

Logistics value co-creation in sustainable last-mile delivery: Evidence from parcel lockers in Indonesia

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Abstract

Indonesia's rapid e-commerce growth has intensified pressure on last-mile delivery (LMD) systems, making sustainable and consumer-centric solutions increasingly urgent. While self-collection parcel (SCP) lockers offer promising alternatives to conventional home delivery, their adoption remains limited despite mounting urban logistics inefficiencies. Drawing on service-dominant logic (SDL), this study examines how logistics value, utilitarian and hedonic orientations, and environmental knowledge influence consumers' willingness to co-create and, subsequently, their intention to adopt SCPs. A quantitative cross-sectional survey was administered to 235 online shoppers in Greater Jakarta, selected through purposive sampling from a target population of active online marketplace users with prior e-commerce experience. Data were collected electronically via a structured questionnaire distributed through online channels and analyzed using partial least squares structural equation modeling (PLS-SEM). Results confirm that logistics value, utilitarian orientation, hedonic orientation, and environmental knowledge each positively influence willingness to co-create. Furthermore, willingness to co-create and environmental knowledge directly and significantly predict SCP adoption intention. These findings advance SDL theory by positioning consumers as active operant resources in sustainable logistics ecosystems, moving beyond traditional efficiency-based perspectives. The study also contributes empirical evidence from a developing urban market, broadening the applicability of co-creation frameworks in contexts where infrastructure limitations and environmental awareness remain uneven. Practical guidance is offered for designing co-creation-oriented SCP services aligned with consumer motivations and sustainability goals.

Introduction

Indonesia has emerged as Southeast Asia's largest online retail market (Google et al., 2024). The scale of this transformation is reflected in the country's 2023 e-commerce transaction value of Rp1,100.87 trillion, generated across 3.82 million registered e-commerce businesses — a 27.40% year-on-year increase that signals a structural shift in how Indonesian consumers access goods and services (Badan Pusat Statistik, 2025).

This growth has placed operational pressure on last-mile delivery (LMD) systems. As the final and most cost-intensive segment of the supply chain, LMD is particularly vulnerable to demand surges: more orders mean more delivery attempts, more vehicles on congested roads, and greater risk of failed deliveries. Despite the emergence of alternative fulfillment models, the traditional home delivery approach continues to dominate the LMD landscape (Sharma et al., 2025). A study by Restuputri et al. (2022) reveals a similar trend in Indonesia, where consumers value home delivery services due to the convenience and ease they offer.

This persistence is largely explained by consumer preference: home delivery eliminates the need for active participation in the collection process, offering a passive convenience that other models have struggled to replicate. Yet this very passivity is what makes home delivery

operationally fragile, as it places the entire burden of coordination and timing on the logistics provider, with little room for consumer contribution or flexibility.

In response, alternative delivery innovations have been introduced, including self-collection parcel lockers (SCPs), micro-fulfillment centers, and two-wheeled courier networks. Among these solutions, parcel lockers have been highlighted as particularly promising, as they provide convenience, flexibility, and environmental benefits through consolidated drop-offs that reduce vehicle mileage and emissions.

The dominant theoretical approaches in LMD remain anchored to provider-centric and functional perspectives. Studies have largely explained LMD adoption through operational attributes such as speed, price, and reliability or through technology acceptance frameworks such as TAM and UTAUT, which focus on perceived usefulness and ease of use as the primary drivers of behavioral intention (Jang et al., 2024). This provider-centric orientation leaves a critical dimension of LMD underexplored: the role of consumer Co-creation in shaping both value realization and adoption intention.

In the context of SCP systems, Co-creation is structurally embedded in the service model. When consumers choose locker locations, schedule pick-up times, and provide feedback on service performance, they are not merely using a service; they are actively contributing to its efficiency and sustainability outcomes. Yet despite this recognition, the factors that activate consumers' willingness to co-create in LMD and the pathways through which this willingness translates into adoption intention remain insufficient.

Existing research on LMD has predominantly adopted a provider-centric and functional orientation (Jang et al., 2024; Sharma et al., 2025), focusing on efficiency, cost, and technology, while overlooking consumers' active role in value Co-creation. Limited studies have examined how consumers' psychological motives and environmental awareness jointly influence their willingness to co-create logistics value, particularly within self-collection parcel (SCP) systems. Although prior work highlights the effects of individualizing and relational motives on participation (Liu et al., 2025), the pathways linking these motives, perceived logistics value, and adoption intention remain unclear, especially in developing megacities like Jakarta.

Service-dominant logic (SDL) provides the appropriate theoretical lens to address these gaps. Unlike functional or technology-acceptance frameworks, SDL reconceptualizes value as something that is co-created through ongoing interactions between consumers and service ecosystems, rather than embedded in the service offering itself (Vargo, 2021). This positions the consumer as an operant resource as a mechanism to examine why and how consumers participate in sustainable LMD solutions such as SCPs.

This study aims to analyze how logistics value, utilitarian and hedonic motives, and environmental knowledge influence willingness to co-create and, in turn, the intention to adopt SCPs. Guided by the SDL framework, the study addresses the following research questions: (1) How do these factors drive value Co-creation? (2) How does value Co-creation contribute to consumers' adoption intention? (3) What insights can inform SCP design and communication strategies?

The present study contributes to the literature by extending the application of SDL in sustainable LMD. This study integrates logistics value, utilitarian and hedonic motives, and environmental knowledge into a unified framework, providing the mechanism of how both functional and affective dimensions shape consumers' willingness to co-create in sustainable logistics ecosystems. The study fills a gap in LMD research in emerging urban markets such as Indonesia.

From a practical standpoint, the study provides insights for e-commerce platforms, logistics providers, and policymakers seeking to enhance the adoption of environmentally sustainable last-mile solutions. By identifying motivational, perceptual factors, and environmental knowledge that foster customer Co-creation, the findings can inform the design, communication, and management of SCP services to better align with consumer expectations of efficiency, convenience, and environmental responsibility.

