

Last-Mile Delivery Service Quality and Customer Loyalty in Online Shopping

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ABSTRACT

As online shopping becomes increasingly widespread, the effectiveness of last-mile delivery has become crucial for e-retailers seeking a competitive advantage. This study investigates how last-mile delivery service quality affects perceived value, customer satisfaction, and loyalty in online shopping. The study utilized a quantitative research design. The research sample includes shoppers who have made online purchases at least once in the last six months. Data gathered through an online questionnaire were analyzed using structural equation modeling. Results show that timeliness, information quality, and order accuracy, which are specific last-mile delivery service quality dimensions, positively affect perceived value, while timeliness, return delivery quality, and information quality positively affect customer satisfaction. Perceived value also contributes positively to customer satisfaction. Finally, customer satisfaction positively affects customer loyalty, while specific delivery dimensions (timeliness, return delivery quality, and information quality) indirectly enhance loyalty through the mediating roles of perceived value and satisfaction. This study extends existing literature by decomposing last-mile delivery into specific service quality dimensions and evaluating their subsequent effects, thereby providing detailed and practical implications for e-retailers.

Keywords: Last-Mile Delivery, Service Quality, Customer Loyalty, Perceived Value, Customer Satisfaction, Online Shopping

1. INTRODUCTION

The online shopping sector has become a focal point for consumers, characterized by intense competition driven by technological innovations, globalization, and changes in consumer habits. With these developments, last-mile delivery—a crucial part of online shopping and the multi-channel supply chain where the business interacts directly with the customer—requires robust solutions to provide optimal service and increase customer satisfaction [1]. Therefore, last-mile delivery encompasses various strategies based on solution-oriented fulfillment and service quality. While these strategies highlight significant opportunities for businesses that can bridge the gap between customer expectations and actual service delivery, they also provide competitive advantages through enhanced last-mile delivery capabilities [2].

Leading online shopping sites identify last-mile delivery services as an advantageous differentiator in the market [3]. For businesses developing diverse operational strategies to best serve customers' increasing demands, last-mile delivery is critical in achieving this goal and gaining a competitive edge [4]. Recent empirical research further validates this by demonstrating that the logistical value created during the delivery process not only drives customer satisfaction and loyalty but also directly translates into concrete business performance metrics, such as increased market shares and profitability [5].

A customer-centric approach in last-mile delivery stands out as an essential aspect of service quality and significantly shapes factors related to customer satisfaction [6]. Last-mile delivery service quality and diverse delivery options, which stand out among the factors that online shoppers care about, directly affect the performance and success of e-commerce companies. Online shopping companies particularly strive to optimize delivery times to enhance the overall customer experience [1].

Efforts and activities focused on customer satisfaction and loyalty also provide insights into how last-mile delivery service quality should be positioned. Improving the process by linking the different stages of service design and operations to the last-mile delivery service remains vital for increasing customer satisfaction and loyalty [7].

Last-mile delivery has become a research area that attracts attention from researchers and practitioners, especially with the spread of online shopping. When examining the literature on last-mile delivery, it predominantly focuses on the last-mile problem and

its logistical solutions. For instance, Wang et al. [8] studied two last-mile delivery modes—supervised home delivery and delivery points—in different scenarios, especially in high-population-density areas. Iwan et al. [9] examined customers' acceptance of smart lockers. Distribution network optimization and routing issues are also frequently encountered in the literature flow. For example, Bergmann et al. [10] investigated the route efficiency of last-mile delivery operations in an urban distribution system.

One of the essential aspects of the last-mile delivery process is service quality. Improvement in the last-mile delivery service structure is crucial because it occurs in a dynamic and developing parallel and requires innovative solutions [11]. Service quality is significant as it is inextricably linked to meeting customer expectations and increasing customer loyalty. Understanding customer expectations and allocating resources to exceed perceived quality is essential for implementing appropriate last-mile delivery options [12]. From this perspective, it can be argued that the effective management of last-mile delivery service quality is a critical factor in increasing the value and satisfaction of customers by meeting their expectations and strengthening their loyalty to the business.

While the existing literature predominantly addresses the last-mile problem through logistical solutions, routing efficiencies, and network optimization [8-10], research investigating the multi-dimensional nature of last-mile delivery service quality from a consumer-centric perspective is still evolving. Prior studies have established the effect of general e-logistics service quality on customer satisfaction and loyalty. However, there is a need to extend this literature by decomposing last-mile delivery service quality into specific, delivery-related dimensions to evaluate their differential effects on consumer evaluations. Although the literature regarding the effect of last-mile delivery service quality on customer behavior is expanding, existing studies often examine isolated mediating variables (such as trust or satisfaction) rather than sequential, multi-stage mediation pathways [13, 14]. Comprehensive models exploring how perceived value shapes loyalty through satisfaction as a sequential mediation mechanism remain limited. Furthermore, recent studies addressing these relationships concurrently [15] are often restricted to narrow geographical contexts and homogeneous samples, prompting scholars to call for increased sample diversity. Therefore, there is a distinct need for studies that holistically investigate the effect of

last-mile delivery service quality on customer loyalty through the sequential mediating roles of perceived value and satisfaction. Based on this theoretical need, the research questions of this study are as follows:

RQ1: How do the specific dimensions of last-mile delivery service quality experienced by online shoppers affect their perceived value and satisfaction?

RQ2: How do these specific last-mile delivery service quality dimensions indirectly affect customer loyalty through perceived value and satisfaction?

Based on these questions, the study aims to determine the effects of last-mile delivery service quality on perceived value and customer satisfaction, and through them, eventually on customer loyalty in online shopping.

Since last-mile deliveries in B2C online shopping consist of individual orders, they present challenging tasks for e-retailers regarding time and cost [16]. Last-mile delivery is a process that requires a profound understanding of customer value, which is crucial in logistics and service quality-based contexts. Therefore, this study contributes to the literature by highlighting the critical aspects of the last-mile delivery process regarding service quality, helping e-retailers navigate these challenges, maximize customer satisfaction, and build loyal customer bases.

2. CONCEPTUAL FRAMEWORK

2.1 Last-mile Delivery Service Quality

Last-mile delivery is the final stage in transporting products from their respective hubs to their final destinations [17]. When considering last-mile delivery as a component of the supply chain, its start and end points define the boundaries of this process. Esper et al. [18] stated that last-mile delivery is the critical link between order processing and product delivery to the consumer in online shopping.

Last-mile delivery is often considered the most challenging part of the delivery process, as it directly affects end-users in the product flow from the business to the consumer and remains a persistent bottleneck for managers [19]. The complexity of last-mile delivery arises from the fact that deliveries are typically composed of individual orders; each order must be delivered to a different address, leading to a significant dispersion of destinations. The difficulty in consolidating shipments in the final stage of transport

also causes costs in this phase to be disproportionately high [20]. Furthermore, last-mile delivery is recognized as the most time-critical stage. Businesses face tight deadlines and significant time pressures, requiring them to manage the entire process in a way that enables fast, accurate, and timely deliveries while allowing consumers to track their orders transparently [21].

Logistics and online shopping businesses worldwide are increasingly turning to modern and practical solutions to address last-mile problems driven by rising customer expectations, high costs, and the transportation of personalized shipments over dynamic routes [22]. In this context, alternative innovative solutions—such as consumer information services, route optimization, drones, autonomous robots, cargo vans, crowdsourcing, and mobile warehouses—are designed with a strong focus on customer satisfaction in last-mile deliveries [10]. Recent literature emphasizes that last-mile delivery is rapidly transforming through technology. The integration of innovations such as delivery robots and real-time tracking systems not only elevates operational efficiency but also fundamentally reshapes the consumer's service quality experience and human-machine interaction [23, 24]. Moreover, contemporary process-oriented frameworks categorize the last-mile delivery experience into pre-delivery, delivery, and post-delivery stages, highlighting that elements such as delivery transparency, driver interaction, and effective post-delivery service quality are fundamental determinants of customer satisfaction and repurchase behaviors [25].

According to Parasuraman et al. [26], service quality is the customer's judgment regarding the difference between service expectations and perceived service. Service quality exhibits varying characteristics depending on the nature of the service. Accordingly, last-mile delivery service quality is formed as a result of comparing the service the customer expects during the delivery process with the actual perceived service. Providing high-quality last-mile delivery is a necessary condition for establishing and maintaining satisfactory relationships with customers, resulting from comparing customers' service expectations and perceptions from a service quality perspective [27].

