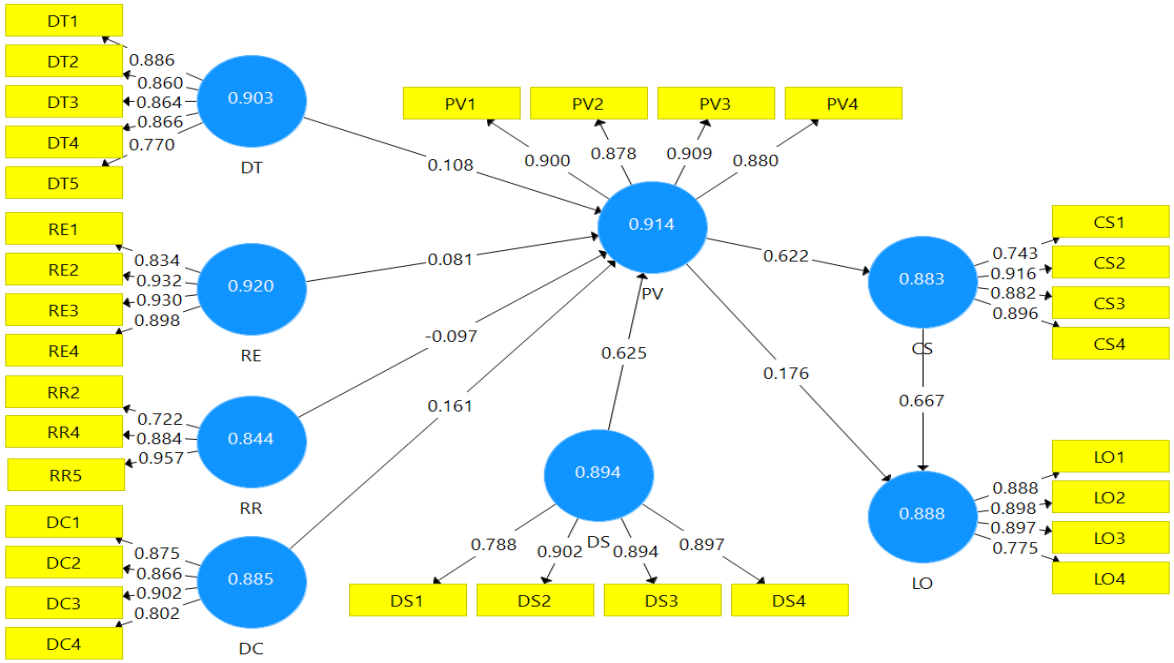
Besides that, the discriminant validity among the variables in the model has been achieved. Specifically, the values on the diagonal (corresponding to the square root of the average variance extracted (AVE) for each variable) are all greater than the correlation values between pairs of other variables, indicating a high level of distinction among the variables. For instance, the value for CS is 0.862, which is greater than all correlation values between CS and other variables (such as DC with 0.797 and DS with 0.643). Similarly, other values such as DC, DS, DT, RE, RR, etc., also meet similar criteria. Overall, this model satisfies the Fornell-Larcker condition for discriminant validity, ensuring the adequacy of the research model.

Table 4: Structural model results (Mean, STDEV, T-Values, P-Values)

	Hypotheses	**Original Sample (O)**	**Sample Mean (M)**	**Standard Deviation (STDEV)**	**T Statistics (|O/STDEV|)**	**P Values**	**Hypothesis Results**
H1	DT -> PV	0.108	0.109	0.025	4.277	0.000	Supported
H2	RE -> PV	0.081	0.083	0.049	1.657	0.008	Supported
H3	RR -> PV	-0.097	-0.093	0.035	2.791	0.005	Supported
H4	DC -> PV	0.161	0.162	0.045	3.586	0.000	Supported
H5	DS -> PV	0.625	0.622	0.055	11.415	0.000	Supported
H6	PV -> CS	0.622	0.620	0.041	15.193	0.000	Supported
H7	PV -> LO	0.176	0.175	0.044	4.038	0.000	Supported
H8	CS -> LO	0.667	0.668	0.041	16.124	0.000	Supported

The results from Figure 2 and Table 4 illustrate the correlation between the latent variables, along with the values of the path coefficients, P values, and T statistics. The analysis reveals that most variables have a positive impact, with the exception of hypothesis H3 (RR → PV), which shows a negative effect, and all variables are statistically significant (P values < 0.05). Specifically, for the independent variables, the order of impact on the variable PV from strongest to weakest is as follows: DS (0.625) > DC (0.161) > DT (0.108) > RR (0.097) > RE (0.081). Notably, RR (Return Rate) has a negative sign, indicating that a higher return rate corresponds to a lower perceived value, which aligns with the research findings. The analysis also indicates that CS (0.667) has a greater impact on LO compared to PV (0.176).