Literature Review and Hypotheses Development

Service-dominant logic

Service-dominant logic (SDL) represents a foundational paradigm shift in how value creation is conceptualized in service and marketing research. Introduced by Vargo and Lusch and subsequently refined through ongoing scholarly dialogue, SDL departs from the goods-dominant paradigm in which value is produced by firms, embedded in outputs, and delivered to passive consumers by arguing that value is always co-created through interactive processes between service providers and consumers within broader service ecosystems (Vargo, 2021). Central to SDL is the distinction between operand resources (static, tangible inputs such as physical infrastructure or logistics networks) and operant resources (dynamic, intangible inputs such as consumers' knowledge, skills, effort, and behavioral engagement), with SDL asserting that it is operant resources, not operand ones, that are the primary drivers of value realization (Vargo & Lusch, 2017). In this framework, the consumer is reconceptualized not as a passive recipient of delivered value but as an active co-creator whose resource integration is constitutive of the service experience itself. In the context of sustainable LMD, this reorientation is theoretically consequential, as it shifts the analytical focus from what logistics providers deliver to how consumers participate in and contribute to the delivery ecosystem.

SDL is a theoretically necessary framework for understanding SCP adoption and value co-creation in sustainable last-mile delivery. The dominant frameworks in LMD adoption research, principally the technology acceptance model (TAM) and its extensions (Jang et al., 2024), as well as expectancy-value models (Justavino-Castillo et al., 2023), conceptualize the consumer as a passive evaluator of system attributes.

First, SDL explains adoption variance that functional frameworks cannot. Since all consumers interacting with the same SCP infrastructure face identical objective service attributes, TAM predicts that consumers with similar perceptions of usefulness and ease of use should exhibit similar adoption intentions. Second, SDL provides a coherent bridge between consumer behavioral engagement and systemic sustainability outcomes. Consumers who participate in SCP collection are not merely completing a transaction; they are actively contributing to the sustainability of the urban logistics system. Each act of self-collection reduces a vehicle trip, lowers per-parcel emissions, and relieves urban congestion. SDL's conceptualization of the consumer as an active resource integrator provides the theoretical basis for this mechanism explicitly, making it structurally capable of capturing the full behavioral logic of SCP adoption in a sustainable logistics ecosystem.

Logistics value in last-mile delivery

Logistics value represents consumers' holistic evaluation of a logistics service, covering not only operational dimensions such as timeliness, accessibility, and information richness, but also experiential, economic, and sustainability dimensions that determine whether the service is perceived as worthwhile (Kawa & Świątowiec-Szczepańska, 2021). This holistic view is important because consumers do not evaluate logistics services in isolation, yet they assess the entire service encounter as an integrated experience, weighing perceived benefits against what they must invest in terms of time, effort, money, and cognitive load (Justavino-Castillo et al., 2023).

From a value-based perspective, logistics value materializes when the cumulative benefits of a service outweigh the sacrifices associated with it (Correa et al., 2021). As consumers interact with a logistics system across multiple touchpoints from order placement and real-time tracking to parcel collection and return management, their perception of value accumulates and is continuously revised. High logistics value therefore reflects a sustained positive evaluation across the entire service journey, not merely satisfaction with a single transaction (Vrhovac et al., 2024).

This holistic conceptualization has direct implications for SCP adoption. Self-collection parcel lockers score favorably on all three dimensions simultaneously: they offer functional reliability through 24/7 access and elimination of failed deliveries; economic value through reduced re-delivery costs and flexible scheduling; and sustainability value through consolidated vehicle trips and lower per-parcel carbon emissions (Hovi & Bø, 2024). When consumers recognize this

multidimensional value, they are not merely satisfied; they develop a motivational foundation for active participation. Logistics value therefore functions not only as an outcome of efficient service provision but as a psychological trigger for Co-creation: consumers who perceive that a service offers genuine and multidimensional value are more inclined to invest their own resources of time, effort, and behavioral adaptation into sustaining and improving that service (Wang et al., 2023).

Core dimensions such as delivery accuracy, transparency of information, and problem-solving efficiency consistently influence customer satisfaction (Vrhovac et al., 2024). In last-mile delivery systems, technologies that facilitate real-time tracking, automated notifications, and flexible collection options such as smart lockers strengthen perceived control and reduce cognitive effort, thereby increasing logistics value. High logistics value emerges when self-collection systems offer reliable access, clear communication, and environmental benefits, positioning them as a customer-centric and eco-efficient solution for last-mile delivery.

Logistics value is not only an outcome of efficient service provision but also a driver of active customer engagement in logistics processes. When consumers perceive that a logistics service provides substantial value, they are more inclined to participate collaboratively in value creation activities (Wang et al., 2023). Such participation, or willingness to co-create, reflects consumers' readiness to share information, adapt behaviors, or use digital interfaces to improve service performance (Sarkar et al., 2022). When customers experience high logistics value, they tend to perceive the service provider as trustworthy and responsive, which encourages reciprocal behavior and collaborative participation (Chen & Ryu, 2025).

When customers expect positive outcomes from a particular subject, they tend to participate in cocreating the values expected (Zhao et al., 2018). Empirical studies in logistics and service marketing confirm that perceived value enhances consumers' psychological ownership and cooperative intentions (Yuen et al., 2019; Zhang et al., 2024). For example Wang et al. (2019) found that positive attributes in logistics services motivate customers to participate in co-creation in delivery.

In sustainable last-mile delivery contexts, customers who recognize tangible and intangible benefits such as reduced environmental footprint and greater delivery flexibility are more likely to contribute to maintaining and improving service quality. Hence, high logistics value fosters a sense of shared responsibility and encourages customers to actively participate in sustainable delivery systems. Hence, this study proposes the following hypothesis:

H1: Logistics value positively influences willingness to co-create.