In the literature, no scale has been developed to directly measure last-mile delivery service quality in its entirety for online shopping. Generally, the relevant dimensions of Logistics Service Quality (LSQ) scale and SERVQUAL scale are adapted to measure

last-mile delivery service quality [28]. SERVQUAL, developed by Parasuraman et al. [26], measures service quality across five dimensions: reliability, assurance, tangibles, empathy, and responsiveness. The LSQ model, developed by Mentzer, Flint, and Hult in 2001 [29], is a SERVQUAL-based approach developed to measure logistics service quality. Based on the literature review, logistics service quality is traditionally measured according to information quality, ordering procedures, order release quantities, timeliness, order accuracy, personnel contact quality, order condition, order discrepancy handling, and order quality [30]. Moreover, as e-commerce continuously evolves with innovative models like crowdsourced delivery, scholars argue that traditional e-logistics service quality (e-LSQ) conceptualizations are expanding. While traditional measurements heavily emphasize operational metrics, recent conceptualizations highlight that modern delivery experiences are increasingly shaped by relational dimensions, such as the responsiveness and courtesy of delivery personnel [31]. Aligning with this contemporary perspective, the measurement approach of this study integrates not only operational efficiency dimensions (e.g., timeliness, order accuracy) but also relational dimensions like personnel communication quality, thereby providing a comprehensive evaluation of the last-mile delivery experience.

2.2 Hypothesis Development

Enhancing last-mile delivery service quality is an effective strategy for businesses to increase customer satisfaction and perceived value while prioritizing operational efficiency. At this point, since customers' perceptions of quality vary, the underlying factors affecting quality must be correctly identified, and service policies should be formulated accordingly [1].

Perceived value relates to how the customer evaluates or rates a product or service by comparing it with others in the market. In this context, perceived value is the personal importance attributed to the benefits received and sacrifices made after the purchase [32]. In other words, perceived value is about how a customer evaluates or ranks a product or service compared to others [33]. The perceived value construct is recognized as a significant component of the customer value literature and a critical driver for achieving competitive advantage in marketing strategies [34].

Studies show that service quality has a positive effect on perceived value (e.g., [4, 35-38]). Ensuring service quality in the last-mile delivery of online shopping requires a

systematic approach for businesses that aim to maintain their competitive position while creating customer value. In light of these factors, it can be argued that the specific dimensions of last-mile delivery service quality have differential positive effects on perceived value.

To provide a more detailed understanding of consumer evaluations, this study does not conceptualize last-mile delivery service quality as a single higher-order construct. Instead, it is treated as seven distinct and independent service quality dimensions: timeliness, order condition, information quality, order accuracy, order discrepancy handling, return delivery quality, and personnel communication quality. Consequently, to examine the specific effects of each independent dimension on perceived value, the hypotheses are formulated as follows:

***H₁*:** The specific dimensions of last-mile delivery service quality—namely timeliness (H_{1-1}), order condition (H_{1-2}), information quality (H_{1-3}), order accuracy (H_{1-4}), order discrepancy handling (H_{1-5}), return delivery quality (H_{1-6}), and personnel communication quality (H_{1-7})—positively affect perceived value.

Although there are various definitions of customer satisfaction, the most widely accepted conceptualization is a post-choice evaluative judgment concerning a specific product or service feature. In this way, customer satisfaction reflects an emotional state resulting from comparison between what is actually received versus what is expected, including the needs and desires associated with the purchase [39]. Customer satisfaction remains one of the core principles of quality management. The way to achieve this is to understand customer expectations and provide a service that focuses on meeting these expectations [40].

In the literature, several studies measure delivery service quality through logistics service quality dimensions and confirm that delivery service quality positively affects customer satisfaction (e.g., [4, 35, 41-43]). When services meet or exceed expectations, satisfied customers are more likely to make repeat purchases. Therefore, ensuring customer satisfaction is the primary goal of marketing activities [39]. At this point, to evaluate how each last-mile delivery dimension individually influences the post-purchase evaluation process, the specific effects on customer satisfaction are hypothesized as follows:

H₂: The specific dimensions of last-mile delivery service quality—namely timeliness (H_{2-1}), order condition (H_{2-2}), information quality (H_{2-3}), order accuracy (H_{2-4}), order discrepancy handling (H_{2-5}), return delivery quality (H_{2-6}), and personnel communication quality (H_{2-7})—positively affect customer satisfaction.

A high level of customer satisfaction, positive perceived value, and effective customer relations strengthen a consumer's relationship with the business and contribute to a substantial increase in overall corporate performance [44]. In this research, besides the effect of the service quality on the perceived value in the context of last-mile delivery, the effect of the service's perceived value on the customer satisfaction is also investigated. Past research consistently demonstrates that perceived value—as the consumer's overall assessment of a service's utility—positively affects customer satisfaction (e.g., [37, 45, 46]). In this context, the following hypothesis is proposed:

H₃: *Perceived value positively affects customer satisfaction.*

In the literature, there are many views on what customer loyalty is and its main drivers [47]. Loyalty is an emotional and behavioral commitment that customers develop in exchange for the fulfillment of their needs. In this context, loyalty is expressed as the situation in which the purchase of a product/service causes the same brand purchase with a commitment to repeat it in the future or to adopt it continuously [48]. In the online environment, customers can easily obtain the product or service they want by comparing prices or brands from different shopping sites. In this context, businesses that harmonize the advantages of online shopping with customer expectations not only achieve a high level of customer satisfaction by providing quality service, but also build strong customer loyalty [40].

Customers' purchasing continuity is one of the most critical factors for companies. The fact that satisfied customers constantly prefer the same company in line with their product and service needs shows their loyalty to the company, which directly affects a company's business volume. Numerous studies confirm the positive effect of customer satisfaction on loyalty and repurchase behaviors, particularly in competitive online marketplaces (e.g., [37, 41-43, 49-53]). Therefore, the following hypothesis is proposed:

H₄: *Customer satisfaction positively affects customer loyalty.*

Figure 1 presents the research model based on the proposed hypotheses.

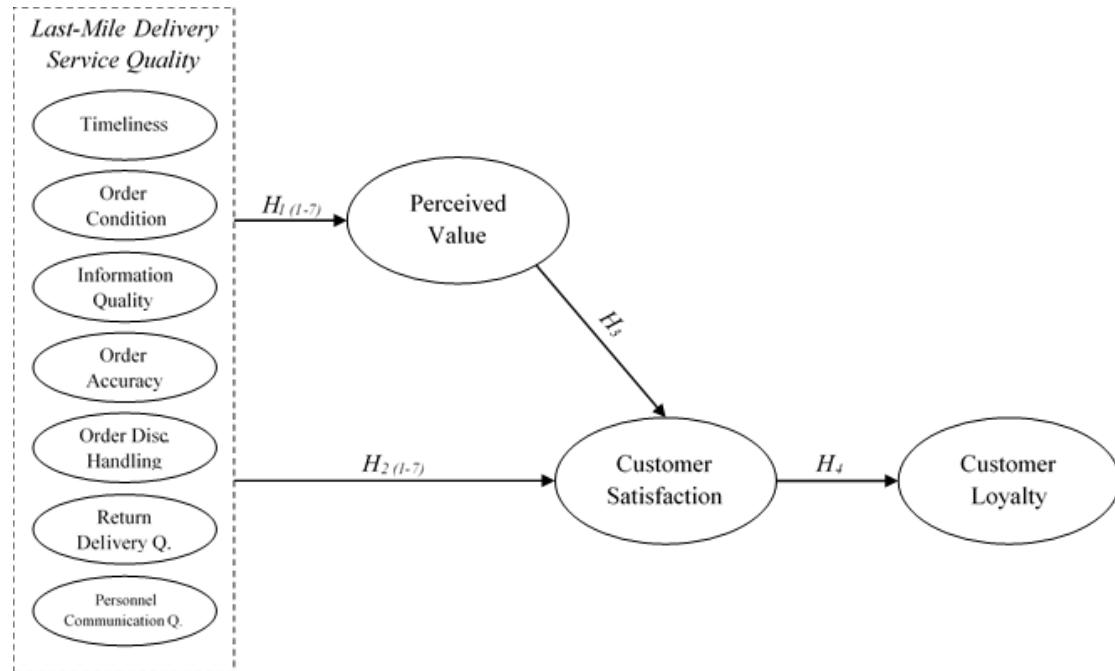


Figure 1. Research model

3. METHODOLOGY

The study utilized a quantitative research design to evaluate the proposed hypotheses. The research model was examined in the context of online shopping. The research variables include last-mile delivery service quality, perceived value, customer satisfaction, and customer loyalty. To capture its multifaceted nature, the last-mile delivery service quality variable was decomposed into seven distinct dimensions: timeliness, order condition, information quality, order accuracy, order discrepancy handling, return delivery quality, and personnel communication quality. All research variables were measured using established scales from the literature. Since a unified scale specifically targeting the entirety of last-mile delivery service quality was lacking, a comprehensive measurement approach was constructed by adapting relevant dimensions from the well-established LSQ and SERVQUAL scales. The specific items used to measure these variables and their adapted sources are detailed in the appendix.

