International Review of Management and Marketing

ISSN: 2146-4405

available at http: www.econjournals.com

International Review of Management and Marketing, 2027, 17(1), 8-21.

Beyond the 3PL Black Box: An Integrated Study of Mediating Mechanisms and the Moderating Effects of Perceived Risk and Usage Frequency in Thai Platform-Bound Delivery

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Received: 27 April 2026 **Accepted:** 17 August 2026 **DOI:** https://doi.org/10.32479/irmm.24341

ABSTRACT

E-commerce platforms increasingly operate their own captive last-mile couriers—a model termed platform-bound delivery that differs fundamentally from outsourced third-party logistics in brand attribution, data control, and ownership of service recovery. However, how this captive model builds customer loyalty remains poorly understood, and the pathway from service quality through perceived value and satisfaction to loyalty has rarely been tested as an integrated sequence. This study develops and tests a serial-mediation model in which four antecedents—customer trust, last-mile delivery quality, platform reliability, and service recovery quality—shape perceived value and satisfaction, which in turn drive loyalty, with perceived risk and delivery experience frequency examined as boundary conditions. Using survey data from 447 platform-bound delivery users in Thailand and partial least squares structural equation modeling, the study finds that the proposed sequence holds and that satisfaction is the decisive driver of loyalty ($\beta = 0.596$, $f^2 = 0.551$, $P < 0.001$), with value and satisfaction acting as coordinated mediators. Trust is the strongest driver of perceived value ($\beta = 0.327$), and all four serial value-satisfaction-loyalty chains are significant; the model explains 36% of the variance in loyalty, 51% in satisfaction, and 56% in perceived value. Neither risk perception nor usage frequency showed a detectable moderating effect on satisfaction formation, providing no evidence that the loyalty mechanism differs across customer types. Theoretically, the study validates and refines the value–satisfaction-loyalty chain in the captive-delivery context. Practically, it advises operators to deliver a uniformly trustworthy, reliable, and recovery-capable experience rather than tailoring service by segment.

Keywords: Platform-Bound Delivery, Last-Mile Logistics, Customer Loyalty, Perceived Value, Customer Satisfaction, Partial Least Squares Structural Equation Modeling
JEL Classifications: M31, L81, M15, R41

1. INTRODUCTION

The surge of e-commerce across Southeast Asia has repositioned last-mile delivery from a back-office logistics function into a frontline determinant of competitive advantage. As online retail has matured in the region's largest markets, platforms have increasingly internalized fulfillment, giving rise to platform-bound delivery: Captive, in-house last-mile networks operated directly by the e-commerce platform itself—exemplified by Shopee Xpress—rather than outsourced to third-party logistics (3PL) providers. In Thailand, this shift is unfolding in one of Southeast Asia's largest and fastest-growing online markets: The Electronic Transactions Development Agency valued Thai e-commerce at 5.43 trillion baht in 2022. It projected that it would rise toward 5.96 trillion the following year, with business-to-consumer trade as its largest segment (ETDA, 2024). Evidence from comparable regional markets confirms that captive delivery is consequential. Harlan et al. (2024) show that, for Shopee and Shopee Xpress users in Indonesia, logistics service quality significantly drives customer satisfaction, loyalty, and brand image, while, in Thailand, Jantapoon (2025) links last-mile performance directly to e-commerce supply chain outcomes and customer satisfaction.

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Platform-bound delivery differs from the 3PL model in three consequential ways. First, brand spillover: Because the courier and the marketplace share a single brand, delivery performance is attributed to the platform rather than to an intermediary. Second, end-to-end data: The platform controls order, payment, fulfillment, and delivery within a single system. Third, recovery control: When delivery fails, the platform—not an external carrier—owns the recovery encounter, a juncture whose importance is underscored by research on failed delivery (Seghezzi and Mangiaracina, 2023). These structural differences imply that the antecedents of loyalty may operate differently in captive delivery than 3PL-based evidence assumes, yet they remain largely untested. This problem is both academically and practically consequential: Loyalty models calibrated on outsourced, bivariate evidence may misattribute where and how loyalty is built once the platform—rather than a third party—owns the brand, the data trail, and the recovery encounter, while operators are committing substantial capital to captive networks without a validated account of how, and for whom, that investment converts into loyalty.

Although last-mile fulfillment is strategically central, the literature has largely treated delivery as a 3PL "black box," linking logistics service quality to satisfaction or loyalty as isolated, often bivariate, effects. Mogire et al. (2023), applying an online-customer lens to last-mile delivery in Kenya, and Chotisarn and Phuthong (2025), examining cross-border e-commerce among Thai consumers, both confirm that delivery-quality dimensions raise satisfaction, which in turn lifts repurchase intention and eWOM—but each treats the pathway as a short, largely single-mediator sequence. Three gaps follow. Firstly, the theoretically anticipated sequence from service quality to perceived value, satisfaction, and loyalty is seldom represented as a serial mediation within the context of service delivery. Where sequential value-based mechanisms have been tested, they appear in adjacent settings: Dhaigude et al. (2023) delineate a sequential progression from perceived value to trust, then to satisfaction, and ultimately to loyalty concerning mobile wallets in India., and Quan et al. (2022) trace perceived value to satisfaction for smart-locker users in Vietnam, yet neither addresses captive platform delivery, and Goutam and Gopalakrishna (2018) caution that satisfaction alone does not fully explain online loyalty. Second, contextual moderators are widely assumed but seldom tested: Perceived risk shapes online satisfaction and purchase intention across financial, privacy, and performance dimensions (Al Halbusi et al., 2022; Bashir et al., 2017), yet whether it conditions the trust–satisfaction link is unresolved. Third, delivery experience frequency is presumed to strengthen the delivery-quality-to-satisfaction relationship—Mogire et al. (2023) report that user status materially alters delivery evaluations—but this boundary condition is rarely modeled as a moderator. Together, these gaps leave practitioners without a validated, mechanism-level account of how platform-bound delivery converts service performance into durable loyalty.

This study addresses these gaps by developing and testing an integrated model of customer loyalty for platform-bound e-commerce delivery in Thailand's Bangkok Metropolitan Region, using survey data and partial least squares structural equation modeling (PLS-SEM). The model positions four service antecedents—customer trust, last-mile delivery quality, platform reliability, and service recovery quality—as drivers of perceived value and satisfaction, links these through a serial pathway to loyalty, and tests perceived risk and delivery experience frequency as moderators. Four research questions guide the inquiry:

1. Do customer trust, last-mile delivery quality, platform reliability, and service recovery quality significantly influence customers' perceived value of platform-bound delivery?
2. Does perceived value influence customer satisfaction, and does satisfaction, in turn, drive customer loyalty?
3. Do perceived value and customer satisfaction serially mediate the relationships between the service antecedents and customer loyalty?
4. Do perceived risk and delivery experience frequency moderate the trust–satisfaction and delivery-quality–satisfaction relationships, respectively?

These questions correspond to the study's four objectives: To assess perceived service levels and their direct effects on value, to test the value-satisfaction-loyalty sequence, to evaluate the serial mediating mechanism, and to examine the proposed moderating boundary conditions. These objectives are operationalized as twelve testable hypotheses (H_{1a}-H_6), developed from the underpinning theories in Section 2.

Beyond confirming individual effects, the study's central contribution is a validated, mechanism-level account of how captive platform-bound delivery converts service performance into loyalty—an account distinct from the outsourced, largely bivariate 3PL evidence base on which current guidance rests. Concretely, it makes three contributions. Theoretically, it integrates means-end value formation, expectation-confirmation, and loyalty-stage perspectives into a single serial-mediation model and tests it in the under-examined captive-delivery setting. In contrast, the nearest prior sequential evidence is situated in m-wallet services (Dhaigude et al., 2023); this study clarifies whether perceived value and satisfaction jointly mediate the effects of service quality on loyalty in platform-bound delivery. Contextually, it extends research on Thai digital services—spanning cross-border logistics (Chotisarn and Phuthong, 2025), ride-hailing (Thaithatkul et al., 2021), and e-commerce behavior (Kasemrat et al., 2025)—to a captive last-mile courier in the high-growth Bangkok Metropolitan Region, yielding actionable guidance for platform operators. Methodologically, it strengthens inferential rigor by complementing conventional PLS-SEM reporting with out-of-sample predictive assessment via PLS predict and CVPAT.