Consumer orientation: utilitarian and hedonic motives

Consumer orientation in technology adoption is often explained through utilitarian and hedonic motives. Utilitarian motives are goal-directed, focusing on efficiency, time-saving, and cost reduction (Puspitasari et al., 2023). By contrast, hedonic motives highlight experiential gratifications such as convenience, autonomy, and enjoyment (Ishizuka & Aoki, 2024). In LMD, both orientations shape consumer preferences: while utilitarian value supports functional adoption, hedonic value enhances perceived experiential richness, thereby reinforcing adoption intention (Barrett et al., 2024).

The distinction between utilitarian and hedonic motives is well established in consumer service experience. Rooted in the dual-process view of motivation, utilitarian and hedonic orientations represent two fundamental evaluative dimensions that guide individuals' decision-making. Utilitarian orientation reflects a goal-directed and cognitive approach (Akdim et al., 2022), emphasizing functional outcomes such as efficiency, time savings, cost reduction, and problem-solving. Consumers motivated by utilitarian value tend to evaluate technological services based on their instrumental usefulness and the extent to which they facilitate task accomplishment. On the other hand, hedonic orientation is experiential and affective, focusing on enjoyment, novelty, and emotional satisfaction derived from the process of consumption itself. Hedonic value stems from the intrinsic pleasure or sense of autonomy users experience when interacting with technology-enabled services (Rohden et al., 2025).

In digital service and logistics contexts, these dual motives are increasingly recognized as critical determinants of adoption and engagement. The interaction of utilitarian and hedonic orientations provides an explanation for technology-related decision-making, where individuals

balance functional benefits with experiential gratification (Dinh & Park, 2024). From an SDL perspective, both orientations are essential to understanding value Co-creation. Utilitarian motives lead customers to engage because they perceive tangible efficiency and control benefits, while hedonic motives stimulate emotional involvement and satisfaction, which further sustain engagement behavior (Alhomaïd & Bel Hadj, 2025). These motivational pathways suggest that customer participation in digital logistics solutions such as self-collection parcel lockers is not solely pragmatic but also experiential, reflecting a synthesis of rational efficiency-seeking and emotional gratification. Thus, the present study posits that:

H2: Utilitarian orientation positively influences willingness to create.

H3: Hedonic orientation positively influences willingness to create.

The nexus of environmental knowledge and sustainable logistics practice

In recent years, growing environmental concerns and regulatory pressures have led both consumers and logistics providers to prioritize sustainability in their operational and behavioral choices (Lai et al., 2025). According to Carrión-Bósquez et al. (2024), environmental awareness acts as a precursor to favorable attitudes toward sustainable consumption, including the adoption of green products and services. Similarly, Shen and Wang (2022) emphasized that consumer knowledge and awareness influence cognitive evaluations of environmental impact, which ultimately guide behavioral intentions. In logistics contexts, Amaya et al. (2025) found that environmentally aware consumers are more likely to adopt sustainable delivery options such as self-collection parcel (SCP), recognizing their potential to reduce emissions and urban congestion.

In LMD, environmental knowledge functions as a motivational driver for collaborative participation in eco-efficient services (Garcia-Herrera et al., 2025). Consumers who understand how logistics activities such as repeated home deliveries or inefficient routing contribute to emissions and waste are more likely to appreciate and support alternative delivery models (Heikkinen, 2024), including SCPs. These systems reduce vehicle trips, optimize delivery consolidation, and lower carbon footprints, aligning with consumers' environmental values. When customers are aware of such benefits, they tend to internalize a sense of shared environmental responsibility, which translates into greater willingness to co-create (Yao et al., 2023) by actively participating in sustainable delivery solutions.

Co-creation occurs when consumers contribute their operant resources to the joint creation of value. In this regard, environmental knowledge enhances cognitive readiness and ethical motivation (Burgos-Espinoza et al., 2024), prompting individuals to engage voluntarily in pro-environmental behaviors that support sustainable logistics systems (Yao et al., 2024). Consumers who possess higher environmental awareness are thus more inclined to collaborate with logistics providers (Putz-Egger et al., 2025), for example, opting for eco-friendly delivery options, returning packaging materials, or utilizing parcel lockers, to achieve mutual environmental goals. Thus, the study posits that:

H4: Environmental knowledge positively influences willingness to co-create.

Prior research has primarily examined the antecedents of environmental awareness such as education, social norms, and ecological knowledge (Perea et al., 2025). However, there remains a paucity of studies exploring its consequential effects in logistics. Wiśniewska et al. (2025) suggested that environmental knowledge and awareness are interrelated yet distinct constructs, where awareness translates ecological cognition into actionable behavioral preferences (Esposito & Jalal, 2025). Therefore, the present study hypothesized that:

H5: Environmental knowledge positively influences intention to adopt SCP.

Willingness to co-create and intention to use sustainable delivery services

Willingness to co-create refers to a consumer's voluntary readiness to engage in value-creating activities with a service provider (Xie et al., 2023). Co-creation emphasizes the active participation of consumers as operant resources, individuals who contribute effort, feedback, and knowledge to enhance the overall service experience. In last-mile delivery systems, Co-creation may involve

consumers collecting parcels themselves, sharing delivery feedback, or adopting flexible delivery options that improve logistics efficiency (Liu et al., 2025).

Prior research indicates that Co-creation behaviors enhance both perceived service value and customer commitment (Nguyen, 2024). When customers are willing to collaborate in the service process, they develop a sense of control and personal contribution toward achieving better outcomes, such as efficiency or sustainability (Reppmann et al., 2025). In LMD, this occurs when consumers take on responsibilities such as self-pickup or flexible scheduling, which enhances their perceived role in supporting environmental preservation. This participatory dynamic influences customers' behavioral intentions (Ahmed et al., 2022). Willingness to co-create has been shown to bridge the gap between attitude and intention, transforming pro-environmental awareness into actual adoption behaviors (Elliot et al., 2023).