The population of this study consists of online shoppers residing in Türkiye who have made at least one online purchase within the last six months. Due to the large size of the population profile, as well as time and cost constraints, a convenience sampling

method was employed to ensure adequate accessibility to respondents [54].

Data were collected through a self-administered online questionnaire. Prior to participation, an informed consent form was presented on the first page of the survey; all respondents were required to read and approve it before proceeding. To ensure consistency in their evaluations, respondents were first asked to identify the specific e-retailer from which they shop most frequently. They were then instructed to answer all subsequent scale items based purely on their past experiences with that specific retailer. Furthermore, to prevent response bias, certain scale items—specifically SAT4 and SAT6 within the customer satisfaction dimension—were phrased negatively in the questionnaire and reverse-coded prior to data analysis.

Before finalizing the questionnaire, a pre-test was conducted with 57 participants, leading to minor revisions in certain items to eliminate clarity issues. During the final data collection process, responses were obtained from 506 consumers. After a rigorous data screening process based on the research's eligibility criteria and completeness, a final sample of 471 valid responses was retained. Covariance-based structural equation modeling (CB-SEM) was subsequently utilized to analyze the research data and test the structural relationships.

4. RESULTS

The sample profile is shown in Table 1, which demonstrates that female participants form the majority (52.4%). Most respondents are in the 18-31 age group (64.3%), hold a high school degree or higher (94.3%), and work in the private sector (33.1%). Furthermore, the participants typically shop online at least once a month (72.4%), prefer orders to be delivered to their home addresses (80.9%), and frequently purchase fashion products (e.g., clothing, footwear) (42.2%).

Table 1. Sample profile (n=471)

Variable	Group	n	(%)
Gender	Male	224	47.6
	Female	247	52.4
Age	18-24	185	39.3
	25-31	118	25.0
	32-38	81	17.2
	39-45	48	10.2
	46 and above	39	8.3
Education level	Elementary school	27	5.7
	High school	206	43.7
	Associate degree	44	9.4
	Undergraduate	156	33.1
	Postgraduate	38	8.1
Occupation	Private sector employee	156	33.1
	Public sector employee	33	7.0
	Self-employed	117	24.9
	Student	83	17.6
	Housewife	42	8.9
	Other	40	8.5
Online shopping frequency	Daily	36	7.7
	At least once a week	100	21.2
	At least once a month	205	43.5
	At least once every three months	90	19.1
	Less frequently	40	8.5
Delivery method	Home delivery	381	80.9
	Pickup at collection points	38	8.1
	Pickup at courier branches	52	11.0
Product category	Fashion (clothing, footwear, etc.)	199	42.2
	Home appliances and furniture	54	11.5
	Technology and electronics	40	8.5
	Food and beverages	40	8.5
	Cosmetics and personal care	32	6.8
	Groceries	16	3.4
	Books, music, films, and games	14	3.0
	Mother and baby products	13	2.8
	Office and stationery supplies	12	2.5
	Pet products	10	2.1
	Other	41	8.7

Potential common method bias (CMB) was assessed using three statistical approaches [55]. First, Harman's single-factor test was conducted [56]. The unrotated exploratory factor analysis (EFA) revealed that the primary factor explained 34.05% of the total variance, which is well below the 50% threshold. Second, a single-factor confirmatory factor analysis (CFA) was performed by loading all items onto a single latent variable [57]. This model produced poor fit indices ($\chi^2 = 11033.438$, $df = 1539$, $p < 0.001$; $\chi^2/df = 7.169$, $CFI = 0.515$, $RMSEA = 0.115$, $SRMR = 0.100$), indicating that the variance in the data cannot be attributed to a single method factor. Finally, the inter-construct correlations were examined [58]. As shown in Table 3, the highest correlation value (0.754) is below the 0.90 threshold. Based on these results, common method variance

is not considered a major concern for this study.

In the structural equation modeling process, a two-stage approach was followed. First, the measurement model was analyzed using CFA, and then the structural model was analyzed using path analysis.

Prior to CFA, an EFA was conducted to determine the underlying factor structures of the adapted scales. Principal Component Analysis with Promax rotation was employed. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity were examined to assess the suitability of the data for factor analysis. Items were retained based on the strict criteria of having a primary factor loading greater than 0.60 and no significant cross-loadings [54, 59-60]. During the EFA process for the Last-Mile Delivery Service Quality scale, items TIM6, TIM7, and RDQ2 were removed due to significant cross-loadings and having primary factor loadings below the 0.60 threshold. The remaining items successfully formed a seven-factor structure (timeliness, order condition, information quality, order accuracy, order discrepancy handling, return delivery quality, and personnel communication quality) that explained 74.84% of the total variance (KMO = 0.91, Bartlett's $p < 0.001$). For the Perceived Value scale, item VAL4 was deleted as its factor loading fell below 0.60. The remaining items formed a single factor explaining 73.66% of the variance (KMO = 0.96, Bartlett's $p < 0.001$). The Customer Satisfaction scale retained all its initial items, yielding a single factor that explained 73.24% of the variance (KMO = 0.91, Bartlett's $p < 0.001$). Lastly, for the Customer Loyalty scale, item LOY5 was excluded due to a factor loading below 0.60. The retained items constituted a single factor explaining 69.79% of the variance (KMO = 0.94, Bartlett's $p < 0.001$).

In CFA, the parameter values of the measurement model must be examined to validate a latent structure. According to Kline [61], the factor loadings of each observed variable representing the relevant latent construct should be reasonably high (e.g., > 0.65), and the correlation values between latent constructs should not be excessively high (e.g., < 0.85). In addition, to establish the reliability and validity of the measurement model, composite reliability (CR) values should be at least 0.70, and AVE values should be 0.50 or above [60]. As presented in Table 2, all measurement model parameters meet the recommended thresholds.

Table 2. Parameter values of the measurement model

Construct	Indicator	Value	Cronbach's Alpha	CR	AVE
Timeliness (TIM)	TIM1	0.675	0.91	0.911	0.674
	TIM2	0.790			
	TIM3	0.908			
	TIM4	0.924			
	TIM5	0.781			
Order condition (ORC)	ORC1	0.756	0.90	0.902	0.606
	ORC2	0.839			
	ORC3	0.796			
	ORC4	0.822			
	ORC5	0.728			
	ORC6	0.720			
Information quality (INQ)	INQ1	0.693	0.85	0.860	0.607
	INQ2	0.817			
	INQ3	0.831			
	INQ4	0.769			
Order accuracy (ORA)	ORA1	0.798	0.93	0.930	0.727
	ORA2	0.882			
	ORA3	0.775			
	ORA4	0.935			
	ORA5	0.862			
Order discrepancy handling (ODH)	ODH1	0.822	0.85	0.848	0.651
	ODH2	0.779			
	ODH3	0.818			
Return delivery quality (RDQ)	RDQ1	0.840	0.88	0.882	0.652
	RDQ3	0.779			
	RDQ4	0.815			
	RDQ5	0.796			
Personnel communication quality (PCQ)	PCQ1	0.866	0.93	0.934	0.780
	PCQ2	0.821			
	PCQ3	0.929			
	PCQ4	0.912			
Perceived value (VAL)	VAL1	0.820	0.95	0.955	0.704
	VAL2	0.813			
	VAL3	0.788			
	VAL5	0.858			
	VAL6	0.884			
	VAL7	0.875			
	VAL8	0.834			
	VAL9	0.875			
	VAL10	0.799			
Customer Satisfaction (SAT)	SAT1	0.854	0.92	0.927	0.679
	SAT2	0.799			
	SAT3	0.824			
	SAT4	0.805			
	SAT5	0.853			
	SAT6	0.808			
Customer Loyalty (LOY)	LOY1	0.806	0.92	0.928	0.648
	LOY2	0.801			
	LOY3	0.815			
	LOY4	0.734			
	LOY6	0.814			
	LOY7	0.852			
	LOY8	0.809			

The measurement model was also analyzed for discriminant validity following Fornell and Larcker's criterion [62]. For this purpose, a correlation matrix was constructed (see Table 3). As shown in Table 3, no inter-construct correlation exceeds 0.85, and the calculated correlation between any pair of latent variables is strictly lower than the square root of their respective AVE values. Thus, the discriminant validity requirement is fully satisfied.