The remainder of the paper proceeds as follows. Section 2 develops the theoretical background and hypotheses. Section 3 details the research design, measures, and analytical approach. Section 4 reports the measurement and structural model results. Section 5 discusses theoretical and managerial implications, and Section 6 concludes with limitations and future research directions.

2. THEORETICAL BACKGROUND AND HYPOTHESIS DEVELOPMENT

2.1. Underpinning Theories

The conceptual framework of this study is founded upon four complementary theories that collectively substantiate a sequential progression from value to satisfaction and ultimately to loyalty. Means-End Chain theory (Gutman, 1982) holds that consumers do not value service attributes for their own sake but for the consequences and end-states those attributes deliver; concrete features such as on-time delivery or a smoothly handled complaint are cognitively translated into an overall judgment of worth, that is, perceived value (Zeithaml, 1988). This positions perceived value as the first-order cognitive integration of service performance and explains why the four service antecedents are theorized to act on value before any affective response forms.

Expectation-Confirmation Theory (Oliver, 1980) supplies the next link. Satisfaction arises when perceived performance confirms or exceeds prior expectations, and value-laden cognition is a proximal input to that confirmation judgment. Perceived value therefore feeds satisfaction, which empirical work consistently treats as the affective evaluation that follows cognitive appraisal (Quan et al., 2022). The four-stage loyalty model (Oliver, 1999) then specifies that satisfaction, once accumulated, advances consumers through cognitive, affective, conative, and action loyalty, making satisfaction the proximal driver of loyalty rather than a parallel outcome. This staged progression is the theoretical warrant for placing satisfaction between value and loyalty rather than alongside it, and for modeling antecedent effects on loyalty as indirect rather than direct.

Commitment-Trust Theory (Morgan and Hunt, 1994) and trust e-commerce research (McKnight et al., 2002) explain why trust functions as a foundational antecedent: Under buyer-seller separation, trust reduces relational uncertainty and underpins both value perceptions and continued patronage (Goutam and Gopalakrishna, 2018). Perceived Risk theory (Jacoby and Kaplan, 1972) frames the customer's appraisal of potential financial, privacy, and performance loss as a force that can dampen or distort the trust-to-satisfaction transmission, motivating its role as both a direct influence and a moderator. The Service Recovery Paradox (Smith et al., 1999) completes the set, accounting for how effective recovery from failure can restore, and occasionally elevate, customer evaluations. Integrated, these theories yield a coherent cognitive-to-affective-to-conative architecture: Service attributes are appraised for value (Means-End Chain), value confirms into satisfaction (Expectation-Confirmation), and satisfaction matures into loyalty (Four-Stage Loyalty), with trust as the foundation and risk and recovery as the conditioning forces.

2.2. Platform-Bound Delivery as the Empirical Context

Four service antecedents constitute the captive-delivery experience. Customer trust (TRU) is the consumer's confidence that the platform and its delivery arm will fulfill obligations reliably and benevolently; in e-commerce, such trust is shaped by service quality, security, and brand recognition (Falahat et al., 2019; Nguyen et al., 2025). Last-mile delivery quality (LMD) captures the performance of the final delivery leg, including timeliness, condition of goods, and courier conduct, dimensions shown to drive downstream marketing outcomes in platform settings (Harlan et al., 2024; Mogire et al., 2023).

The remaining two antecedents are distinctively platform-specific levers, available precisely because delivery is captive rather than outsourced. Platform reliability (PFR) reflects the dependability of the integrated marketplace-plus-courier system, encompassing system availability, fulfillment consistency, and the structural assurance that the end-to-end process will perform as promised (Fadli et al., 2024; Widyanto et al., 2022). In a 3PL arrangement, this dependability is fragmented across firms and partly outside the retailer's control; under platform-bound delivery, it becomes a single, governable construct. Service recovery quality (SRQ) is the effectiveness of the platform's resolution of delivery failures. Because the platform owns the recovery encounter end-to-end, rather than deflecting to an external carrier, it can deploy coordinated recovery strategies whose quality materially shapes post-failure evaluations (Jeon et al., 2025; Seghezzi and Mangiaracina, 2023). PFR and SRQ thus operationalize the brand-spillover, end-to-end data, and recovery-control properties that differentiate captive delivery from the 3PL model and are the levers through which a platform can most directly engineer loyalty.

2.3. Antecedents of Perceived Value (H_{1a}-H_{1d})

Means-End Chain theory (Gutman, 1982) specifies a cognitive hierarchy in which concrete service attributes are valued only insofar as they yield desired consequences; perceived value is the consumer's summary appraisal of benefits relative to sacrifice along this hierarchy (Zeithaml, 1988). Each H_1 hypothesis traces one captive-delivery attribute to that appraisal, distinguishing whether the attribute augments the benefit pole (delivery quality) or reduces the sacrifice pole (trust, reliability, recovery) of the value judgment.

Customer trust operates at the sacrifice pole. Commitment-Trust Theory (Morgan and Hunt, 1994) holds that trust substitutes for the costly monitoring and safeguarding that exchange uncertainty would otherwise require. In platform-bound delivery, the consumer relinquishes physical control of the order to the platform's courier; trust removes the uncertainty premium that would depress the value calculus, converting the attribute of platform dependability into the valued consequence of a secure, low-effort transaction. This trust-to-value link is corroborated in digital-service contexts (Dhaigude et al., 2023; Goutam and Gopalakrishna, 2018).

H_{1a}. Customer trust positively influences perceived value.

Last-mile delivery quality is the most direct application of Means-End logic: Attributes such as on-time arrival and intact condition are the concrete means whose successful ends—reliable and convenient receipt—constitute the benefit side of the value equation. Because, in the captive model, these ends are produced and signaled by the platform itself, the attribute-to-value inference is undiluted by an intermediary (Harlan et al., 2024; Quan et al., 2022).

H_{1b}. Last-mile delivery quality positively influences perceived value.

Platform reliability increases value through the same hierarchy, but at the expense of sacrifice. The structural-assurance perspective (Widyanto et al., 2022) holds that consumers infer value from institutional safeguards that guarantee consistent performance; a dependable, integrated marketplace-and-courier system lowers the perceived cognitive and temporal effort of obtaining a sound outcome, which Means-End theory treats as a reduced sacrifice and hence greater net value (Candra et al., 2022).

H_{1c}. Platform reliability positively influences perceived value.

Service recovery quality contributes value by lowering the expected cost of adverse events. The Service Recovery Paradox (Smith et al., 1999) establishes that a competently handled failure can restore or even exceed pre-failure evaluations; within Means-End reasoning, credible recovery is an attribute delivering the consequence of insurance against loss. Because the platform owns the recovery encounter end-to-end, this benefit is credible rather than contingent on a third party (Jeon et al., 2025).

H_{1d}. Service recovery quality positively influences perceived value.

2.4. Antecedents of Customer Satisfaction (H_{2a}-H_{2d})

Expectation-Confirmation Theory (Oliver, 1980) governs this set: Satisfaction is the affective state arising when perceived performance confirms or exceeds prior expectations. Each H_2 hypothesis identifies an antecedent that shapes either the expectation or the confirmation in the captive-delivery encounter.