In SCP adoption, consumers who willingly engage in co-creation perceive their participation as meaningful and aligned with personal and societal sustainability values. Their active role in parcel collection reinforces a sense of ownership and perceived behavioral control, which strengthens intention to use eco-efficient delivery systems. As previous studies have emphasized, Co-creation enhances trust, satisfaction, and perceived value, which are key determinants of technology adoption and continued usage in digital logistics services (Bordian et al., 2024; Royo-Vela et al., 2024). Therefore, when individuals are motivated and willing to co-create, they are more likely to adopt and sustain engagement with environmentally responsible delivery solutions such as parcel lockers. Thus, this study posits that:

H6: Willingness to co-create positively influences intention to use sustainable delivery.

Thus, the proposed conceptual framework of this study is formulated in Figure 1.

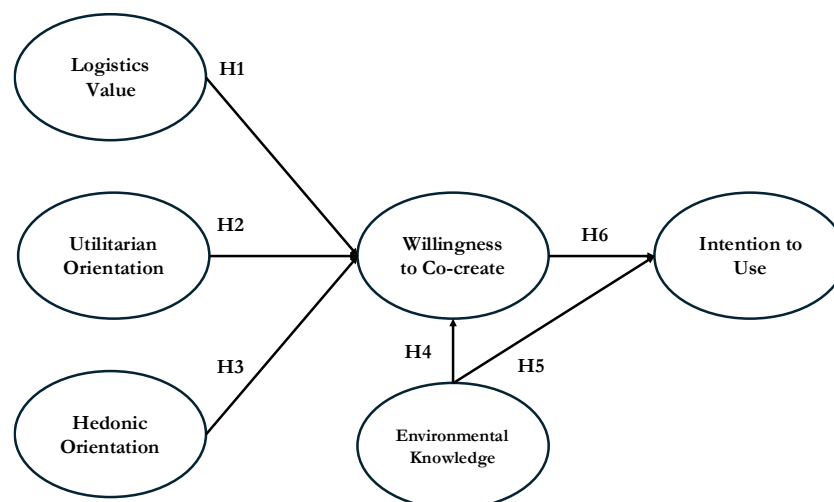


Figure 1. Conceptual Framework

Research Methods

This study employed a quantitative approach using an electronic survey to investigate the determinants of consumers' intention to adopt SCPs. Grounded in the SDL framework, the study focuses on examining how logistics value, utilitarian and hedonic motives, and environmental knowledge influence consumers' willingness to participate in Co-creation, which in turn affects their intention to adopt SCPs.

Sampling and data collection

The target population consisted of Greater Jakarta online marketplace users such as Shopee, Tokopedia, Lazada, and TikTok Shop, who had prior experience purchasing goods online. Data were collected using a non-probability purposive sampling method, with eligibility criteria operationalized through screening questions embedded at the survey entry point to ensure that only respondents meeting two pre-specified conditions were included: (1) active online shopping

engagement within the past three months, and (2) direct experience with or awareness of self-collection parcel locker services. This criterion-based filtering ensures that all respondents possessed the experiential basis necessary to meaningfully evaluate the study's constructs.

Data were collected exclusively online through a single-wave cross-sectional survey administered via Google Forms. The survey link was distributed through online channels to reach active e-commerce users. A single round of data collection was conducted within a two-month window to maintain temporal consistency across responses.

To minimize data collection bias, several procedural measures were implemented. First, the survey was designed to be anonymous, reducing social desirability bias by ensuring respondents could not be individually identified. Second, screening questions at the entry point prevented ineligible respondents from proceeding, preserving sample relevance. Third, the questionnaire items were arranged to avoid leading or suggestive wording. Fourth, after data collection, a thorough data cleaning process was conducted, removing 107 invalid responses from an initial pool of 342, including incomplete questionnaires, inconsistent answer patterns, and extreme outliers. The remaining 235 valid responses were retained for analysis. Additionally, common method bias (CMB) was statistically assessed using Harman's single-factor test and a full collinearity VIF analysis.

Measurement instruments

All constructs were measured using multi-item scales adapted from established instruments in prior research and modified to align with the SCP context. The logistics value construct was operationalized through four items, while utilitarian motives, hedonic motives, environmental knowledge, willingness to co-create, and intention to use were each measured using three items. All measurement items employed a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The complete list of items and their theoretical sources is presented in Table 1.

Table 1. Measurement Items

Construct	Code	Measurement Item	Source(s)
Logistics Value (LV)	LV1	The SCP service provides reliable and up-to-date information about my parcel.	Kawa & Światowiec-Szczepańska (2021)
	LV2	Collecting my parcel is convenient and time-saving.	
	LV3	Returning or exchanging items through the delivery system is easy and hassle-free.	
	LV4	The SCP service provides flexibility in choosing when to pick up my parcel.	
Utilitarian Orientation (UO)	UO1	I use SCP services because they help me save time and effort in receiving my parcels.	Indrawati et al. (2022)
	UO2	I choose SCP services to ensure better control over delivery quality and reliability.	
	UO3	SCPs are practical solutions for managing my deliveries.	
Hedonic Orientation (HO)	HO1	I find using SCP services to be an enjoyable experience.	Indrawati et al. (2022)
	HO2	I feel a sense of satisfaction or pleasure when using SCPs.	
	HO3	Trying new delivery options like SCPs is fun and interesting to me.	
Environmental Knowledge (EK)	EK1	I understand that using self-collection parcel lockers can reduce vehicle trips and lower carbon emissions.	Burgos-Espinoza et al. (2024)
	EK2	I am aware that frequent home deliveries contribute to traffic congestion and higher fuel consumption.	
	EK3	I believe that choosing eco-friendly delivery options, such as parcel lockers, helps minimize environmental impact.	

Construct	Code	Measurement Item	Source(s)
	EK4	I know that waste from packaging and delivery materials can be reduced by consolidating deliveries through lockers.	
	EK5	I understand that my delivery choices can influence the level of air pollution in urban areas.	
	EK6	I am aware that adopting sustainable delivery methods supports broader efforts to reduce environmental degradation.	
Willingness to Co- create (WC)	WC1	I am willing to actively participate in the delivery or collection process (e.g., using self-collection lockers).	Wang et al. (2023)
	WC2	I am willing to invest my time in participating in the delivery or collection process.	
	WC3	I am willing to put in effort and energy to take part in the delivery or collection process.	
Intention to Use (IU)	IU1	I intend to use SCPs to receive parcels in the future.	Tsai & Tiwasing (2021)
	IU2	I would recommend SCPs to others.	
	IU3	I plan to use SCPs regularly for future deliveries.	