Figure 2: PLS-SEM Structural Equation Model



4.3. Discussion of hypothesis testing results

This section presents the study's empirical results, analyzing each hypothesis to existing research and explaining its relevance in the Mekong Delta's last-mile delivery (LMD) context.

H1: Delivery Time → Perceived Value (Supported)

The positive and significant effect of delivery time on perceived value is consistent with previous studies by Restuputri et al. (2022) and Raj et al. (2024), who found that timeliness boosts customer satisfaction and perceived reliability. In the Mekong Delta, infrastructural issues that can delay transit make punctual deliveries particularly valuable, emphasizing the importance of punctuality in enhancing customer experience in emerging e-commerce markets.

H2: Reliability → Perceived Value (Supported)

Although reliability was statistically significant, its influence on perceived value was relatively small, indicating that customers view service promises as a baseline expectation rather than a source of added satisfaction. This aligns with Kervenoael et al. (2020) and Tsai & Tiwasing (2021), who suggest that in mature markets, reliability mainly prevents dissatisfaction rather than increasing satisfaction unless coupled with attributes like empathy or responsiveness.

H3: Return Rate → Perceived Value (Supported, Negative Impact)

The return rate had a significant negative impact, showing that customers link higher return rates to poor service quality, product mismatches, or logistical errors. This agrees with Ain & Siddiqui (2020) and Buldeo Rai et al. (2019), who note that complicated return processes diminish perceived convenience and trust. This reveals a vulnerability for online retailers in the Mekong Delta, where reverse logistics may not be fully developed.

H4: Delivery Cost → Perceived Value (Supported)

Delivery cost had a significant positive effect on perceived value, supporting findings from Agatz et al. (2013) and Barker & Brau (2020). In price-sensitive markets, affordable or discounted delivery charges increase perceived value and reduce cart abandonment. Since most respondents in this study reported incomes below 5 million VND, this price sensitivity is expected and provides retailers with a strategic advantage.

H5: Delivery Staff → Perceived Value (Supported, Strongest Effect)

Delivery staff had the strongest impact on perceived value, highlighting the importance of interpersonal service qualities in last-mile delivery (LMD). This aligns with findings by Masorgo et al. (2023) and Seghezzi & Mangiaracina (2021), who

noted that courier courtesy, professionalism, and empathy can significantly enhance perceived service quality. In developing regions, face-to-face interactions still influence brand impressions, making delivery personnel key brand ambassadors.

H6: Perceived Value → Customer Satisfaction (Supported)

The strong link between perceived value and satisfaction supports previous research by Kawa & Zdrenka (2023). Customers who perceive timely, affordable, and courteous service tend to be more satisfied, which positively affects their likelihood to continue shopping online. This underscores the multifaceted role of LMD in shaping consumer attitudes.

H7: Perceived Value → Customer Loyalty (Supported)

Although the effect of perceived value on loyalty was statistically significant, it was smaller than expected, indicating that perception of value influences repurchase intentions but alone may not ensure loyalty without emotional or experiential factors. According to Narvanen et al. (2020), loyalty involves both rational evaluation (value) and emotional connection (satisfaction, trust).

H8: Customer Satisfaction → Customer Loyalty (Supported, Strongest Link to LO)

Customer satisfaction had the strongest effect on loyalty, confirming its mediating role as shown in studies by Saha & Mukherjee (2022) and Aljohani (2024). This relationship highlights that consistent satisfaction through efficient delivery experiences encourages repeat purchases and advocacy, positioning satisfaction as both an objective and a strategy for building loyalty.