Trust influences satisfaction through both routes. Under Commitment-Trust Theory (Morgan and Hunt, 1994), trust encodes the expectation that the platform will act competently and benevolently; when the delivery experience confirms that expectation, the resulting positive disconfirmation registers as satisfaction. In platform-bound delivery, trust also lowers the anxiety of surrendering an order to a courier, so its confirmation is felt acutely at the moment of receipt (Candra et al., 2022; Falahat et al., 2019).

H_{2a}. Customer trust positively influences customer satisfaction.

Last-mile delivery quality is the proximal object of confirmation in a delivery service. Expectation-Confirmation logic predicts that the customer compares realized speed, condition, and courtesy against expectations, and the magnitude of (dis)confirmation drives satisfaction; this is among the most robust regularities in last-mile and platform research (Chotisarn and Phuthong, 2025; Jantapoon, 2025; Mogire et al., 2023).

H_{2b}. Last-mile delivery quality positively influences customer satisfaction.

Perceived risk enters through Perceived Risk theory (Jacoby and Kaplan, 1972), which frames the consumer's appraisal of potential financial, privacy, and performance loss. The conventional prediction is negative (Al Halbusi et al., 2022; Bashir et al., 2017). In the captive setting, however, two theoretical forces may invert the sign. First, where the platform owns protection and recovery, risk salience directs attention to the platform's visible competence in safeguarding orders—a Service-Recovery-Paradox dynamic in which the risk-aware customer credits demonstrated reliability more strongly. Second, under Expectation-Confirmation logic, risk-aware customers have lower performance expectations, so adequate delivery yields a larger positive disconfirmation. We therefore advance a non-directional hypothesis, theorized as risk-awareness salience, and revisit it in the discussion.

H_{2c}. Perceived risk is associated with customer satisfaction.

Delivery experience frequency raises satisfaction through the cumulative-confirmation premise of Expectation-Confirmation Theory: Satisfaction is reinforced as expectations are repeatedly met across many deliveries, so habituated users accumulate a stronger affective evaluation, and usage status has been shown to alter delivery assessments (Mogire et al., 2023).

H_{2d}. The frequency of delivery experience positively influences customer satisfaction.

Because perceived risk and delivery experience frequency shape satisfaction here and are also theorized to condition other antecedents (Section 2.6), each enters the model in a dual role.

2.5. The Serial Value-Satisfaction-Loyalty Mechanism (H_3-H_4 and Indirect Effects)

The model's core is a serial pathway derived by chaining three theories. Expectation-Confirmation Theory (Oliver, 1980) positions cognition as antecedent to affect: Having appraised the service as worthwhile, the consumer experiences that favorable cognition as satisfaction. Perceived value is therefore not a parallel outcome but the proximal cognitive input to the confirmation judgment, a value-to-satisfaction sequence demonstrated in digital-wallet and smart-locker contexts (Dhaigude et al., 2023; Quan et al., 2022; Wang and Prompanyo, 2020).

H_3. Perceived value positively influences customer satisfaction.

The four-stage loyalty model (Oliver, 1999) supplies the final link, specifying that loyalty develops sequentially from cognitive to affective to conative to action stages, with satisfaction the affective engine that propels the consumer through these stages. Satisfaction is thus the proximal determinant of loyalty rather than one driver among many, a relationship confirmed across banking, retail, ride-hailing, and SME settings (Jasin et al., 2023; Thaithatkul et al., 2021; van Deventer and Redda, 2023; Wahyuni and Ghozali, 2019).

H_4. Customer satisfaction positively influences customer loyalty.

Read together, the three theories imply a coherent serial-mediation architecture rather than a set of disjoint effects: Means-End Chain converts each service antecedent into perceived value (H_{1a}-H_{1d}), Expectation-Confirmation Theory converts value into satisfaction

(H_3), and the Four-Stage Loyalty Model converts satisfaction into loyalty (H_4). The theoretical implication posits that each value-relevant antecedent influences loyalty indirectly via the sequence of antecedent → perceived value → satisfaction → loyalty, without a direct antecedent-to-loyalty link. This staged reasoning suggests that loyalty is attained through accumulated satisfaction rather than circumventing it. Theoretically, this is a full-mediation expectation: Because Means-End Chain locates the antecedents at the attribute level, two cognitive-affective transformations (attribute to value, satisfaction value) must intervene before the loyalty stages of Oliver's (1999) model can be reached, yielding a strong theoretical expectation of full mediation. This expectation is, however, treated as a hypothesis to be tested rather than as a premise: Whether antecedent effects reach loyalty exclusively through the chain is established empirically by estimating an augmented model that adds the four direct antecedent-to-loyalty paths and confirming their non-significance (Section 4.5), not by excluding those paths a priori. The same staged logic also predicts that the chains will not be uniform: An antecedent that also acts directly on satisfaction (H_{2a}-H_{2b}) can reach loyalty through both a serial-indirect and a shorter satisfaction-mediated route, so its total effect compounds two theoretically distinct mechanisms. This derivation extends the nearest prior evidence, which establishes a sequential value-trust-satisfaction–loyalty path in m-wallets (Dhaigude et al., 2023) and shows that service evaluations reach loyalty partly through satisfaction and value (Roberts-Lombard and Petzer, 2025), by relocating the mechanism to captive last-mile delivery and testing four antecedent chains simultaneously. Consistent with the hierarchy, the strongest value driver under H_1 should generate the strongest indirect route; the analysis therefore distinguishes each chain's specific indirect effect from the total effect to establish whether value and satisfaction jointly transmit the antecedent influence to loyalty.

2.6. Moderating Boundary Conditions (H_5-H_6)

The two moderation hypotheses are not ad hoc interactions but boundary conditions implied by the underpinning theories themselves, each specifying when an antecedent-to-satisfaction relationship should strengthen or weaken.

Delivery experience frequency is theorized to moderate the last-mile-quality-to-satisfaction relationship through the expectation-formation premise of Expectation-Confirmation Theory (Oliver, 1980). Because satisfaction depends on performance relative to expectations, and because expectations are calibrated by accumulated experience, the same objective delivery performance should confirm into satisfaction differently for frequent versus occasional users: seasoned users hold firmer, higher reference standards that may attenuate the effect, while their sharper sensitivity to deviation may instead amplify it. Evidence that user status materially changes delivery evaluations supports treating frequency as the relevant boundary (Mogire et al., 2023).

H_5. Delivery experience frequency moderates the relationship between last-mile delivery quality and customer satisfaction.

Perceived risk is theorized to moderate the trust-to-satisfaction relationship, directly, in Perceived Risk theory (Jacoby and Kaplan, 1972), in which trust serves as the principal mechanism for mitigating felt risk. If trust's value lies in reducing risk, then the satisfaction return on confirmed trust should be contingent on the level of risk present. Under high perceived risk, reassurance is scarcer, and confirmed trust may matter more, whereas pervasive risk may instead overwhelm the benefits of trust. Because risk has been shown to condition satisfaction-related outcomes in online purchasing (Al Halbusi et al., 2022; Bashir et al., 2017), it is a theoretically warranted moderator.

H_6. Perceived risk moderates the relationship between customer trust and customer satisfaction.

Framing H_5 and H_6 as theory-derived boundary conditions allows the study to test whether satisfaction formation is contingent on customer experience and risk perception or operates uniformly, with direct implications for whether platforms should segment service strategies by usage tier and risk profile. The full set of hypothesized relationships, including the serial value-satisfaction-loyalty pathway and the two moderating effects, is summarized in the conceptual model (Figure 1).