Data analysis procedure

The data were analyzed using partial least squares structural equation modeling (PLS-SEM) with SmartPLS. The analysis proceeded in two phases (Hair et al., 2022), measurement model assessment evaluating internal consistency (Cronbach's α , composite reliability), convergent validity (average variance extracted, AVE), and discriminant validity using HTMT criteria. Structural model assessment tests the hypothesized relationships among constructs using bootstrapping with 5,000 subsamples to determine path significance.

Results and Discussion

Respondent profile

Table 2. Respondent Profile (n = 235)

Profile	Category	Frequency	Percentage (%)
Gender	Female	143	60.9
	Male	92	39.1
Age (years old)	18–25	78	33.2
	26–35	96	40.9
	36–45	41	17.4
	> 45	20	8.5
Education Level	High School	32	13.6
	Bachelor's Degree	148	63.0
	Master's Degree	45	19.1
	Doctorate	10	4.3
Occupation	Student	72	30.6
	Private Employee	92	39.1
	Civil Servant	29	12.3
	Entrepreneur	25	10.6
	Others	17	7.2
Online Shopping Frequency	1–2 times	64	27.2
	3–5 times	101	43.0
	6–10 times	47	20.0
	> 10 times	23	9.8

As seen in Table 2, the sample consisted predominantly of women (60.9%). Most respondents were young adults aged 26–35 years (40.9%), followed by those aged 18–25 years (33.2%). A majority held a bachelor's degree (63.0%), and nearly four in ten were private-sector

employees, while students also formed a substantial proportion (30.6%). Respondents typically shopped online three to five times per month (43.0%).

The demographic composition of the sample is broadly consistent with the profile of active e-commerce users in urban Indonesia. The predominance of female respondents (60.9%) aligns with documented patterns of online shopping behavior in Indonesia, where women represent the primary driver of e-commerce transaction volume (Badan Pusat Statistik, 2025). The concentration of respondents in the 18–35 age range (74.1% combined) is particularly significant for the study's theoretical framework. This cohort represents the digital-native generation that has grown up with mobile commerce and real-time tracking service interactions. The dominance of private-sector employees (39.1%) and students (30.6%) is noteworthy in the context of SCP adoption. Both groups operate under time constraints that make delivery flexibility a high-priority consideration.

Finally, the online shopping frequency distribution confirms that respondents are active and habitual e-commerce participants rather than occasional users.

Measurement model analysis

Common method bias (CMB) test

Prior to evaluating the measurement model, a test for common method bias (CMB) was conducted to ensure that the results were not substantially affected by single-source response bias. Following Kock (2022), Harman's single-factor test was performed using exploratory factor analysis. The results in Table 3 indicated that the first unrotated factor accounted for less than 50% of the total variance, suggesting that CMB was not a major concern.

Table 3. Results of Harman's Single-Factor Test

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.670	25.771	25.771	5.084	23.110	23.110

Full collinearity test as suggested by Kock (2017) was also performed to identify if the constructs present VIF scores larger than 3.3. The results in Table 4 suggest that the model is robust and that common method bias is likely not a significant threat to the validity of the results.

Table 4. Results of Full Collinearity Test

Variables	LV	UO	HO	EK	WCC	IU
VIF	1.036	1.099	1.138	1.256	1.489	1.148

Validity and reliability

Convergent validity was assessed by examining indicator loadings, average variance extracted (AVE), and composite reliability (CR or Rho_A). As presented in Table 5, all items demonstrated loadings above 0.70, indicating that each item strongly reflected its underlying construct, except LV4 (0.699). Hair et al. (2022) state that while indicator loadings of 0.70 or above are preferred, loadings between 0.40 and 0.70 are acceptable and should be retained when their removal does not substantially improve the AVE or composite reliability of the construct beyond the recommended thresholds. In the case of LV4, the construct's AVE (0.602) already exceeds the 0.50 minimum threshold, and its composite reliability meets the required standard, meaning that removing LV4 would not meaningfully improve measurement quality. The AVE values for all constructs exceeded the 0.50 threshold, suggesting that more than half of the variance of the indicators was explained by their respective latent constructs. These findings confirm the adequacy of convergent validity in the measurement model.

Construct reliability was evaluated using both Cronbach's alpha (α) and composite reliability (Rho_A) coefficients. As reported in Table 5, five of the six constructs reported α and Rho_A values meeting or exceeding the recommended 0.70 cutoff, indicating satisfactory internal

consistency. The exception is the Intention to Use construct, which returned a Cronbach's alpha of 0.648 and Rho_A of 0.649 — marginally below the 0.70 threshold — suggesting a lower level of internal consistency among its three measurement items.

Table 5. Measurement Model Analysis

Constructs	Items	SLF	Cr. α	Rho_A	AVE	T-values	P-values
Logistics Value			0.789	0.922	0.602		
	LV1	0.893				3.993	0.000
	LV2	0.731				3.363	0.000
	LV3	0.767				3.430	0.000
	LV4	0.699				3.016	0.001
Utilitarian Orientation			0.832	0.876	0.746		
	UO1	0.770				7.540	0.000
	UO2	0.914				16.490	0.000
	UO3	0.900				15.294	0.000
Hedonic Orientation			0.833	0.841	0.749		
	HO1	0.848				29.225	0.000
	HO2	0.856				28.382	0.000
	HO3	0.892				44.767	0.000
Environmental Knowledge			0.900	0.906	0.668		
	EK1	0.829				38.250	0.000
	EK2	0.760				23.142	0.000
	EK3	0.854				48.083	0.000
	EK4	0.774				25.159	0.000
	EK5	0.857				48.896	0.000
	EK6	0.826				33.024	0.000
Willingness to Co-create			0.852	0.858	0.771		
	WC1	0.894				68.349	0.000
	WC2	0.854				41.977	0.000
	WC3	0.886				51.211	0.000
Intention to Use			0.648	0.649	0.587		
	IU1	0.769				21.394	0.000
	IU2	0.777				24.227	0.000
	IU3	0.752				19.421	0.000