Table 3. Discriminant validity

	TIM	ORC	INQ	ORA	ODH	RDQ	PCQ	VAL	SAT	LOY
TIM	0.821									
ORC	0.566	0.778								
INQ	0.497	0.638	0.779							
ORA	0.425	0.434	0.402	0.852						
ODH	0.295	0.335	0.316	0.227	0.807					
RDQ	0.363	0.489	0.473	0.454	0.288	0.808				
PCQ	0.248	0.202	0.238	0.330	0.110	0.219	0.883			
VAL	0.520	0.492	0.469	0.453	0.275	0.410	0.238	0.839		
SAT	0.659	0.516	0.529	0.441	0.277	0.481	0.289	0.754	0.824	
LOY	0.569	0.489	0.506	0.489	0.296	0.438	0.253	0.688	0.670	0.805

Note: Square Root of AVE in diagonals

Subsequently, the model fit indices of both the measurement and structural models were examined. The fit indices of the measurement model are $\chi^2/df = 1.552$; RMSEA = 0.034; CFI = 0.964; AGFI = 0.848; SRMR = 0.039. The fit indices of the structural model are $\chi^2/df = 1.611$; RMSEA = 0.036; CFI = 0.959; AGFI = 0.843; SRMR = 0.054. Accordingly, all fit indices for both models are within the acceptable thresholds [63-65]. As the next stage, the structural model was constructed and analyzed via path analysis. Table 4 presents the results of the structural relationships.

Table 4. Results for structural relations

	Structural Relations	Standardized Direct Effect (β)	p-value	Results
H ₁₋₁	TIM $\rightarrow$ VAL	0.257	0.000*	Supported
H ₁₋₂	ORC $\rightarrow$ VAL	0.119	0.056	Not Supported
H ₁₋₃	INQ $\rightarrow$ VAL	0.125	0.037*	Supported
H ₁₋₄	ORA $\rightarrow$ VAL	0.175	0.000*	Supported
H ₁₋₅	ODH $\rightarrow$ VAL	0.048	0.283	Not Supported
H ₁₋₆	RDQ $\rightarrow$ VAL	0.098	0.059	Not Supported
H ₁₋₇	PCQ $\rightarrow$ VAL	0.036	0.395	Not Supported
H ₂₋₁	TIM $\rightarrow$ SAT	0.320	0.000*	Supported
H ₂₋₂	ORC $\rightarrow$ SAT	-0.036	0.443	Not Supported
H ₂₋₃	INQ $\rightarrow$ SAT	0.097	0.033*	Supported
H ₂₋₄	ORA $\rightarrow$ SAT	-0.010	0.797	Not Supported
H ₂₋₅	ODH $\rightarrow$ SAT	-0.010	0.763	Not Supported
H ₂₋₆	RDQ $\rightarrow$ SAT	0.132	0.000*	Supported
H ₂₋₇	PCQ $\rightarrow$ SAT	0.051	0.103	Not Supported
H ₃	VAL $\rightarrow$ SAT	0.518	0.000*	Supported
H ₄	SAT $\rightarrow$ LOY	0.705	0.000*	Supported

Note: TIM: Timeliness; ORC: Order condition; INQ: Information quality; ORA: Order accuracy; ODH: Order discrepancy handling; RDQ: Return delivery quality; PCQ: Personnel communication quality; VAL: Perceived value; SAT: Customer satisfaction; LOY: Customer loyalty; * $p < 0.05$

According to the structural relationships in the model:

- Timeliness ($\beta = 0.257$), information quality ($\beta = 0.125$), and order accuracy ($\beta = 0.175$) have significant, positive effects on perceived value ($p < 0.05$). The other last-mile service quality dimensions do not significantly affect perceived value ($p > 0.05$). Therefore, hypotheses H_{1-1} , H_{1-3} , and H_{1-4} are supported, while H_{1-2} , H_{1-5} , H_{1-6} , and H_{1-7} are not supported.
- Timeliness ($\beta = 0.320$), return delivery quality ($\beta = 0.132$), and information quality ($\beta = 0.097$) have significant, positive effects on customer satisfaction ($p < 0.05$). The other last-mile service quality dimensions do not significantly affect customer satisfaction ($p > 0.05$). Therefore, hypotheses H_{2-1} , H_{2-3} and H_{2-6} are supported, while H_{2-2} , H_{2-4} , H_{2-5} , and H_{2-7} are not supported.
- Perceived value ($\beta = 0.518$) has a strong, positive effect on customer satisfaction ($p < 0.05$). Thus, hypothesis H_3 is supported.
- Customer satisfaction ($\beta = 0.705$) has a strong, positive effect on customer loyalty ($p < 0.05$). Thus, hypothesis H_4 is supported.

The R^2 values of the final structural model (Figure 2) indicate that the model explains 39% of the variance in perceived value, 72% of the variance in customer satisfaction, and 50% of the variance in customer loyalty. These values are above the minimum thresholds suggested by Cohen [66] and indicate an appropriate level of explanatory power.

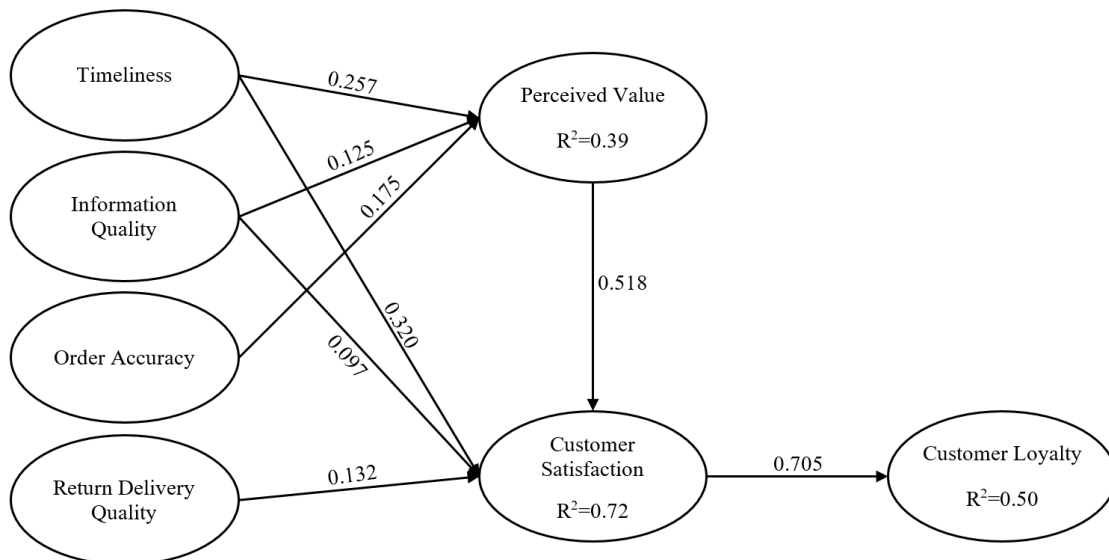


Figure 2. The final structural model

To examine the mediating mechanism within the structural model, the indirect effects of last-mile delivery service quality dimensions on customer loyalty were analyzed. Since there are no direct paths from the service quality dimensions to customer loyalty in the established model, the total effects are entirely composed of the indirect effects. Following the recommended procedures for mediation [67-68], a bootstrapping approach with 5,000 resamples was performed using AMOS to generate bias-corrected 95% confidence intervals (CI). An indirect effect is considered statistically significant if its 95% CI does not include zero [69]. As presented in Table 5, timeliness ($\beta = 0.320$, $p < 0.001$), return delivery quality ($\beta = 0.129$, $p = 0.001$), and information quality ($\beta = 0.114$, $p = 0.003$) have significant, positive indirect effects on customer loyalty through the sequential mediation of perceived value and customer satisfaction. The indirect effects of the remaining dimensions on customer loyalty were not statistically significant.