5. CONCLUSION AND RECOMMENDATIONS

5.1. Conclusion

The quality of service in last-mile delivery plays a crucial role in customers' perceived value, which in turn affects their satisfaction and loyalty. This study has identified various factors of service quality, such as delivery time, reliability, delivery costs, and delivery personnel, which positively influence perceived value. In contrast, the return rate factor has a negative impact on perceived value, reflecting the realities of the market. All logistics service quality factors significantly affect customers' perceived value, subsequently influencing their satisfaction and loyalty in last-mile delivery operations. This research contributes to the theoretical framework regarding service quality in last-mile delivery and provides practical solutions to help businesses improve their sales and delivery systems while optimizing the entire supply chain.

However, the study also has certain limitations, as it focuses on a specific group of respondents with similar characteristics, lacking diversity and balance among various age groups and income levels. Consequently, the research findings may not fully represent the entire last-mile delivery process for online sales. Therefore, future studies should broaden the survey population to encompass a more diverse range of customer segments, thereby enhancing the representativeness and reliability of the results concerning service quality in last-mile delivery within the online sales environment.

5.2. Recommendations

To ensure quality in last-mile delivery when selling online, businesses should focus on implementing several solutions:

First, it is essential to enhance the notification system to provide specific and accurate information about when customers can expect their orders. This helps customers conveniently arrange their time for receiving goods and enhances their service experience. Additionally, businesses must ensure on-time delivery as promised by optimizing warehouse processes, packaging, and transportation. Companies should also adopt advanced technologies and smart demand forecasting software for efficient delivery planning to meet customer expectations regarding delivery times. Moreover, to ensure that delivery timelines are not disrupted, businesses need to develop contingency plans to mitigate impacts related to weather conditions. Lastly, businesses should establish a network of distribution centers in local areas and implement fast delivery processes for target regions. This initiative will shorten the time from order placement to receipt, increasing customer satisfaction and loyalty.

Secondly, businesses need to establish a rigorous quality inspection process to ensure that goods are delivered exactly as ordered from the very first time. This process should involve collaboration among various parties, including the warehouse department, delivery teams, and a technology system for tracking orders to minimize errors. Companies should also focus on carefully and neatly packaging products. This will help protect the items from physical impacts during transportation while also creating a positive impression on customers. Additionally, thorough checks should be conducted on goods before

delivery to minimize shortages or damages, ensuring that products are delivered complete and intact. Companies should also provide full information about the delivery personnel and the delivery vehicle and notify customers of this information prior to delivery. This will create trust and reassurance for customers, enhancing the company's reputation in the e-commerce market.

Thirdly, businesses need to establish a flexible return and exchange process that allows customers to inspect goods upon receipt and to exchange or return items immediately if there are any issues. This will help customers feel more secure when shopping and will also enable businesses to address problems quickly. Additionally, companies should create clear and transparent return policies that are widely communicated to customers. For products that do not meet requirements, businesses must provide satisfactory solutions such as refunds or sending replacement products at no additional cost. At the same time, companies need to build an effective customer service system that responds to inquiries promptly and provides timely support for any arising issues. These solutions will not only improve customer satisfaction but also enhance the reputation and trustworthiness of the business.

Fourthly, businesses need to seek out and collaborate with reputable shipping companies that offer reasonable rates, or they could develop an in-house delivery system to better control costs and quality. This activity helps businesses optimize expenses, providing the best benefits for customers and enhancing their competitive edge in the market. Companies should also plan a clear business strategy that focuses on offering shipping cost incentives, such as free or discounted shipping for orders that meet certain thresholds. This is an effective solution to encourage customers to shop more and create a positive experience. An important issue that businesses need to particularly focus on is establishing a reasonable shipping fee that corresponds to the quality of service provided to customers. This helps ensure fairness for customers and enhances the company's reputation in the industry.

Fifthly, businesses need to establish uniform regulations for delivery staff or choose delivery partners that meet these requirements. A tidy, neat, and professional uniform will help create a positive impression on customers, enhance brand image, and increase professionalism. Additionally, staff should be adequately equipped with the necessary tools for delivery operations (motorbikes, phones, delivery boxes, etc.) to ensure the delivery process runs smoothly and safely. This activity not only helps improve work efficiency but also protects products from damage during transportation. Companies should also enhance training for delivery personnel to equip them with the necessary skills to assist customers, enabling them to effectively address inquiries and handle customer requests. Finally, businesses need to train and instill in all employees the importance of customer service attitude. This is a key factor in building trust, satisfaction, and customer loyalty.

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