The construct is retained in the present study due to the following. First and most importantly, the construct retains acceptable convergent validity, with an AVE of 0.587 exceeding the minimum threshold of 0.50, indicating that the three items collectively explain more than half of the variance in the underlying construct (Hair et al., 2022). Second, while Cronbach's alpha and Rho_A are sensitive to the number of items in a scale, the composite reliability criterion provides a more appropriate and less penalizing estimate of internal consistency for short scales in PLS-SEM (Hair et al., 2022). Third, the theoretical centrality of Intention to Use as the study's primary dependent variable is non-negotiable: removing it would eliminate the study's core outcome construct and render the research model theoretically incomplete. Fourth, the marginal reliability may be partly attributable to the contextual novelty of SCP services in Indonesia, where consumers' adoption intentions are still forming and may not yet be sufficiently crystallized to produce high inter-item consistency across respondents. The marginal reliability of this construct is acknowledged as a limitation of the study and discussed further in the Limitations section. With this exception noted, the overall reliability of the measurement model was deemed satisfactory for subsequent structural analysis.

Discriminant validity

Discriminant validity was established through the heterotrait–monotrait (HTMT) ratio of correlations, following the guidelines of Roemer et al. (2021). All HTMT values, as seen in Table 6, were found to be below the threshold of 0.85, indicating that each construct was empirically distinct from the others. The pattern of HTMT values observed in this study warrants further theoretical elaboration to strengthen confidence in construct distinctiveness. Regarding the relatively higher HTMT value between willingness to co-create and intention to use (0.761), while this value approaches the upper range of acceptable discriminant validity, it remains below the 0.85 threshold and is theoretically justified by the conceptual proximity of the two constructs. Willingness to Co-create captures consumers' present-state behavioral readiness to invest personal resources in the service co-production process, whereas Intention to Use reflects a forward-looking cognitive commitment to adopting SCP as a preferred delivery modality. The former is a motivational state; the latter is a behavioral decision. Their correlation is expected, given that readiness to coproduce naturally predicts intention to adopt, but this fundamental difference preserves their conceptual and operational distinctiveness, confirming that the two constructs measure related but non-redundant facets of consumer engagement with sustainable last-mile delivery systems.

Table 6. Discriminant Validity with HTMT

		1	2	3	4	5	6
1	EK						
2	HO	0.052					
3	IU	0.686	0.347				
4	LV	0.064	0.060	0.136			
5	UO	0.078	0.063	0.184	0.162		
6	WCC	0.466	0.382	0.761	0.107	0.210	

Structural model analysis

The structural model was evaluated using the partial least squares structural equation modeling (PLS-SEM) approach. The results, presented in Table 7, indicate that the model fits the data well, as shown by the standardized root mean square residual (SRMR) value of 0.059 (below the 0.08 threshold) and the normed fit index (NFI) of 0.799. Although the NFI falls marginally below the 0.90 threshold commonly referenced in covariance-based SEM literature, its interpretation in the PLS-SEM requires important qualification. Hair et al. (2022) explicitly caution that NFI in PLS-SEM is sensitive to sample size and model complexity. Further, Hair et al. (2022) recommend the SRMR as the primary model fit criterion in PLS-SEM, as it is less susceptible to these biases. The SRMR value of 0.059 in this study falls well below the recommended threshold of 0.08, providing strong evidence of adequate model fit. All VIF values were below 3.3, suggesting no multicollinearity among constructs.

The analysis revealed that logistics value had a positive and significant effect on willingness to co-create ($\beta = 0.124$, $t = 1.766$, $p < 0.05$), supporting H1. Similarly, utilitarian orientation ($\beta = 0.196$, $t = 3.662$, $p < 0.001$) and hedonic orientation ($\beta = 0.310$, $t = 6.218$, $p < 0.001$) were both significant predictors of willingness to co-create, supporting H2 and H3. Among the antecedents, environmental knowledge exerted the strongest effect on willingness to co-create ($\beta = 0.404$, $t = 7.581$, $p < 0.001$), confirming H4. Regarding intention to use SCPs, both environmental knowledge ($\beta = 0.353$, $t = 6.512$, $p < 0.001$) and willingness to co-create ($\beta = 0.423$, $t = 8.416$, $p < 0.001$) significantly influenced adoption intention, supporting H5 and H6.

Model strength

The model explained 31.5% of the variance in willingness to co-create ($R^2 = 0.315$) and 42.6% of the variance in intention to use SCPs ($R^2 = 0.426$), indicating moderate predictive power (Hair et al., 2021). The f^2 effect size analysis shows that environmental knowledge ($f^2 = 0.238$), willingness

to co-create ($f^2 = 0.258$), and environmental knowledge $\rightarrow$ intention to use ($f^2 = 0.180$) have medium-to-large effects.

Table 7. Structural Model Analysis

	β	T-values	P-values	f^2	VIF
<i>Direct effects</i>					
H1: Logistics Value $\rightarrow$ Willingness to Co-create	0.124	1.766	0.042	0.022	1.018
H2: Utilitarian Orientation $\rightarrow$ Willingness to Co-create	0.196	3.662	0.000	0.055	1.018
H3: Hedonic Orientation $\rightarrow$ Willingness to Co-create	0.310	6.218	0.000	0.140	1.001
H4: Environmental Knowledge $\rightarrow$ Willingness to Co-create	0.404	7.581	0.000	0.238	1.001
H5: Environmental Knowledge $\rightarrow$ Intention to Use	0.353	6.512	0.000	0.180	1.206
H6: Willingness to Co-create $\rightarrow$ Intention to Use	0.423	8.416	0.000	0.258	
R^2					
Willingness to Co-create (0.315)					
Intention to Use (0.426)					
<i>Model Fit</i>					
SRMR (0.059)					
NFI (0.799)					

Out-sample model predictive capability

In addition to the model's internal predictive capabilities (as shown in R^2 scores), the model's capability to predict using data outside the model is also assessed. Based on the suggestion by Shmueli et al. (2019), the study used PLSpredict to assess the PLS-SEM_RMSE and the LM_RMSE scores.