3. METHODOLOGY

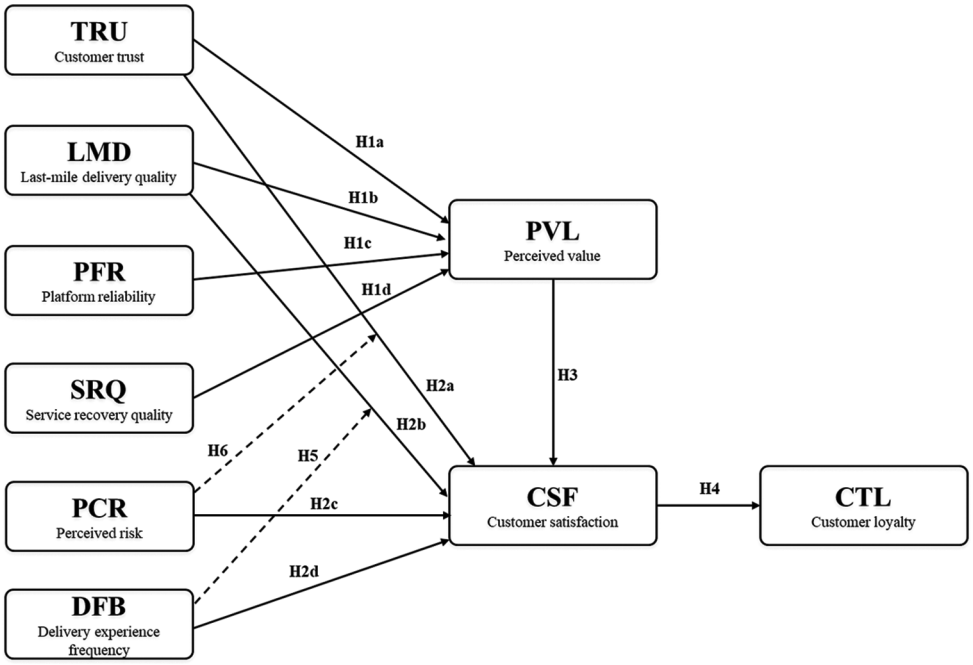
3.1. Research Design and Context

This study adopts a quantitative, cross-sectional survey design situated within a positivist research philosophy and a deductive logic, appropriate for testing a theory-derived model of relationships among latent constructs. The empirical context is platform-bound last-mile delivery in Thailand, operationalized through Shopee Xpress, the captive courier of the Shopee marketplace. The target population comprised consumers in the Bangkok Metropolitan Region (BMR), encompassing Bangkok and the adjacent provinces of Pathum Thani, Nonthaburi, Samut Prakan, Samut Sakhon, and Nakhon Pathom, who had received a Shopee Xpress delivery within the preceding 6 months. The BMR was selected because it concentrates the country's e-commerce activity and its most developed last-mile delivery operations: E-commerce businesses in Thailand are most heavily concentrated in Bangkok and the adjacent provinces of Nonthaburi, Samut Prakan, and Pathum Thani—placing four of the country's five leading e-commerce provinces within the region (Electronic Transactions Development Agency [ETDA], 2024), making it the setting in which the hypothesized mechanisms are most observable. The unit of analysis is the individual consumer. A cross-sectional horizon was appropriate because the study tests a structural pattern of association rather than change over time, and the survey method efficiently captures perceptions across a geographically dispersed population. A single-platform focus was adopted deliberately to hold the delivery model constant, isolating the captive-delivery dynamics of interest rather than confounding them with third-party logistics variation across platforms; Shopee Xpress was chosen as the most widely used platform-bound courier in the market, maximizing access to eligible, experienced respondents.

3.2. Sampling and Data Collection

The sampling frame consisted of adult consumers meeting four inclusion criteria: Having used a platform-bound delivery

Figure 1: Conceptual model



Solid arrows = hypothesized direct paths (H_{1a}-H_4); dashed arrows = moderating effects (H_5, H_6). TRU: Trust, LMD: Last-mile delivery quality, PFR: Platform reliability, SRQ: Service recovery quality, PCR: Perceived risk, DFB: Delivery experience frequency, PVL: Perceived value, CSF: Customer satisfaction, CTL: Customer loyalty. PCR and DFB act as both direct antecedents of satisfaction and moderators

service at least once in the past 6 months, residing in the BMR, being at least 18 years old, and being able to communicate in Thai. Respondents were excluded if they had never used such a service, had last used it more than 6 months earlier, omitted more than 10% of items, or completed the questionnaire in under 2 min. Data were collected through a self-administered online questionnaire distributed via social media channels and snowball sampling, with two screening questions on the opening page to ensure eligibility.

Data quality was protected through a four-layer control procedure: Eligibility screening, three embedded attention-check items, a response-time filter that removed speeders (under 2 min), and a response-pattern check that detected straight-lining and contradictory answers. Of 451 raw submissions, four were removed during cleaning—one for excessive missing data and three for straight-lining and attention-check failures—yielding a final analytic sample of N = 447.

Minimum sample size was evaluated against three benchmarks. Hair et al.'s (2011) 5:1 and 10:1 item-to-response rules implied 235 and 470 responses for the multi-item instrument; Kline's (2011) guidance for complex SEM models indicated at least 200 to 250; a power analysis in G*Power ($f^2 = 0.15$, $\alpha = 0.05$, power = 0.80, four predictors) returned a minimum of 85, raised to roughly 107 after the 26% increment Aguinis et al. (2001) recommend for detecting interaction effects. The inverse-square-root method (Kock and Hadaya, 2018), applied to the model's substantive path magnitudes at 5% significance and 80% power, set a lower bound well below the achieved sample. With 447 valid cases, the study exceeds the SEM and inverse-square-root thresholds. It approaches the 10:1 ideal, providing sufficient power for the serial mediation and moderation tests, which require greater power than direct effects alone.

3.3. Measures

The questionnaire comprised four parts: Screening items, demographic and behavioral items, the multi-item measurement battery, and the moderator-and-context block. All reflective latent constructs were measured on a five-point Likert scale (1 = strongly disagree, 5 = strongly agree). Each reflective construct was operationalized with five indicators adapted from established scales and contextualized to platform-bound delivery: Customer trust from McKnight et al. (2002); last-mile delivery quality from logistics-service-quality measures (Murfield et al., 2017; Mogire et al., 2023); platform reliability from information-systems-success and B2C website-quality measures (McKnight et al., 2002; DeLone and McLean, 2003; Lin, 2007); service recovery quality from the recovery-evaluation literature (Smith et al., 1999); perceived value from Sweeney and Soutar (2001); customer satisfaction from Oliver (1980); customer loyalty from Zeithaml et al. (1996); and perceived risk, capturing financial, privacy, and performance facets, from Bashir et al. (2017). Perceived risk was specified as a single reflective dimension because the study models overall felt risk—rather than its separate facets—as the latent appraisal bearing on satisfaction; the financial, privacy, and performance items function as interchangeable manifestations of this common appraisal, consistent with the unidimensional operationalization in Bashir et al. (2017). Delivery experience frequency (DFB) was measured using two behavioral items—monthly Shopee Xpress receipt frequency and the length of platform-bound service use. Although these are behavioral counts, they were specified reflectively as interchangeable manifestations of a single underlying disposition—habituated reliance on platform-

bound delivery—rather than as distinct, defining components of it. Consistent with this specification, the two items were strongly correlated (r = 0.71) and loaded highly and evenly on the common factor (0.919 and 0.930), and the construct met the reflective reliability and validity thresholds reported in Section 4.2 (AVE = 0.854). Because a two-item reflective construct is identification-fragile, single-composite and formative treatments were also considered; the strong inter-item correlation and high, balanced loadings support retaining the reflective specification.

Item wording was developed in Thai and reviewed for clarity and conceptual fidelity. Content validity was established by three expert reviewers using the item-objective congruence (IOC) index, with all retained items meeting the conventional 0.50 criterion. The instrument was pilot-tested with 30 respondents to confirm internal consistency reliability before the main collection. Indicator quality in the main study was judged against the criteria of Hair et al. (2019): Outer loadings at or above 0.708 for indicator reliability, composite reliability and Cronbach's alpha above 0.70 for internal consistency, average variance extracted above 0.50 for convergent validity, and heterotrait-monotrait (HTMT) ratios below 0.85 for discriminant validity (Henseler et al., 2015). In the final measurement model, every reflective construct retained all five indicators, and DFB retained both items, for a total of 42 indicators. All indicators loaded above the 0.708 threshold (range: 0.814-0.930), so no indicator required trimming. Convergent validity was supported by average variance extracted values ranging from 0.729 to 0.854, and discriminant validity by a maximum HTMT of 0.732; full psychometric details are reported in Section 4. DFB additionally served as a moderator, and perceived risk entered both as a direct antecedent and as a moderator, consistent with the conceptual model.