Table 5. Bootstrapped Indirect and Total Effects on Customer Loyalty

Paths (Indirect)	Standardized Indirect Effect (β)	95% BC CI (Lower)	95% BC CI (Upper)	p-value	Result
TIM $\rightarrow$ LOY	0.320	0.226	0.435	0.000*	Supported
RDQ $\rightarrow$ LOY	0.129	0.056	0.204	0.001*	Supported
INQ $\rightarrow$ LOY	0.114	0.044	0.192	0.003*	Supported
ORA $\rightarrow$ LOY	0.057	-0.006	0.126	0.076	Not Supported
PCQ $\rightarrow$ LOY	0.049	-0.004	0.106	0.075	Not Supported
ORC $\rightarrow$ LOY	0.018	-0.074	0.106	0.752	Not Supported
ODH $\rightarrow$ LOY	0.010	-0.045	0.068	0.730	Not Supported

Note: Due to the full mediation structure of the model, direct paths from antecedents to LOY are constrained to zero; thus, indirect effects equal total effects.

TIM: Timeliness; ORC: Order Condition; INQ: Information Quality; ORA: Order Accuracy; ODH: Order Discrepancy Handling; RDQ: Return Delivery Quality; PCQ: Personnel Communication Quality; VAL: Perceived Value; SAT: Customer Satisfaction; LOY: Customer Loyalty; * $p < 0.05$

5. CONCLUSION

In the age of rapidly evolving information and technology, last-mile delivery is driven by the wants and demands of consumers, necessitating the implementation of effective policies to ensure consumer satisfaction [70]. In this context, rather than treating delivery as a unified process, the present study extends the existing literature by decomposing last-mile delivery service quality into distinct dimensions and revealing their differential effects on creating customer value, satisfaction, and subsequent loyalty.

The findings demonstrate that the timeliness dimension of last-mile delivery service

quality positively affects consumers' satisfaction levels. This result regarding the critical role of timeliness directly aligns with recent evidence demonstrating that timely delivery expectations and time preferences act as primary strategic drivers of consumer satisfaction and loyalty in last-mile e-logistics [71]. This finding is also consistent with other researchers' findings (e.g., [52]). The study highlights the absolute necessity of delivering customer orders on time for online businesses operating with a consumer satisfaction-oriented service approach. Recent studies corroborate this, demonstrating that strict adherence to delivery times and transparent tracking information are the most critical determinants preventing customer defection to competitors [72]. Similarly, additional evidence from Asian markets confirms that delivery time and detailed shipping information are among the primary drivers of customer satisfaction in e-logistics operations [73].

Order accuracy and information quality were found to positively affect the perceived value of the e-retailer's service. This result is consistent with the findings of related researchers (e.g., [74]). In this context, the quality of information consumers receive about their orders directly shapes the value they perceive from the service. Similarly, ensuring that the delivered order is exactly what was purchased and is entirely error-free is an essential component of perceived service value. Therefore, an online shopping business should pay sensitive attention to order management accuracy and the quality of the information provided to the customer.

Return delivery quality has a positive effect on consumers' satisfaction levels. Because customers purchase products without physically inspecting them, return delivery quality becomes a critical operational factor. The findings show that customers place significant importance on a hassle-free return process. In this respect, businesses must optimize procedures such as self-managed returns and overall ease of the return experience to maintain high satisfaction.

The findings also reveal that perceived value positively affects customer satisfaction, which aligns with previous studies (e.g., [75]). Depending on the service structure offered and customer expectations, perceived value acts as a fundamental antecedent shaping consumer satisfaction. Furthermore, customer satisfaction has a strong positive effect on loyalty tendencies [45]. Satisfied customers increase their frequency of choosing the same service and strengthen their behavioral commitment to the business.

The non-significant relationships identified in the study are also noteworthy. Order condition, order discrepancy handling, and personnel communication quality did not significantly influence perceived value or customer satisfaction. This outcome suggests a potential shift in online shoppers' baseline expectations. Currently, receiving an undamaged product (order condition) is likely viewed as a fundamental requirement rather than a value-enhancing service feature. Similarly, the widespread adoption of automated delivery tracking systems, chatbots, and self-service return portals may have reduced the need for direct personnel communication. Consumers may now prioritize efficient, automated solutions over human interaction during the delivery process. Furthermore, because return delivery quality significantly affects satisfaction, it appears that customers value a functional, self-managed return system more than the interactive process of discrepancy handling. This finding aligns with recent evidence suggesting that online shoppers consider operational elements, such as order condition and discrepancy handling, as baseline factors that must be met without necessarily increasing satisfaction [76].

Additionally, the mediation analysis clarifies the sequential mechanism driving consumer behavior. The findings indicate that last-mile delivery dimensions vary in their effect on customer loyalty. Specifically, timeliness, return delivery quality, and information quality exhibit significant indirect effects on loyalty through perceived value and customer satisfaction. This highlights a sequential process in which fast delivery, transparent tracking, and practical return procedures first enhance perceived value and satisfaction, which subsequently lead to customer loyalty. Conversely, the absence of significant indirect effects for dimensions such as order accuracy and order condition implies that these factors function strictly as basic expectations. Customers assume they will receive the correct and undamaged item; fulfilling this baseline expectation prevents dissatisfaction but is generally insufficient to independently generate customer loyalty.

Drivers shaping customers' perceptions of service quality in last-mile delivery—particularly timeliness—have a decisive effect on satisfaction levels and repurchase intentions. To maximize customer satisfaction, businesses should closely monitor industry innovations, identify critical service elements, and heavily invest in the delivery features most valued by consumers. By adopting a customer-oriented approach and refining order status transparency and return delivery processes, e-retailers can

differentiate themselves, attract customers, and achieve sustainable success in the highly competitive e-commerce sector.

From a managerial perspective, the mediation results provide practical implications for e-retailers. To improve customer retention and build a loyal customer base, businesses should prioritize their logistical investments in three key areas: accelerating delivery speed, enhancing tracking transparency, and simplifying return procedures. Because customers generally expect accurate and undamaged orders as standard industry requirements, meeting these baseline expectations is necessary but not sufficient to ensure repeat purchases. Therefore, e-retailers should focus on the value-adding elements of the last-mile delivery process—specifically speed, effective communication, and post-purchase convenience—as these dimensions are the primary drivers of customer satisfaction and loyalty.

Limitations and suggestions for further research

The scope of this research is limited to consumers living in Türkiye who actively shop online. Another research limitation is the lack of a universally established scale designed exclusively for last-mile delivery service quality. For future research, when examining last-mile delivery service quality in terms of customer value, it is suggested to incorporate different variables that capture essential stages of the consumer-retailer relationship (e.g., customer experience, perceived risk, utilitarian & hedonic values). Additionally, researchers are encouraged to develop and validate a comprehensive scale to directly measure the modern last-mile delivery construct. Finally, relying on cross-sectional, self-reported data presents a theoretical risk of common method bias, even though the statistical tests conducted in this study showed no severe threat. Causal inferences should be made cautiously. Future studies could employ longitudinal designs or utilize objective operational data (e.g., actual delivery metrics from logistics providers) to mitigate this risk and further validate the findings.

6. ACKNOWLEDGMENT

This article is derived from a master's thesis prepared by the first author under the supervision of the second author.

