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The Effect of Green Logistics Practices, Digital Order Tracking Transparency, and Transportation on Last Mile Delivery Performance and Its Implications for Logistics Customer Satisfaction

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Abstract: This study examines the effects of Green Logistics Practices, Digital Order Tracking Transparency, and Transportation on Last Mile Delivery Performance and their implications for Logistics Customer Satisfaction among courier and logistics service customers at PT Pos Indonesia Situbondo Branch. A quantitative explanatory research design was employed. Data were collected through questionnaires distributed to 131 respondents selected using stratified random sampling from a population of 188 customers. The data were analyzed using Structural Equation Modeling Partial Least Square with Smart PLS3. The results demonstrate that Green Logistics Practices, Digital Order Tracking Transparency, and Transportation have positive and significant effects on Last Mile Delivery Performance. These variables also have positive and significant direct effects on Logistics Customer Satisfaction. Furthermore, Last Mile Delivery Performance has a positive and significant effect on Logistics Customer Satisfaction and acts as a mediating variable that strengthens the influence of Green Logistics Practices, Digital Order Tracking Transparency, and Transportation on customer satisfaction. These findings highlight the importance of sustainable logistics practices, transparent digital information systems, and reliable transportation in enhancing last mile delivery performance and customer satisfaction. The study provides practical insights for logistics service providers in improving service quality through integrated and sustainable logistics strategies.

Keywords: Green Logistics Practices; Digital Order Tracking Transparency; Transportation; Last Mile Delivery Performance; Logistics Customer Satisfaction.

INTRODUCTION

Courier and logistics services are far more than a standard business unit; they serve as the foundational pillar supporting the financial stability of PT Pos Indonesia's Situbondo Branch. However, the revenue performance of this sector between 2021 and 2025 reveals a volatile landscape filled with significant challenges. In a stark demonstration of this instability,

2022 saw a massive contraction in logistics revenue by Rp 895,390,451, a sharp 32.96% drop from the previous year. Although a brief window of optimism opened in 2023 with a 61.87% growth (Rp1,126,516,165), the momentum proved unsustainable. By 2024, earnings eroded once again by Rp1,151,410,340 (39.07%), a downward trend that persisted into 2025 with an additional 32.81% decline. Such recurring financial instability serves as a critical warning sign of operational inefficiencies that could have systemic impacts on the company's overall health (Savage & Walters, 2024).

This substantial loss of revenue is theoretically and empirically rooted in deep-seated issues regarding Logistics Customer Satisfaction. As emphasized by Christopher and Martin (2022), satisfying the logistics consumer is vital for maintaining brand loyalty and ensuring the long-term viability of a company's income. Satisfaction essentially stems from a psychological evaluation where customers determine if the service they received aligned with or surpassed their initial expectations (Vaidyanathan, 2023). At the Situbondo Branch, 2025 operational data highlights a painful gap between promise and reality: while the success target for pickups was set at 95%, the branch saw 7,156 units (10.37%) experience pickup delays. This was further exacerbated by a 10.91% failure rate in data entry due to poor internet connectivity. According to Nguyen (2024), such technical glitches are not merely inconveniences; they drastically diminish a customer's perception of a postal provider's professionalism and reliability.

The frustration felt by customers is primarily concentrated on the poor quality of Last Mile Delivery Performance—the definitive stage where a package moves from the courier to the recipient. Records indicate that of the 37,902 units scheduled for delivery, 11.21% (4,250 units) arrived late. This failure is particularly damaging because the "last mile" is the primary lens through which customers judge punctuality and the overall service experience (Nagari et al., 2023). When this final link in the supply chain falters, it creates a ripple effect that undermines the company's reputation. To address this, the branch has looked toward modernizing its operations through sustainable initiatives, yet the execution of these strategies remains a significant point of concern.

One internal factor that is expected to strengthen this performance is the implementation of Green Logistics Practices. While PT Pos Situbondo has introduced electric motorcycles and eco-friendly materials to align with modern sustainability standards, the persistent delays suggest that these green initiatives have yet to reach their peak operational efficiency (Oluwaseyi, 2025)(Fischer, H, 2022). This misalignment reflects the views of (Adelina et al, 2024), who argue that without meticulous fleet management, environmental initiatives can unintentionally become an operational burden that slows down distribution. Consequently, the transition to "green" must be balanced with operational agility to ensure that environmental goals do not come at the cost of delivery speed.

In addition to physical fleet management, the modern consumer demands a high degree of Digital Order Tracking Transparency. When internet connectivity issues prevent on-site data entry, customers lose real-time visibility of their orders, creating a sense of uncertainty. In today's logistics era, digital tracking is the cornerstone of building consumer trust and reliability (Lu, 2025). Without it, customers feel a loss of agency over their shipments (Liu et al, 2025), which (MacCarthy et al, 2022) identify as a major driver of dissatisfaction in the digital logistics space. Therefore, achieving transparency is not just a technical requirement, but a psychological necessity to keep the customer connected to the service process.