3.4. Analytical Strategy

The model was estimated using partial least squares structural equation modeling (PLS-SEM) in SmartPLS 4. PLS-SEM was selected for three reasons aligned with the study's aims: Its prediction-and-explanation orientation suits a model intended to inform managerial action; it accommodates the complex serial-mediation structure with two moderators without the strict distributional and identification constraints of covariance-based SEM; and it is robust to the non-normal, ordinal-Likert data typical of survey research (Hair et al., 2019). Analysis proceeded in stages. Descriptive statistics first summarized respondent characteristics and item-level response patterns. The measurement model was then assessed for reliability and validity, following the staged protocol of Hair et al. (2019), before the structural model was evaluated. Structural assessment examined lateral collinearity using inner-model variance inflation factors, explanatory power using R^2, effect sizes using f^2, and the significance and relevance of the path coefficients. Moderating effects were estimated with the two-stage approach (Henseler and Chin, 2010), which is appropriate when latent moderators are involved, and prediction is prioritized. Statistical inference relied on bootstrapping with 5,000 subsamples using the bias-corrected and accelerated (BCa) method to obtain confidence intervals for path coefficients and indirect effects; mediation was classified following Nitzl et al. (2016) and Zhao et al. (2010). Predictive validity was examined out-of-sample through PLSpredict (Shmueli et al., 2019) and the cross-validated predictive ability test (Liengaard et al., 2021), extending standard in-sample reporting.

3.5. Common Method Bias and Research Ethics

Because all measures were self-reported in a single instrument, common method bias was assessed in two complementary ways. As the primary diagnostic, a full collinearity assessment (Kock, 2015) examined the inner-model variance inflation factors, supplemented by Harman's single-factor test as a secondary check to determine whether a single factor accounted for the majority of the variance. All inner-model VIF values fell between 1.000 and 2.054, well below the 3.3 threshold, indicating that common method bias was not a material concern (Kock, 2015; Podsakoff et al., 2003). Procedural remedies reinforced this conclusion: Respondent anonymity and assured confidentiality reduced apprehension about evaluation, and item order separated the predictor and criterion measures. The study was conducted in accordance with human research ethics principles and received Exemption Review approval from the Silpakorn University Research Ethics Committee (project code REC 69.0515-068-4183; certificate of exemption no. COE 69.0521-027). Participation was voluntary and anonymous, preceded by informed consent; collected data were stored securely and used solely for the stated research purpose.

4. RESULTS

4.1. Respondent Profile

Profiling the analytic sample defined by the inclusion criteria and screening procedure in Section 3.2, and consistent with the convenience-based online and snowball recruitment used there, the demographic distribution below should be read as descriptive of the achieved sample rather than representative of the wider Bangkok Metropolitan Region population. The final sample comprised 447 valid respondents. The majority were female (57.3%), followed by male (41.4%) and LGBTQ+ (1.3%). Generationally, Generation X formed the largest group (40.9%), ahead of Generation Y (31.8%), Baby Boomers (17.2%), and Generation Z (10.1%). Educational attainment was high: 49.7% held a bachelor's degree and a further 44.3% a postgraduate qualification. Respondents were distributed across the Bangkok Metropolitan Region, residing in four of its six provinces—Pathum Thani (27.1%), Samut Prakan (26.4%), Nonthaburi (25.7%), and Bangkok (20.8%)—and none in Samut Sakhon or Nakhon Pathom, with monthly income concentrated in the 15,000-50,000 baht range. That Bangkok itself returned the smallest of these shares, despite anchoring the region selected for its delivery density, reflects the snowball recruitment route rather than the underlying population distribution and is acknowledged as a limitation of the convenience sample. Importantly, the sample was highly experienced with platform-bound delivery: The plurality ordered 6-10 times per month (29.5%), received 11-20 Shopee Xpress parcels in the prior month (26.0%), and had used the service for more than 1 to 2 years (29.1%), confirming the relevance of their evaluations.

4.2. Measurement Model

The nine constructs were specified reflectively and assessed following Hair et al. (2019). Indicator reliability was satisfactory:

All 42 retained indicators loaded above the 0.708 threshold, ranging from 0.814 to 0.930, each significant at $P < 0.001$ under 5,000-subsample bootstrapping (Table 1). Internal consistency reliability was confirmed, with Cronbach's α between 0.830 and 0.925, rho_A between 0.833 and 0.927, and composite reliability (ρc) between 0.921 and 0.944, all within the recommended 0.70-0.95 band and thus free of redundancy concerns. Convergent validity was supported, as every construct's average variance extracted (AVE) exceeded 0.50, ranging from 0.729 (trust) to 0.854 (delivery experience frequency), with perceived value at 0.770 and customer loyalty at 0.750. Discriminant validity was established primarily using the heterotrait-monotrait (HTMT) ratio (Henseler et al., 2015): Every inter-construct ratio fell below the conservative 0.85 criterion, with the highest being 0.732 between perceived risk and delivery experience frequency (Table 2). The Fornell-Larcker criterion corroborated this result, with each construct's square root of the AVE exceeding its correlations with all other constructs (Table 3). Together, these results indicate that the measurement instrument is reliable and valid, providing a sound basis for structural assessment.

Table 1: Measurement model: Indicator loadings, internal consistency reliability, and convergent validity

Construct	Item	Loading	α	ρA	ρc	AVE
TRU	TRU1	0.859	0.907	0.908	0.931	0.729
	TRU2	0.850				
	TRU3	0.851				
	TRU4	0.856				
	TRU5	0.853				
LMD	LMD1	0.866	0.910	0.911	0.933	0.735
	LMD2	0.860				
	LMD3	0.874				
	LMD4	0.848				
	LMD5	0.838				
PFR	PFR1	0.895	0.910	0.915	0.933	0.735
	PFR2	0.835				
	PFR3	0.842				
	PFR4	0.858				
	PFR5	0.855				
SRQ	SRQ1	0.879	0.907	0.909	0.931	0.730
	SRQ2	0.860				
	SRQ3	0.837				
	SRQ4	0.843				
	SRQ5	0.852				
PVL	PVL1	0.902	0.925	0.927	0.944	0.770
	PVL2	0.890				
	PVL3	0.867				
	PVL4	0.839				
	PVL5	0.890				
CSF	CSF1	0.882	0.907	0.909	0.931	0.730
	CSF2	0.864				
	CSF3	0.872				
	CSF4	0.837				
	CSF5	0.814				
CTL	CTL1	0.867	0.917	0.919	0.937	0.750
	CTL2	0.869				
	CTL3	0.876				
	CTL4	0.834				
	CTL5	0.883				
PCR	PCR1	0.819	0.911	0.913	0.934	0.738
	PCR2	0.884				
	PCR3	0.887				
	PCR4	0.857				
	PCR5	0.846				
DFB	DFB1	0.919	0.830	0.833	0.921	0.854
	DFB2	0.930				

All standardized outer loadings are significant at P<0.001 (5,000-subsample bootstrap). α=Cronbach's alpha; ρA=composite reliability (rho_A); ρc=composite reliability (rho_c); AVE: Average variance extracted. Construct abbreviations: TRU: Customer trust, LMD: Last-mile delivery quality, PFR: Platform reliability, SRQ: Service recovery quality, PVL: Perceived value, CSF: Customer satisfaction, CTL: Customer loyalty, PCR: Perceived risk, DFB: Delivery experience frequency

4.3. Common Method Bias

Because the data were self-reported through a single instrument, common method bias was evaluated using two complementary procedures, with primary weight given to the more diagnostic full-collinearity assessment (Kock, 2015). The full-collinearity test examined the inner-model variance inflation factors; all values lay between 1.000 and 2.054, comfortably below the 3.3 criterion, indicating that common method bias is not a material concern. As a secondary check, Harman's single-factor test was conducted by entering all indicators into an unrotated exploratory factor analysis; the first (largest) factor accounted for <50% of the total variance, consistent with the full-collinearity result. Because Harman's test is now widely regarded as insensitive, it is reported only for completeness, and the full-collinearity result is treated as the primary diagnostic. Both diagnostics converge on the conclusion that common method bias is not a material threat to the validity of the findings (Kock, 2015; Podsakoff et al., 2003), consistent with the procedural remedies applied during data collection.