7. REFERENCES

- [1] J. E. Collier and C. C. Bienstock, "How do customers judge quality in an e-tailer?," MIT Sloan Management Review, vol. 48, no. 1, pp. 35-40, 2006.
- [2] H. Stadtler, "Supply chain management: an overview," in Supply Chain Management and Advanced Planning: Concepts, Models, Software, and Case Studies, Berlin: Springer, 2014, pp. 3-28.
- [3] B. Melović, D. Šehović, V. Karadžić, M. Dabić, and D. Ćirović, "Determinants of Millennials' behavior in online shopping—Implications on consumers' satisfaction and e-business development," Technology in Society, vol. 65, 2021, Art. no. 101561.
- [4] C. H. Lien, M. J. Wen, and C. C. Wu, "Investigating the relationships among e-service quality, perceived value, satisfaction, and behavioral intentions in Taiwanese online shopping," Asia Pacific Management Review, vol. 16, no. 3, pp. 211-223, 2011.
- [5] A. Kawa and W. Zdrenka, "Logistics value in e-commerce and its impact on customer satisfaction, loyalty and online retailers' performance," The International Journal of Logistics Management, vol. 35, no. 2, pp. 577-600, 2024.
- [6] N. Hill, J. Brierley, and R. MacDougall, How to Measure Customer Satisfaction, Aldershot: Gower Publishing, 2003.
- [7] A. A. Brogowicz, L. M. Delene, and D. M. Lyth, "A synthesised service quality model with managerial implications," International Journal of Service Industry Management, vol. 1, no. 1, pp. 27-45, 1990.
- [8] X. Wang, L. Zhan, J. Ruan, and J. Zhang, "How to choose 'last mile' delivery modes for e-fulfillment," Mathematical Problems in Engineering, vol. 2014, Art. no. 417129, 2014.
- [9] S. Iwan, K. Kijewska, and J. Lemke, "Analysis of parcel lockers' efficiency as the last mile delivery solution—the results of the research in Poland," Transportation Research Procedia, vol. 12, pp. 644-655, 2016.
- [10] F. M. Bergmann, S. M. Wagner, and M. Winkenbach, "Integrating first-mile pickup and last-mile delivery on shared vehicle routes for efficient urban e-commerce distribution," Transportation Research Part B: Methodological, vol. 131, pp. 26-62, 2020.
- [11] J. Olsson, D. Hellström, and H. Pålsson, "Framework of last mile logistics research: a systematic review of the literature," Sustainability, vol. 11, no. 24, Art. no. 7131, 2019.
- [12] M. C. Wolfinbarger and M. C. Gilly, "eTailQ: dimensionalizing, measuring and

- predicting eTail quality,” *Journal of Retailing*, vol. 79, no. 3, pp. 183-198, 2003.
- [13] M. U. H. Uzir, H. Al Halbusi, R. Thurasamy, R. L. Thiam Hock, M. A. Aljaberi, N. Hasan, and M. Hamid, "The effects of service quality, perceived value and trust in home delivery service personnel on customer satisfaction: evidence from a developing country," *Journal of Retailing and Consumer Services*, vol. 63, Art. no. 102721, 2021.
- [14] Y. Vakulenko, J. Arsenovic, D. Hellström, and P. Shams, "Does delivery service differentiation matter? Comparing rural to urban e-consumer satisfaction and retention," *Journal of Business Research*, vol. 142, pp. 476–484, 2022.
- [15] C. Tran Trung, T. Phan Tran Xuan, and H. Tran Thanh, "The impact of last-mile delivery logistics service quality factors on customer loyalty: the case of online shopping in the Mekong Delta Region," *International Journal of Business and Society*, vol. 26, no. 2, pp. 793–805, 2025.
- [16] Y. Vakulenko, P. Shams, D. Hellström, and K. Hjort, "Online retail experience and customer satisfaction: the mediating role of last mile delivery,” *The International Review of Retail, Distribution and Consumer Research*, vol. 29, no. 3, pp. 306-320, 2019.
- [17] I. Cardenas, Y. Borbon-Galvez, T. Verlinden, E. Van de Voorde, T. Vanellander, and W. Dewulf, "City logistics, urban goods distribution and last-mile delivery and collection,” *Competition and Regulation in Network Industries*, vol. 18, no. 1-2, pp. 22-43, 2017.
- [18] T. L. Esper, T. D. Jensen, F. L. Turnipseed, and S. Burton, "The last mile: an examination of effects of online retail delivery strategies on consumers,” *Journal of Business Logistics*, vol. 24, no. 2, pp. 177-203, 2003.
- [19] K. H. Leung, K.L. Choy, P.K. Siu, G.T. Ho, H.Y. Lam, and C.K. Lee, "A B2C e-commerce intelligent system for re-engineering the e-order fulfilment process,” *Expert Systems with Applications*, vol. 91, pp. 386-401, 2018.
- [20] N. Tiwapat, C. Pomsing, and P. Jomthong, "Last mile delivery: modes, efficiencies, sustainability, and trends,” in *Proc. 3rd IEEE International Conference on Intelligent Transportation Engineering (ICITE)*, 2018, pp. 313-317.
- [21] R. Gevaers, E. Van de Voorde, and T. Vanellander, "Characteristics of innovations in last-mile logistics—using best practices, case studies and making the link with green and sustainable logistics,” in *Proc. European Transport Conference*, 2009, pp. 1-21.
- [22] A. Giret, C. Carrascosa, V. Julian, M. Rebollo, and V. Botti, "A crowdsourcing approach for sustainable last mile delivery,” *Sustainability*, vol. 10, no. 12, Art. no. 4563, 2018.

- [23] C. Nagadeepa, B. Dyczek, A. K. Mishra, B. Valerii, O. Oleksandr, and K. Sokoliuk, "Last-mile delivery innovations: the future of e-commerce logistics," in *Technology-Driven Business Innovation*, R. El Khoury, Ed., Springer Nature Switzerland, 2024, pp. 283–296.
- [24] S. Xu, X. Zhang, R. Kim, and M. Su, "Anthropomorphic last-mile robots and consumer intention: an empirical test under a theoretical framework," *Journal of Retailing and Consumer Services*, vol. 81, Art. no. 104028, 2024.
- [25] N. Masorgo, D. D. Dobrzykowski, and B. S. Fugate, "Last-mile delivery: a process view, framework, and research agenda," *Journal of Business Logistics*, vol. 45, no. 4, Art. no. e12397, 2024.
- [26] A. Parasuraman, V. A. Zeithaml, and L. L. Berry, "SERVQUAL: a multiple-item scale for measuring consumer perceptions of service quality," *Journal of Retailing*, vol. 64, no. 1, pp. 12–40, 1988.
- [27] B. Angelova and J. Zekiri, "Measuring customer satisfaction with service quality using American Customer Satisfaction Model (ACSI Model)," *International Journal of Academic Research in Business and Social Sciences*, vol. 1, no. 3, pp. 232-258, 2011.
- [28] N. Boysen, S. Fedtke, and S. Schwerdfeger, "Last-mile delivery concepts: a survey from an operational research perspective," *OR Spectrum*, vol. 43, no. 1, pp. 1-58, 2021.
- [29] J. T. Mentzer, D. J. Flint, and G. T. M. Hult, "Logistics service quality as a segment-customised process," *Journal of Marketing*, vol. 65, no. 4, pp. 82-104, 2001.
- [30] R. Leuschner and D. M. Lambert, "Establishing logistics service strategies that increase sales," *Journal of Business Logistics*, vol. 37, no. 3, pp. 247-270, 2016.
- [31] H. Ta, T. L. Esper, A. R. Hofer, and A. C. Sodero, "Reconceptualizing e-logistics service quality (E-LSQ) in emerging contexts: the case of crowdsourced delivery," *Journal of Business Logistics*, vol. 46, no. 1, Art. no. e12401, 2025.
- [32] R. Sánchez-Fernández and M. Á. Iniesta-Bonillo, "The concept of perceived value: a systematic review of the research," *Marketing Theory*, vol. 7, no. 4, pp. 427-451, 2007.
- [33] J. L. M. Tarn, "The effects of service quality, perceived value and customer satisfaction on behavioral intentions," *Journal of Hospitality & Leisure Marketing*, vol. 6, no. 4, pp. 31-43, 1999.
- [34] F. Huber, A. Herrmann, and R. E. Morgan, "Gaining competitive advantage through customer value oriented management," *Journal of Consumer Marketing*, vol. 18, no. 1, pp. 41-53, 2001.