Table 8. PLSpredict Analysis Results

	Q^2_{predict}	PLS-SEM_RMSE	LM_RMSE
IU1	0.224	1.251	1.302
IU2	0.193	1.276	1.324
IU3	0.151	1.311	1.325
WCC1	0.237	1.240	1.279
WCC2	0.172	1.292	1.338
WCC3	0.239	1.240	1.282

Table 8 shows that all the Q^2_{predict} scores of the indicators are above 0 and all PLS-SEM_RMSE < LM_RMSE, suggesting that the present model is considered to have good out-of-sample predictive capabilities.

Discussion

The results support H1, showing that logistics value exerts a significant and positive influence on willingness to co-create. This finding aligns with prior studies emphasizing that consumers' perceived logistics value strengthens their engagement in service co-creation (Justavino-Castillo et al., 2023). When consumers perceive logistics services as efficient and environmentally responsible, they are more motivated to actively participate, for instance, by collecting parcels independently or providing delivery feedback. This reinforces the notion that logistics value serves as a psychological trigger for participatory behavior, reflecting both utilitarian efficiency and experiential satisfaction (Correa et al., 2021). The finding also extends prior research by demonstrating that, beyond enhancing satisfaction, logistics value stimulates proactive collaboration between consumers and logistics providers. Thus, in emerging markets like Indonesia, logistics value functions not merely as a service outcome but as a co-creation enabler that encourage consumers to take part in sustainable delivery processes.

It is worth noting a theoretically interesting pattern emerging from the data. Although logistics value significantly predicts willingness to co-create (H1: $\beta = 0.124$, $p < 0.05$) and willingness to co-create, in turn, significantly predicts intention to use (H6: $\beta = 0.423$, $p < 0.001$), the sequential influence of logistics value through willingness to co-create onto intention to use does not reach significance. This pattern is consistent with a weak first-stage effect condition, in which a small initial path coefficient, as with logistics value ($\beta = 0.124$), the smallest among all antecedents, attenuates the downstream influence to the point that it cannot generate sufficient momentum to produce a meaningful effect on the final outcome. This suggests that logistics value operates primarily as a perceptual enabler that activates co-creation engagement at a modest level, rather than as a strong motivational force capable of driving intention to use through the co-creation pathway. The motivational work required to translate willingness to co-create into intention to use appears to be more effectively performed by constructs with stronger first-stage effects, particularly environmental knowledge ($\beta = 0.404$), hedonic orientation ($\beta = 0.310$), and utilitarian orientation ($\beta = 0.196$). This interpretation is consistent with the SDL perspective that value perceptions, while necessary to initiate consumer engagement, are insufficient on their own to sustain the behavioral commitment required for adoption of a novel and participatory delivery modality such as SCP.

Both H2 and H3 are supported, indicating that utilitarian and hedonic orientations significantly influence willingness to co-create. Consistent with the dual-process motivation framework, utilitarian motives such as efficiency, time savings, and cost reduction drive functional engagement with SCPs. This aligns with findings by Puspitasari et al. (2023) and Gao and Liang (2025), which suggest that consumers who value performance and convenience are more likely to adopt self-service technologies that reduce dependence on delivery personnel. In parallel, hedonic orientation also exhibits a positive effect, confirming that emotional gratification, enjoyment, and perceived autonomy enhance co-creation behaviors. This echoes findings from Ishizuka and Aoki (2024) and Rohden et al. (2025), who noted that experiential enjoyment fosters deeper engagement in technology-enabled services. The autonomy and novelty associated with using self-collection parcel lockers provide a sense of empowerment, reinforcing emotional attachment and voluntary participation. These results highlight that both rational efficiency-seeking (utilitarian) and emotional enjoyment (hedonic) act as complementary forces that motivate consumers to engage in sustainable, technology-mediated logistics interactions.

The findings also validate H4, confirming that environmental knowledge positively influences willingness to co-create. This relationship underscores the cognitive foundation of sustainable behavior, supporting earlier studies Yao et al. (2024), which demonstrated that knowledge of environmental issues enhances individuals' responsibility and pro-environmental engagement. In last-mile logistics, consumers who understand the ecological implications of failed deliveries or excessive routing are more inclined to participate in environmentally responsible solutions, such as SCPs. This finding extends the literature by showing that environmental knowledge translates awareness into participatory action, consistent with the protection motivation theory Balla and Hagger (2025). Consumers become active contributors in creating logistics value, reflecting the emergence of a shared environmental consciousness between consumers and service providers.

H5 is supported, indicating that willingness to co-create has a strong positive effect on intention to use SCPs. This aligns with previous research emphasizing that Co-creation enhances perceived control, satisfaction, and behavioral intention (Bordian et al., 2024; Nguyen, 2024). In last-mile delivery, when customers perceive their participation as meaningful, such as choosing locker locations or self-pickup, they develop a sense of ownership and alignment with sustainability goals.

The results support H6, confirming that willingness to co-create influences intention to use SCPs. This finding is theoretically significant because it positions co-creation willingness not merely as an attitudinal disposition but as the critical behavioral gateway through which consumers' diverse motivations. When consumers are willing to invest their own resources into the parcel collection process, they develop a sense of personal agency and perceived ownership over the service

outcome, which in turn reinforces their commitment to continued engagement with SCP systems. This aligns with prior research demonstrating that participatory experiences in service co-production strengthen perceived control, trust, and behavioral intention in digital logistics contexts. This relationship corroborates findings by Ahmed et al. (2022) and Royo-Vela et al. (2024), who highlighted that participatory experiences reinforce trust and continuity in digital logistics adoption.