4.4. Structural Model

Before interpreting the path estimates, lateral collinearity was assessed: All inner-model VIF values (1.000-2.054) were below 3.3, so collinearity did not bias the structural coefficients. The model explained a substantial share of the variance in the endogenous constructs, with R^2 values of 0.564 for perceived value, 0.512 for customer satisfaction, and 0.355 for customer loyalty—indicating moderate explanatory power by Hair et al.'s (2019) benchmarks. All ten hypothesized direct paths were positive and statistically significant (Table 4).

For perceived value, trust was the strongest driver ($\beta = 0.327$), followed by service recovery quality ($\beta = 0.289$), last-mile delivery quality ($\beta = 0.265$), and platform reliability ($\beta = 0.197$). For satisfaction, the largest direct effect came from delivery experience frequency (0.276), then perceived risk (0.163)—a positive coefficient revisited below—last-mile delivery quality (0.129), and trust (0.112). Most decisively, customer satisfaction exerted a dominant effect on loyalty ($\beta = 0.596$, $t = 20.402$), with a large effect size ($f^2 = 0.551$; Table 5), confirming satisfaction as the principal engine of loyalty. Model fit was acceptable: The saturated-model SRMR was 0.033, and NFI was 0.906, although the estimated-model SRMR of 0.086 marginally exceeded the 0.08 threshold, which was noted as a limitation.

4.5. Mediation

Serial mediation was tested following Nitzl et al. (2016) using bootstrapped indirect effects. All four serial-mediation chains—antecedent → perceived value → satisfaction → loyalty—were significant: The trust chain was strongest ($\beta = 0.041$, $t = 3.786$),

Table 2: Discriminant validity: Heterotrait-monotrait (HTMT) ratios

	CSF	CTL	DFB	LMD	PCR	PFR	PVL	SRQ	TRU
CSF	—								
CTL	0.651	—							
DFB	0.717	0.679	—						
LMD	0.533	0.503	0.543	—					
PCR	0.641	0.608	0.732	0.570	—				
PFR	0.643	0.500	0.601	0.341	0.625	—			
PVL	0.648	0.619	0.671	0.534	0.620	0.515	—		
SRQ	0.557	0.617	0.509	0.209	0.500	0.357	0.567	—	
TRU	0.548	0.585	0.582	0.366	0.547	0.341	0.633	0.396	—

All HTMT ratios are below the conservative 0.85 threshold (Henseler et al., 2015); the maximum is 0.732 (PCR-DFB). Construct abbreviations as in Table 1

Table 3: Discriminant validity: Fornell-Larcker criterion

	CSF	CTL	DFB	LMD	PCR	PFR	PVL	SRQ	TRU
CSF	0.854								
CTL	0.596	0.866							
DFB	0.623	0.593	0.924						
LMD	0.484	0.460	0.470	0.857					
PCR	0.584	0.557	0.637	0.519	0.859				
PFR	0.584	0.458	0.524	0.311	0.570	0.857			
PVL	0.594	0.571	0.587	0.490	0.571	0.475	0.878		
SRQ	0.506	0.564	0.443	0.190	0.457	0.327	0.521	0.854	
TRU	0.498	0.533	0.505	0.334	0.498	0.311	0.581	0.360	0.854

Diagonal elements (in bold in the original) are the square roots of the AVEs; off-diagonal elements are inter-construct correlations. Each square-root AVE exceeds the construct's correlations with all other constructs. Construct abbreviations as in Table 1

Table 4: Structural model results: Standardized direct effects (H_{1a}-$_{H4}$)

H	Path	β	t	P	Result
H_{1a}	TRU→PVL	0.327	9.758	<0.001	Supported
H_{1b}	LMD→PVL	0.265	7.426	<0.001	Supported
H_{1c}	PFR→PVL	0.197	5.660	<0.001	Supported
H_{1d}	SRQ→PVL	0.289	7.876	<0.001	Supported
H_{2a}	TRU→CSF	0.112	2.527	0.012	Supported
H_{2b}	LMD→CSF	0.129	3.115	0.002	Supported
H_{2c}	PCR→CSF	0.163	3.232	0.001	Supported
H_{2d}	DFB→CSF	0.276	5.472	<0.001	Supported
H_3	PVL→CSF	0.209	4.274	<0.001	Supported
H_4	CSF→CTL	0.596	20.402	<0.001	Supported

β=standardized path coefficient; t- and P values were obtained from bootstrapping with 5,000 subsamples using the bias-corrected and accelerated (BCa) method; a path is reported as Supported when P<0.05 and the 95% confidence interval excludes zero. TRU: Customer trust, LMD: Last-mile delivery quality, PFR: Platform reliability, SRQ: Service recovery quality, PCR: Perceived risk, DFB: Delivery experience frequency, PVL: Perceived value, CSF: Customer satisfaction, CTL: Customer loyalty

Table 5: Effect sizes (f^2) for all structural paths

Path	f^2	Effect size
TRU→PVL	0.1907	Medium
LMD→PVL	0.1353	Small
PFR→PVL	0.0717	Small
SRQ→PVL	0.1566	Medium
TRU→CSF	0.0155	Negligible
LMD→CSF	0.0224	Small
PCR→CSF	0.0266	Small
DFB→CSF	0.0771	Small
PVL→CSF	0.0439	Small
CSF→CTL	0.5510	Large
DFB×LMD→CSF	0.0002	Negligible
PCR×TRU→CSF	0.0011	Negligible

f^2 thresholds (Cohen, 1988; Hair et al., 2019): 0.02=small, 0.15=medium, 0.35=large. The last two rows are the interaction terms.

followed by service recovery (0.036), last-mile delivery (0.033), and platform reliability (0.024), each with a bootstrap confidence interval excluding zero (Table 6). The shorter satisfaction-mediated routes (antecedent → CSF → CTL) were likewise significant, with the largest being delivery experience frequency (β = 0.164, t = 5.170), followed by perceived value (0.124), perceived risk (0.097), last-mile delivery (0.077), and trust (0.067). Classified by the typology of Zhao et al. (2010), most relationships constitute complementary (partial) mediation: Both the direct and indirect effects are significant and have the same sign—for instance, trust affects satisfaction directly (β = 0.112) and indirectly via perceived value (β = 0.068). These results show that perceived value and satisfaction operate as a coordinated sequence that transmits service-quality effects toward loyalty, rather than as redundant parallel mediators. Because the estimated model specifies no direct antecedent-to-loyalty paths, the complementary (partial) mediation classified above pertains to the value path (antecedent → satisfaction), not to loyalty. Therefore, classifying full versus partial mediation with respect to loyalty requires an augmented model that adds the four direct antecedent-to-loyalty paths and demonstrates their non-significance.