- [35] S. Behjati, M. Nahich, and S. N. Othaman, "Interrelation between E-service Quality and E-satisfaction and Loyalty," *European Journal of Business and Management*, vol. 4, no. 9, pp. 75-85, 2012.
- [36] L. Jiang, M. Jun, and Z. Yang, "Customer-perceived value and loyalty: how do key service quality dimensions matter in the context of B2C e-commerce?," *Service Business*, vol. 10, no. 2, pp. 301-317, 2016.
- [37] I. Gil-Saura, G. Berenguer-Contrí, and E. Ruiz-Molina, "Satisfaction and loyalty in B2B relationships in the freight forwarding industry: adding perceived value and service quality into equation," *Transport*, vol. 33, no. 5, pp. 1184-1195, 2018.
- [38] M. T. Rico, S. Wahyoedi, and E. D. Purnama, "The effects of trust, service quality and perceived value on satisfaction and their impact on loyalty," in *Proc. 7th International Conference on Entrepreneurship and Business Management (ICEBM)*, 2019, pp. 325-330.
- [39] R. Sánchez-Fernández and M. Á. Iniesta-Bonillo, "Consumer perception of value: literature review and a new conceptual framework," *Journal of Consumer Satisfaction, Dissatisfaction and Complaining Behavior*, vol. 19, pp. 40-58, 2006.
- [40] V. Shankar, A. K. Smith, and A. Rangaswamy, "Customer satisfaction and loyalty in online and offline environments," *International Journal of Research in Marketing*, vol. 20, no. 2, pp. 153-175, 2003.
- [41] A. Otsetova, "Relationship between logistics service quality, customer satisfaction and loyalty in courier services industry," *Management & Education/Upravlenie i Obrazovanie*, vol. 13, pp. 51-57, 2017.
- [42] L. Hafez, E. Elakkad, and M. Gamil, "A study on the impact of logistics service quality on the satisfaction and loyalty of e-shoppers in Egypt," *Open Journal of Business and Management*, vol. 9, no. 5, pp. 2464-2478, 2021.
- [43] T. T. Yen, N. T. T. Trang, and T. T. Anh, "Impact of e-logistics service quality on customer's satisfaction and loyalty: evidence in Hanoi, Vietnam," *East Asian Journal of Multidisciplinary Research*, vol. 1, no. 5, pp. 739-752, 2022.
- [44] S. Cook, *Customer care excellence: how to create an effective customer focus*, 6th ed., London: Kogan Page Publishers, 2010.
- [45] H. H. Chang, Y. H. Wang, and W. Y. Yang, "The impact of e-service quality, customer satisfaction and loyalty on e-marketing: moderating effect of perceived value," *Total Quality Management & Business Excellence*, vol. 20, no. 4, pp. 423-443, 2009.
- [46] M. A. Scridon, S. A. Achim, M. O. Pintea, and M. D. Gavriltea, "Risk and perceived value: antecedents of customer satisfaction and loyalty in a sustainable business model," *Economic Research-Ekonomska Istraživanja*, vol. 32, no. 1, pp.

909-924, 2019.

- [47] F. F. Reichheld, *Loyalty rules!: how today's leaders build lasting relationships*, Boston, MA: Harvard Business Press, 2001.
- [48] R. L. Oliver, "Whence consumer loyalty?," *Journal of Marketing*, vol. 63, no. 4_suppl1, pp. 33-44, 1999.
- [49] J. T. Bowen and S. L. Chen, "The relationship between customer loyalty and customer satisfaction," *International Journal of Contemporary Hospitality Management*, vol. 13, no. 5, pp. 213-217, 2001.
- [50] S. Rao, T. J. Goldsby, S. E. Griffis, and D. Iyengar, "Electronic logistics service quality (e-LSQ): its impact on the customer's purchase satisfaction and retention," *Journal of Business Logistics*, vol. 32, no. 2, pp. 167-179, 2011.
- [51] A. Kahwaji and M. M. Almubayed, "A study of customer satisfaction dimensions and their impact on customer loyalty to online shopping sites: an analytical study of online shopping sites in Arabic market," *International Journal of Economic Research*, vol. 13, no. 3, pp. 1041-1054, 2016.
- [52] S. Akıl and M. C. Ungan, "E-commerce logistics service quality: customer satisfaction and loyalty," *Journal of Electronic Commerce in Organizations*, vol. 20, no. 1, pp. 1-19, 2022.
- [53] Y. Miranti and T. Y. R. Syah, "Marketplace analysis: the effect of e-service quality, product brand perception and social support on repurchase through consumer satisfaction and trust," *International Journal of Electronic Commerce Studies*, vol. 14, no. 4, pp. 45-72, 2023.
- [54] N. K. Malhotra, *Marketing research: an applied orientation*, 7th global ed., Upper Saddle River, NJ: Pearson, 2020.
- [55] P. M. Podsakoff, S. B. MacKenzie, and N. P. Podsakoff, "Sources of method bias in social science research and recommendations on how to control it," *Annual Review of Psychology*, vol. 63, pp. 539-569, 2012.
- [56] P. M. Podsakoff, S. B. MacKenzie, J. Y. Lee, and N. P. Podsakoff, "Common method biases in behavioral research: a critical review of the literature and recommended remedies," *Journal of Applied Psychology*, vol. 88, no. 5, pp. 879-903, 2003.
- [57] N. K. Malhotra, S. S. Kim, and A. Patil, "Common method variance in IS research: a comparison of alternative approaches and a reanalysis of past research," *Management Science*, vol. 52, no. 12, pp. 1865-1883, 2006.
- [58] P. A. Pavlou, H. Liang, and Y. Xue, "Understanding and mitigating uncertainty in online exchange relationships: a principal-agent perspective," *MIS Quarterly*, vol.

- 31, no. 1, pp. 105-136, 2007.
- [59] Ö. Çokluk, G. Şekercioğlu, and Ş. Büyüköztürk, *Sosyal bilimler için çok değişkenli istatistik: SPSS ve LISREL uygulamaları*. Ankara: Pegem Akademi, 2012.
- [60] J. F. Hair, W. C. Black, B. J. Babin, and R. E. Anderson, *Multivariate Data Analysis*, 7th ed., Upper Saddle River, NJ: Pearson, 2010.
- [61] R. B. Kline, *Principles and Practice of Structural Equation Modeling*, 3rd ed., New York, NY: The Guilford Press, 2010.
- [62] C. Fornell and D. F. Larcker, "Structural equation models with unobservable variables and measurement error: algebra and statistics," *Journal of Marketing Research*, vol. 18, no. 3, pp. 382-388, 1981.
- [63] G. Dash and J. Paul, "CB-SEM vs PLS-SEM methods for research in social sciences and technology forecasting," *Technological Forecasting and Social Change*, vol. 173, Art. no. 121092, 2021.
- [64] D. Hooper, J. Coughlan, and M. R. Mullen, "Structural equation modelling: guidelines for determining model fit," *Electronic Journal of Business Research Methods*, vol. 6, no. 1, pp. 53-60, 2008.
- [65] L. Hu and P. M. Bentler, "Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives," *Structural Equation Modeling*, vol. 6, no. 1, pp. 1-55, 1999.
- [66] J. Cohen, *Statistical power analysis for the behavioral sciences*, New York: Academic Press, 1988.
- [67] G. W. Cheung and R. S. Lau, "Testing mediation and suppression effects of latent variables: bootstrapping with structural equation models," *Organizational Research Methods*, vol. 11, no. 2, pp. 296-325, 2008.
- [68] K. J. Preacher and A. F. Hayes, "Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models," *Behavior Research Methods*, vol. 40, no. 3, pp. 879-891, 2008.
- [69] X. Zhao, J. G. Lynch Jr, and Q. Chen, "Reconsidering Baron and Kenny: myths and truths about mediation analysis," *Journal of Consumer Research*, vol. 37, no. 2, pp. 197-206, 2010.
- [70] A. Payne, P. Frow, and A. Eggert, "The customer value proposition: evolution, development, and application in marketing," *Journal of the Academy of Marketing Science*, vol. 45, no. 4, pp. 467-489, 2017.
- [71] M. Briana and G. Malindretos, "The clock is ticking: a quantitative study of consumer expectations in last-mile e-logistics," *Global Business Review*, p.