Conclusion and Implications

The findings of this study reveal a meaningful pattern in which consumers' willingness to co-create is the most proximate and influential determinant of SCP adoption intention, serving as the central behavioral gateway through which multiple antecedent motivations are converted into sustainable adoption behavior. Among the antecedents of co-creation willingness, environmental knowledge emerges as the dominant driver, followed by hedonic orientation, utilitarian orientation, and logistics value. This indicates that cognitive-environmental motivation, that is, consumers' awareness of the ecological consequences of their delivery choices, is a more powerful activator of co-creation engagement than either experiential or functional orientations. This distinguishes the present study from prior LMD research that has emphasized efficiency and convenience as the primary adoption drivers.

A key insight concerns the relative importance of the two direct pathways through which environmental knowledge shapes adoption intention. In practical terms, interventions that target consumers' co-creation engagement, rather than environmental awareness or functional value in isolation, are likely to yield the greatest returns in accelerating SCP adoption in emerging urban markets.

Theoretical contributions

This study advances logistics and service marketing theory in three ways. First, it extends SDL theory by establishing its explanatory relevance in the context of sustainable urban logistics. It demonstrates that SDL's core premise holds across the varied conditions of an emerging urban market. Specifically, it advances SDL by embedding it within a sustainability frame in the logistics domain.

Second, it establishes willingness to co-create as a behavioral mechanism that bridges consumer motivations and sustainable adoption intention in LMD systems. Co-creation willingness is therefore not simply an attitudinal variable but a behavioral gateway through which diverse motivational states are converted into sustained engagement with sustainable logistics services. This mechanism suggests that logistics value operates primarily as a perceptual enabler rather than a motivational driver of adoption.

Third, it identifies environmental knowledge as a dual-role predictor in sustainable logistics adoption, functioning simultaneously as an antecedent of Co-creation willingness and as an independent direct predictor of SCP adoption intention. This means environmental knowledge operates through two theoretically distinct pathways: a motivational pathway, in which ecological awareness activates consumers' sense of shared environmental responsibility and readiness to participate as resource integrators in sustainable delivery systems; and a cognitive-evaluative pathway, in which environmental knowledge directly informs consumers' behavioral intentions by providing the informational basis for evaluating SCP as an environmentally superior delivery alternative.

Managerial implications

The findings provide several actionable insights for logistics providers, e-commerce platforms, and policymakers:

First, service providers should communicate the reliability, transparency, and environmental advantages of SCPs to strengthen consumers' perception of logistics value. Initiatives such as real-time tracking, flexible pick-up options, and visible eco-impact metrics can increase perceived efficiency and trust, fostering stronger engagement.

Second, SCP systems should be designed to satisfy both rational and experiential motives. While functionality (e.g., ease of access, speed, cost savings) remains essential, providers should also focus on user experience design—for example, by offering intuitive interfaces, personalized notifications, or gamified features that make parcel retrieval more enjoyable.

Third, policymakers and logistics firms can jointly invest in public awareness campaigns highlighting the environmental benefits of SCP adoption, such as reduced emissions and traffic congestion. Educating consumers about the ecological value of their participation can convert environmental awareness into consistent behavioral action. In addition, firms should frame SCP adoption as a collaborative effort toward sustainable urban living. Involving customers in locker location decisions, feedback loops, or incentive programs (e.g., loyalty rewards for eco-friendly deliveries) can enhance their sense of ownership and deepen commitment to SCP usage.

Finally, the insights from this study can inform the development of city-level logistics strategies that integrate SCP networks into broader sustainability policies. Aligning consumer engagement with public infrastructure initiatives can create a virtuous cycle of efficiency, environmental responsibility, and urban livability.

Limitations of the study

This study is not without limitations. First, the sample was confined to Indonesian urban consumers, particularly those familiar with e-commerce, limiting generalizability to rural populations or other developing economies with differing logistics infrastructure. Additionally, the model did not account for contextual moderators such as technology readiness, delivery reliability, or perceived accessibility of parcel lockers, which could further explain adoption variations. Future studies could examine and test the moderating influence of service design or policy interventions.

A limitation concerns the internal consistency of the intention to use construct. As reported in the measurement model analysis, the Cronbach's alpha ($\alpha = 0.648$) and Rho_A (0.649) values for this construct sit at the lower boundary of the conventionally accepted threshold of 0.70, indicating a marginal level of internal consistency among the three measurement items. Although the average variance extracted (AVE = 0.587) exceeds the minimum threshold of 0.50, confirming adequate convergent validity, the relatively low alpha and Rho_A values suggest that the items measuring intention to use may not capture the construct with sufficient consistency across respondents. This may partly reflect the novelty of SCP services in the Indonesian market, where consumers' intention to adopt parcel lockers is still forming and may not yet be stable enough to be measured with high internal coherence using existing scales adapted from more mature SCP markets. Future research should consider refining or expanding the intention to use measurement scale or developing and validating a context-specific instrument grounded in the Indonesian e-commerce and logistics environment. Addressing this measurement limitation would strengthen the construct's reliability and increase confidence in the structural relationships involving adoption intention reported in this study.

A further methodological limitation concerns the heterogeneity introduced by the study's respondent screening criterion, which combined individuals with direct SCP usage experience and those with only awareness of SCP services into a single analytical sample. Respondents with direct usage experience may evaluate logistics value, co-creation willingness, and adoption intention from a richer and more stable experiential foundation, while awareness-only respondents may assess the same constructs more hypothetically, potentially introducing evaluative variability that attenuates construct reliability and response consistency. Future research should consider disaggregating these two groups to examine whether SCP experience moderates the relationships proposed in this study, or alternatively restrict sampling to direct SCP users as locker penetration increases and a sufficiently experienced user base becomes available in the Indonesian market.

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