Furthermore, all these delivery efforts are heavily dependent on the reliability of Transportation logistics. Field data from 2025 shows a staggering bottleneck: out of 365 vehicle trips to the Probolinggo Distribution Center, only 28.9% were on time, leaving 70.96% (259 trips) delayed. On the return side, 65.48% (239 trips) of arriving vehicles were also behind schedule. As (Kou et al, 2022) point out, transportation reliability is the backbone of any logistics network; if the links between distribution centers are broken, achieving an on-time

last-mile delivery becomes nearly impossible (Gupta, 2025). These logistical delays at the transport level inevitably lead to the failure of the final delivery, completing a cycle of inefficiency.

By considering the conditions above, the author undertook this study with the aim of conducting further analysis with the title: "The Influence of Green Logistics Practices, Digital Order Tracking Transparency, and Transportation on Last Mile Delivery Performance and its Implications for Logistics Customer Satisfaction".

Literatur Review

Green Logistics Practices represent a transformative approach to modern supply chains, where environmental stewardship is seamlessly integrated with corporate strategy. Rather than viewing sustainability as a mere compliance requirement, these practices serve as a bridge between minimizing ecological footprints and maximizing economic efficiency (Adelina et al., 2024; Hassan, 2022). In a practical sense, this involves a holistic redesign of operations, ranging from the adoption of electric vehicle fleets and the implementation of sophisticated route optimization to the systematic use of recyclable packaging and waste management protocols (Hill, 2025; Kim, 2025). When a company commits to these "green" initiatives, they are essentially future-proofing their operations against the rising costs of traditional energy while appealing to an increasingly eco-conscious consumer base (Zhang & Tan, 2023).

In the digital era, the physical movement of goods must be accompanied by a parallel flow of information, known as Digital Order Tracking Transparency. This variable is defined by the capacity of a logistics system to offer real-time, accurate, and easily accessible data regarding the journey of a package (MacCarthy & Ivanov, 2022). Transparency acts as a psychological buffer for the customer; by providing visibility into every stage of the delivery process (Lu & Zhao, 2025), companies can significantly reduce consumer anxiety and foster a deeper sense of trust (Gomez, 2024; Lu & Zhao, 2025). High levels of transparency ensure that even when delays occur, the customer is kept informed, which mitigates the negative impact on the perceived quality of service (Muller, 2025; White, 2023).

The physical foundation of this entire process is Transportation, the lifeblood of any logistics network. It is the fundamental component that ensures goods are moved through various nodes of the distribution network with reliability and precision (Soeparyanto et al., 2024). The strength of a transportation system is measured not just by the presence of vehicles, but by the consistency and punctuality of its trips, or "ritase" (Kou & Ergu, 2022). When transport reliability is high, it provides a stable platform for all subsequent logistics activities, whereas frequent delays in transport schedules create a ripple effect that destabilizes the entire supply chain and jeopardizes the company’s promise of timely delivery (Gupta, 2025; Savage & Walters, 2024).

The convergence of green practices, digital transparency, and transport reliability ultimately manifests in Last Mile Delivery Performance. This stage is arguably the most critical "moment of truth" in the customer journey, as it represents the final physical interaction between the service provider and the recipient (Nagari et al., 2023). Performance here is not solely about speed; it encompasses order accuracy, the pristine condition of the product upon arrival, and the professional conduct of the courier (Aljohani, 2024; James, 2024). Because last-mile delivery is the most prominent and costly part of the logistics chain, any failure here immediately resonates with the customer, directly shaping their overall Logistics Customer Satisfaction (Arroyo, 2023; Vaidyanathan, 2023).

Ultimately, customer satisfaction is the ultimate barometer of a company's operational success. It reflects a complex psychological evaluation where the customer compares the actual service experience against their pre-existing expectations (Oliver, 2022; Patel, 2024). Existing literature suggests that while green practices and digital tracking are essential drivers, their

impact is often mediated by the tangible success of the delivery itself (Nguyen, 2024). By optimizing the last mile through a combination of sustainable fleet management, transparent data sharing, and reliable transport infrastructure, companies can ensure a superior customer experience that fosters long-term loyalty and sustainable revenue growth (Christopher & Martin, 2022; O'Connor, 2024)

Research Model and Hypotheses

This study assumes that Logistics Customer Satisfaction is influenced both directly by operational logistics practices and indirectly through Last Mile Delivery Performance. Green Logistics Practices, Digital Order Tracking Transparency, and Transportation are positioned as independent variables, while Last Mile Delivery Performance serves as an intervening variable.

Based on this framework, ten hypotheses (H1–H10) were developed, examining both direct and indirect effects among the variables as specified in the research model.