4.6. Moderation and Predictive Validity

Neither moderation hypothesis was supported (Table 7); consistent with this, the two interaction terms have negligible effect sizes (Table 5). Using the two-stage approach (Henseler and Chin, 2010), the interaction of delivery experience frequency on the last-mile-quality–satisfaction path was non-significant (H_5: β = −0.012, t = 0.339, P = 0.735, f^2 = 0.0002), as was the interaction of perceived risk on the trust-satisfaction path (H_6: β = −0.024, t = 0.680, P = 0.497, f^2 = 0.0011). Both interaction effect sizes were essentially zero, but the achieved statistical power to detect them was low—*post-hoc* power of 8.1% for H_5 and 12.7% for H_6 at α = 0.05. A non-significant interaction in a single cross-

sectional sample of this size therefore indicates no detectable moderation, rather than confirmed invariance: The satisfaction-forming relationships show no evidence of moderation across the observed levels of customer experience and risk perception, but the data cannot rule out a small interaction that the study was underpowered to detect. Out-of-sample prediction was examined via PLSpredict and CVPAT. Latent-variable Q^2 predict values were all positive (PVL = 0.555, CSF = 0.508, CTL = 0.409), confirming predictive relevance; however, at the indicator level all five loyalty items showed higher PLS-SEM than linear-model RMSE, indicating low predictive power for loyalty specifically (Shmueli et al., 2019). CVPAT confirmed the model significantly outperformed the indicator-average benchmark overall (average loss difference = −0.586, $P < 0.001$), while its comparison against the linear model was statistically equivalent overall. Finally, an importance-performance map (IPMA) identified customer satisfaction as the highest-importance driver of loyalty (total effect ≈ 0.596) with a mid-range performance score, making it the primary managerial lever.

5. DISCUSSION

5.1. Interpretation of Findings

The results render a coherent picture of how platform-bound delivery converts service performance into loyalty. Trust emerged as the strongest determinant of perceived value (β = 0.327), which is intelligible in the captive-delivery setting: Because the consumer surrenders physical control of the order to a courier carrying the platform's own brand, confidence that the platform will act reliably and benevolently removes the uncertainty premium that would otherwise erode the value calculus. Trust thus does its heaviest work at the sacrifice pole of the value judgment, consistent with the means-end logic that framed H_{1a}. Recent meta-analytic evidence reinforces this benefit-over-sacrifice reading, identifying the trade-off between perceived benefits and perceived sacrifices as the core of perceived-value formation (Blut et al., 2024). By contrast, the dominant direct driver of satisfaction was delivery experience frequency (β = 0.276), and the same construct originated the largest satisfaction-mediated route to loyalty (DFB → CSF → CTL, β = 0.164). This pattern fits a cumulative-confirmation reading: Habituated users have accumulated repeated instances of met expectations, and each successful delivery reinforces the affective evaluation, a dynamic anticipated by the user-status effects reported in last-mile research (Mogire et al., 2023).

Most decisively, satisfaction was the overwhelming proximal driver of loyalty (β = 0.596, $f^2 = 0.551$), confirming the Four-Stage Loyalty premise that loyalty is reached through accumulated satisfaction rather than around it. The serial chain therefore functions as theorized: Antecedents generate value, value confirms into satisfaction, and satisfaction propels loyalty. Notably, trust dominates value formation while delivery frequency dominates direct satisfaction, indicating that the two mediators are fed by different mechanisms—trust by uncertainty reduction and frequency by accumulated confirmation—rather than by a single undifferentiated quality signal.

The two non-significant moderations are themselves a noteworthy result rather than a shortfall. Neither delivery experience frequency nor perceived risk detectably altered the strength of the satisfaction-forming relationships theorized to be bounded; the conditional slopes for last-mile quality remained significant and almost identical across experience levels, and the trust-to-satisfaction effect was stable across risk levels. Given the low achieved power for the interaction terms (Section 4.6), these results are best read as showing no detectable moderation rather than as establishing strict invariance: Within this sample, a given improvement in delivery quality or trust appears to pay a similar satisfaction dividend whether the customer is a novice or a veteran, risk-anxious or risk-relaxed, though a small conditioning effect cannot be ruled out. So read, the absence of detectable moderation is consistent with—rather than proof of—a core mechanism that operates similarly across customer types.

5.2. Theoretical Contributions

The study makes three theoretical contributions. First, it validates a serial value–satisfaction–loyalty mechanism in the under-examined context of captive, platform-bound delivery, and does so for four antecedent chains simultaneously. Whereas the nearest prior

Table 6: Specific indirect (mediation) effects

Indirect path	β	t	P	LLCI	ULCI
Serial chains (antecedent→PVL→CSF→CTL)					
TRU→PVL→CSF→CTL	0.041	3.79	0.0002	0.021	0.063
SRQ→PVL→CSF→CTL	0.036	3.44	0.0006	0.017	0.058
LMD→PVL→CSF→CTL	0.033	3.83	0.0001	0.017	0.050
PFR→PVL→CSF→CTL	0.024	3.06	0.0023	0.011	0.042
Satisfaction-mediated routes (→CSF→CTL)					
DFB→CSF→CTL	0.164	5.17	<0.001	0.103	0.227
PVL→CSF→CTL	0.124	4.17	<0.001	0.067	0.183
PCR→CSF→CTL	0.097	3.12	0.0018	0.039	0.163
LMD→CSF→CTL	0.077	3.08	0.0021	0.027	0.126
TRU→CSF→CTL	0.067	2.50	0.0125	0.016	0.119
Value-stage paths (antecedent→PVL→CSF)					
TRU→PVL→CSF	0.068	3.88	0.0001	0.036	0.104
SRQ→PVL→CSF	0.060	3.52	0.0004	0.029	0.096
LMD→PVL→CSF	0.055	3.87	0.0001	0.029	0.085
PFR→PVL→CSF	0.041	3.10	0.0020	0.018	0.070

β=standardized specific indirect effect; t- and P-values, and the lower and upper bounds of the 95% percentile bootstrap confidence interval (LLCI, ULCI), are from 5,000-subsample bootstrapping. An effect is significant when the LLCI and ULCI share the same sign (i.e., the interval excludes zero). Each serial chain combines the corresponding H_1 path (antecedent→PVL), H_3 (PVL→CSF), and H_4 (CSF→CTL); each satisfaction-mediated route combines the corresponding H_2 path (antecedent→CSF) with H_4; the value-stage paths isolate the within-value mediation (H_1 path with H_3) underlying the complementary (partial) mediation classified in Section 4.5

Table 7: Moderation results (two-stage approach)

H	Interaction	β	t	P	f^2	Power (%)	Result
H_5	DFB×LMD→CSF	−0.012	0.339	0.735	0.0002	8.1	Not supported
H_6	PCR×TRU→CSF	−0.024	0.680	0.497	0.0011	12.7	Not supported

β, t, and P from 5,000-subsample bootstrapping; power=*post-hoc* achieved power for the interaction term at α=0.05. The low achieved power indicates that the null interactions reflect no detectable moderation rather than confirmed invariance

evidence established a sequential value–trust–satisfaction–loyalty path in mobile-wallet services (Dhaigude et al., 2023), the present findings relocate and confirm the chained cognitive-to-affective-to-conative logic in last-mile delivery, demonstrating that perceived value and satisfaction operate as a coordinated sequence rather than redundant parallel mediators. The predominance of complementary (partial) mediation (Zhao et al., 2010) further specifies that service quality reaches loyalty through both a direct satisfaction route and the longer value-mediated route, refining how the integrated model should be theorized.

Second, the study contributes by integrating service recovery quality into a service-quality–value framework that has conventionally emphasized core delivery attributes, confirming recovery as a significant value driver ($\beta = 0.289$) in a setting where the platform owns the recovery encounter end-to-end. This extends the service-quality literature, which in last-mile and cross-border contexts has typically modeled delivery quality alone (Chotisarn and Phuthong, 2025; Mogire et al., 2023), by showing that recovery competence is a distinct, value-relevant attribute when the platform, rather than an external carrier, controls the failure response. The study also contributes contextually, providing robust evidence from Thailand's high-growth Bangkok Metropolitan Region on a captive courier, and methodologically by pairing conventional in-sample reporting with out-of-sample PLSpredict and CVPAT evidence, thereby strengthening the credibility of its predictive claims.