- OnlineFirst, 2025, doi: 10.1177/0972150925139153.
- [72] K. Aljohani, "The role of last-mile delivery quality and satisfaction in online retail experience: an empirical analysis," *Sustainability*, vol. 16, no. 11, Art. no. 4743, 2024.
- [73] M. N. Tran, Q. T. Nguyen, and N. H. P. Nguyen, "Factors influencing the satisfaction of e-logistics customers in Vietnam: the mediating role of information technology," *International Journal of Electronic Commerce Studies*, vol. 13, no. 4, pp. 81-96, 2022.
- [74] T. T. A. Ngo, G. K. An, D. K. Dao, N. Q. N. Nguyen, N. Y. V. Nguyen, and B. H. Phong, "Roles of logistics service quality in shaping generation Z customers' repurchase intention and electronic word of mouth in e-commerce industry," *PLoS One*, vol. 20, no. 5, Art. no. e0323962, 2025.
- [75] K. Chaisaengduean, "Market orientation and logistics service process quality: an empirical investigation in the logistics service providers in Thailand," in *Proc. International Academic Multidisciplinary Research Conference in Vienna*, 2019, pp. 174-179.
- [76] R. R. Cuison, R.M.V. Ingalla, J.H.R.B. Amor, J.L. Remigio, K.X. Guerra, G.A.D. Arellano, P. G. M. Asis, J. A. Gabrillo, and C.D. Francisco, "The effects of perceived value and customer satisfaction in online businesses," *International Journal of Academic Multidisciplinary Research*, vol. 5, no. 1, pp. 41-45, 2021.
- [77] R. E. Anderson and S. S. Srinivasan, "E-satisfaction and e-loyalty: a contingency framework," *Psychology & Marketing*, vol. 20, no. 2, pp. 123-138, 2003.
- [78] A. Parasuraman, V. A. Zeithaml, and A. Malhotra, "ES-QUAL: a multiple-item scale for assessing electronic service quality," *Journal of Service Research*, vol. 7, no. 3, pp. 213-233, 2005.
- [79] Y. Xing, D. B. Grant, A. C. McKinnon, and J. Fernie, "Physical distribution service quality in online retailing," *International Journal of Physical Distribution & Logistics Management*, vol. 40, no. 5, pp. 415-432, 2010.
- [80] J. C. Sweeney and G. N. Soutar, "Consumer perceived value: the development of a multiple item scale," *Journal of Retailing*, vol. 77, no. 2, pp. 203-220, 2001.
- [81] H. W. Kim, Y. Xu, and S. Gupta, "Which is more important in Internet shopping, perceived price or trust?," *Electronic Commerce Research and Applications*, vol. 11, no. 3, pp. 241-252, 2012.
- [82] V. A. Zeithaml, L. L. Berry, and A. Parasuraman, "The behavioral consequences of service quality," *Journal of Marketing*, vol. 60, no. 2, pp. 31-46, 1996.

APPENDIX:

Scale items

LAST-MILE DELIVERY SERVICE QUALITY	
Timeliness (<i>adapted from Collier and Bienstock [1], Mentzer et al. [29], and Parasuraman et al. [78]</i>)	
TIM1	In this e-retailer, the time between placing the order and making the delivery is short.
TIM2	This e-retailer delivers orders at the promised time.
TIM3	The time to confirm and process an order in this e-retailer is short.
TIM4	This e-retailer quickly makes the order ready for delivery.
TIM5	This e-retailer delivers the order quickly.
TIM6*	This e-retailer does its best to fulfil the customer's urgent order.
TIM7*	This e-retailer offers the customer multiple delivery time options (like same day, next day).
Order Condition (<i>adapted from Collier and Bienstock [1]</i>)	
ORC1	This e-retailer packs the orders carefully so that they are not damaged during the shipping process.
ORC2	This e-retailer ensures that orders are delivered undamaged.
ORC3	Shipping of orders from this e-retailer is usually not damaged.
ORC4	This e-retailer delivers products undamaged.
ORC5	This e-retailer does its best to ensure that the products in the order are delivered with the outer packaging intact.
ORC6	This e-retailer is reliable in order delivery.
Information Quality (<i>adapted from Parasuraman et al. [78] and Mentzer et al. [29]</i>)	
INQ1	This e-retailer is reliable in terms of the stock information it provides before the order.
INQ2	This e-retailer makes the right commitments on delivery.
INQ3	This e-retailer provides the information to the customer about the delivery status/process of the order.
INQ4	The information that this e-retailer provides to the customer about the delivery status/process of the order is sufficient.
Order Accuracy (<i>adapted from Parasuraman et al. [78] and Mentzer et al. [29]</i>)	
ORA1	This e-retailer delivers the order as promised.
ORA2	This e-retailer sends exactly what products are ordered.
ORA3	Orders delivered by this e-retailer rarely contain the wrong product.
ORA4	Orders delivered by this e-retailer rarely contain an incorrect number of items.
ORA5	Orders delivered by this e-retailer rarely contain a substitute (similar) product instead of the ordered product.
Order Discrepancy Handling (<i>adapted from Mentzer et al. [29]</i>)	
ODH1	This e-retailer's compensation for incorrectly sent orders is satisfactory.
ODH2	The process for reporting incorrectly shipped orders for customers in this e-retailer is well designed.
ODH3	This e-retailer's response to customer requests for incorrectly shipped orders is satisfactory.
Return Delivery Quality (<i>adapted from Xing et al. [79] and Parasuraman et al. [78]</i>)	
RDQ1	This e-retailer's return procedure is easy.
RDQ2*	This e-retailer offers different delivery options for product returns (such as home pickup or return from store/collection point).
RDQ3	This e-retailer receives returned items immediately.
RDQ4	This e-retailer offers hassle-free delivery options for product returns.
RDQ5	This e-retailer manages product return processes well.

Personnel Communication Quality (adapted from Parasuraman et al. [78] and Mentzer et al. [29])

PCQ1	The customer representatives of this e-retailer quickly deal with customer issues related to order delivery.
PCQ2	The customer representatives of this e-retailer strive to understand the customer's problems with order delivery.
PCQ3	This e-retailer's customer representatives solve customer problems with order delivery.
PCQ4	The customer representatives of this e-retailer have sufficient knowledge/experience to respond to customers.

PERCEIVED VALUE

(adapted from Sweeney and Soutar [80], Parasuraman et al. [78], and Kim et al. [81])

VAL1	This e-retailer has consistent quality.
VAL2	This e-retailer has an acceptable quality standard.
VAL3	This e-retailer regularly serves with similar performance.
VAL4*	This e-retailer is generally reasonably priced.
VAL5	This e-retailer gives me good value for money.
VAL6	This e-retailer repays my effort.
VAL7	This e-retailer generally satisfies my wants and needs.
VAL8	By shopping at this e-retailer, I get more benefits compared to the costs I incur.
VAL9	It is a pleasure to shop at this e-retailer.
VAL10	I am happy to shop from this e-retailer.

CUSTOMER SATISFACTION

(adapted from Anderson and Srinivasan [77])

SAT1	I am happy with my decision to shop at this e-retailer.
SAT2	I think my decision to shop at this e-retailer was wise.
SAT3	My purchase(s) from this e-retailer met my expectations.
SAT4	I feel bad about my decision to shop at this e-retailer. (R)
SAT5	I think I did the right thing by shopping at this e-retailer.
SAT6	I am unhappy to shop from this e-retailer. (R)

CUSTOMER LOYALTY

(adapted from Anderson and Srinivasan [77] and Zeithaml et al. [82])

LOY1	I intend to shop more from this e-retailer in the future.
LOY2	I don't think I will change this e-retailer as long as their current service continues.
LOY3	I try to use this e-retailer when I need to make an online purchase.
LOY4	This e-retailer is my first choice when I need to make an online purchase.
LOY5*	I don't usually think of changing this e-retailer.
LOY6	In my opinion this e-retailer is the best e-retailer for online shopping.
LOY7	I tell other people positive things about this e-retailer.
LOY8	I encourage my friends and relatives to use this e-retailer.

* These items were dropped during the exploratory factor analysis.