Third, and most cautiously, the positive and significant effect of perceived risk on satisfaction ($\beta = 0.163$) warrants careful theoretical treatment. This direction contradicts the conventional expectation that risk depresses satisfaction (Al Halbusi et al., 2022; Bashir et al., 2017). A plausible interpretation is risk-awareness salience: Customers more attuned to financial, privacy, and performance risks may also attend more closely to, and credit more strongly, the platform's visible competence in safeguarding orders. We deliberately stop short of claiming a Service Recovery Paradox. Because the data are cross-sectional and the risk-related moderation was non-significant, the positive coefficient is best read as a context-specific association requiring replication and, ideally, mediation testing that explicitly models perceived safeguarding, rather than as confirmation of a paradox mechanism. Treating the finding as provisional preserves the integrity of the contribution while flagging a clear avenue for future theory development.

5.3. Managerial Implications

The findings translate into a clear hierarchy of action for platform operators and their captive couriers. Because satisfaction is by far the strongest determinant of loyalty and the importance-performance map identifies it as the highest-importance lever at only mid-range performance, the priority is to raise satisfaction directly. The single largest direct contributor to satisfaction was delivery experience frequency, which suggests that engagement mechanisms that generate repeated positive delivery experiences—such as membership tiers, usage incentives, and reliability guarantees—can build the habituated satisfaction that converts into loyalty, echoing the loyalty dynamics observed for platform couriers elsewhere (Harlan et al., 2024).

Trust deserves equal attention but through a different channel: As the strongest driver of perceived value, trust is best cultivated by reducing the uncertainty inherent in handing over an order. Transparent, real-time parcel tracking, rigorous vetting of delivery personnel, and visible data-security measures are concrete levers, particularly because they also address the financial and privacy concerns embedded in perceived risk. Service recovery quality is a third lever that platform-bound operators are uniquely positioned to pull: Since the platform controls the recovery encounter, investing in fast, fair compensation and professional communication after a failed or delayed delivery directly enhances perceived value (Jeon et al., 2025).

Finally, the null moderations carry a distinct and useful managerial message about segmentation. Because the satisfaction-forming effects of delivery quality and trust showed no detectable variation with customers' usage frequency or risk perception (a null that the study was only modestly powered to detect; Section 4.6), the present evidence provides no support for fragmenting these core service investments across experience tiers or risk profiles; a uniform, high-quality service strategy appears to yield comparable satisfaction returns across the customer base, which is operationally efficient, though this guidance should be revisited should better-powered tests reveal a moderating effect. Segmentation effort is better redirected toward acquisition and trust-building communication for risk-sensitive prospective users than toward differentiating the delivery experience itself. Perceived risk warrants a nuanced response: Although it was positively associated with satisfaction in this sample, that association should not be read as a license to tolerate risk, since reducing financial and privacy exposure remains the most direct route to the trust that builds perceived value. Operators should therefore continue to lower objective risk while ensuring their safeguarding efforts are visible to customers. In short, the data support concentrating resources on universally strong delivery quality, trust, and recovery, reinforced by transparent risk mitigation, rather than on experience- or risk-contingent service tailoring; the path to loyalty in platform-bound delivery runs through a consistently satisfying core experience delivered to every customer.

6. CONCLUSION, LIMITATIONS, AND FUTURE RESEARCH

6.1. Conclusion

This study set out to explain how platform-bound e-commerce delivery converts service performance into customer loyalty by developing and testing an integrated serial mediation model with 447 Shopee Xpress users in Bangkok, Thailand. The evidence supports the central thesis: Four captive-delivery antecedents—trust, last-mile delivery quality, platform reliability, and service recovery quality—raise perceived value, which confirms into satisfaction, which in turn drives loyalty. Satisfaction proved the decisive proximal driver of loyalty, fed by two distinct upstream mechanisms: Trust anchoring value formation and accumulated delivery experience directly anchoring satisfaction. All four serial-mediation chains were significant, establishing

perceived value and satisfaction as a coordinated rather than redundant sequence. The two hypothesized moderations were non-significant, indicating no detectable moderation of satisfaction formation by customers' usage frequency or risk perception (a null result obtained with limited statistical power for the interaction terms). Set against a literature that has largely treated last-mile delivery as an outsourced "black box" and modeled its effects bivariately, these findings show that, in the captive model, perceived value and satisfaction transmit antecedent effects to loyalty as a coordinated sequence rather than as parallel or single-step mediators, extending the value–satisfaction–loyalty evidence previously confined to adjacent digital services (Dhaigude et al., 2023; Renaldi et al., 2024; Wang and Prompanyo, 2020) to platform-controlled delivery. The most unexpected result—a positive association between perceived risk and satisfaction—runs counter to the conventional risk-as-deterrent view and, interpreted cautiously as risk-awareness salience, marks the clearest opening for future theory development. Collectively, the findings advance a mechanism-level account of loyalty in captive last-mile delivery and offer platform operators a clear, evidence-based hierarchy of service priorities centered on building satisfaction through trust, reliable delivery, and competent recovery. More broadly, as e-commerce platforms continue to internalize last-mile delivery, the study's central message is that loyalty in this model is earned less by tailoring service to customer type than by delivering a uniformly trustworthy, reliable, and recovery-capable experience that compounds—through value and satisfaction—into durable loyalty.

6.2. Limitations

Several limitations qualify these conclusions. First, the cross-sectional design captures associations at a single point in time and cannot establish how loyalty evolves, limiting causal inference. Second, the study examined a single captive courier (Shopee Xpress) in a single region (the Bangkok Metropolitan Region), so the demographic and behavioral profile may not represent consumers on other platforms, in other regions, or in rural areas. Third, the data were entirely self-reported. However, Harman's single-factor test and full-collinearity diagnostics indicated that common method bias was not a material concern; response and interpretation biases cannot be wholly excluded. Fourth, the estimated-model SRMR of 0.086 marginally exceeded the conventional 0.08 threshold (despite a saturated-model SRMR of 0.033), suggesting some approximation error in the fitted structure. Fifth, recruitment relied on online and snowball distribution, which, while efficient for reaching experienced users, does not guarantee a probability sample. Finally, loyalty was the least well-explained construct ($R^2 = 0.355$), and its indicator-level out-of-sample predictive power was low, suggesting that meaningful determinants of loyalty—such as brand image, switching costs, or logistics technology—lie outside the present model and temper the strength of any specific predictive claims about loyalty.

6.3. Future Research

These limitations chart a clear research agenda. Longitudinal designs would allow researchers to trace how satisfaction and loyalty develop over repeated delivery cycles and to test the causal ordering the present model assumes. A particularly promising direction is an explicit comparison between platform-bound and third-party logistics delivery, ideally across multiple platforms and markets, to determine whether the captive-delivery dynamics observed here—especially the brand-attribution and recovery-control effects—systematically differ from those in outsourced models. Researchers should also extend the nomological network by incorporating the determinants that the modest loyalty R^2 implies are missing, including brand image and logistics-technology innovation, and by testing alternative moderators and mediators beyond those examined here. Given the unexpected positive association between perceived risk and satisfaction, future work should replicate this effect and explicitly model perceived safeguarding to clarify whether a risk-awareness-salience mechanism, rather than a Service Recovery Paradox, accounts for it. Methodologically, complementary techniques such as necessary-condition analysis and multi-group comparisons across generational or usage segments could reveal asymmetries and heterogeneity that the aggregate model masks. Replication in other countries and consumer segments would further establish the boundary conditions and generality of the integrated model. It would help determine whether the dominance of the satisfaction-to-loyalty pathway observed here is a stable feature of platform-bound delivery or specific to this market.

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