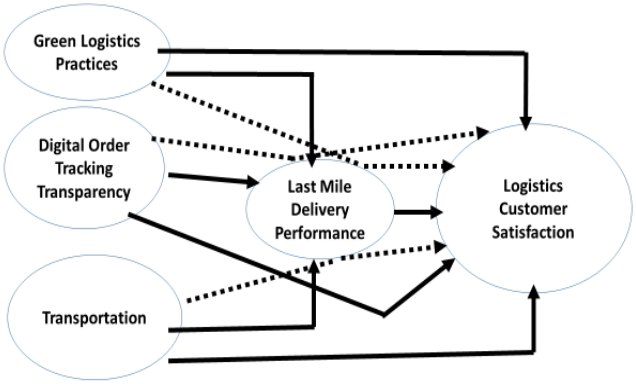

Figure 1. Research Model

This study proposes the following hypotheses :

H1 : Green Logistics Practices have a positive value and impact on Last Mile Delivery Performance at the Situbondo Branch Office.

H2 : Green Logistics Practices have a positive value and impact on Logistics Customer Satisfaction at the Situbondo Branch Office.

H3 : Digital Order Tracking Transparency has a positive value and impact on Last Mile Delivery Performance at the Situbondo Branch Office.

H4 : Digital Order Tracking Transparency postively and impact on Logistics Customer Satisfaction at the Situbondo Branch Office.

H5 : Transportation has a positive and impact on Last Mile Delivery Performance at the Situbondo Branch Office.

H6 : Transportation positively and impact on Logistics Customer Satisfaction at the Situbondo Branch Office.

H7 : Last Mile Delivery Performance positively and impact on Logistics Customer Satisfaction at the Situbondo Branch Office.

H8 : Green Logistics Practices have a positive value and impact on Logistics Customer Satisfaction through Last Mile Delivery Performance at the Situbondo Branch Office.

H9 : Digital Order Tracking Transparency has a positive value and impact on Logistics Customer Satisfaction through Last Mile Delivery Performance at the Situbondo Branch Office.

H10 : Transportation has a positive value and impact on Logistics Customer Satisfaction through Last Mile Delivery Performance at the Situbondo Branch Office.

METHOD

A quantitative explanatory approach with a cross-sectional design was adopted. The population comprised 188 courier and logistics service customers of PT Pos Indonesia Situbondo Branch. Using stratified random sampling and Slovin's formula at a 5 percent significance level, 131 respondents were selected

Table 1. Respondents Population Business Type Sample

No	Type of Business	Number of Customers	%
1	UMKM	30	22.87
2	Pabrik Makanan	23	17.55
3	Toko Kosmetika	15	11.70
4	Toko Aksesoris	13	9.57
5	Distributor Obat	11	8.51
6	Badan Usaha Milik Negara	10	7.45
7	Satuan Kerja Perangkat Daerah	8	6.38
8	Perbankan	7	5.32
9	Distributor Fast Moving Consumer Goods	6	4.26
10	Toko Fashion (Baju, Celana)	4	3.19
11	Toko Komputer	4	3.19
	Total	**131**	**100.00**

Source: Respondents Population Business Type Sample

Data were collected through questionnaires, supported by literature review and observation. Instrument validity and reliability were tested using SEM-PLS with SmartPLS 3. Convergent and discriminant validity met the required criteria, with outer loadings ≥ 0.70 and AVE ≥ 0.50. Reliability tests showed Cronbach's Alpha, rho_A, and composite reliability values above 0.70.

Hypotheses were tested using t-statistics and p-values, with significance determined at $\alpha = 0.05$. Mediation effects were examined using bootstrapping, with significance indicated by t-statistics greater than 1.96.

RESULTS AND DISCUSSION

The research results consist of validity testing, reliability testing, descriptive analysis, hypothesis testing, and coefficient of determination testing."

Validity Test

Table 2. Validity Test Results

No	Variable	Range of Outer Loading Values	Validity Standard	Decision
1	Green Logistics Practices	0.716–0.902	0.700	Valid
2	Digital Order Tracking Transparency	0.749–0.871	0.700	Valid
3	Transportation	0.752–0.891	0.700	Valid
4	Last Mile Delivery Performance	0.847–0.908	0.700	Valid
5	Logistics Customer Satisfaction	0.871–0.902	0.700	Valid

Source: Questionnaire data processed using SmartPLS

The data in Table 2. shows that the outer loading values for the five variables studied range above 0.700. Therefore, the data obtained from respondents through the questionnaire are declared valid. Valid data indicate that the questionnaire is a high-quality instrument for collecting data from respondents (Iman Supriadi, 2025).

Reliability Test

Table 3. Reliability Test Results

Research Variables	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
Digital Order Tracking Transparency	0.890	0.907	0.915	0.641
Green Logistics Practices	0.911	0.943	0.929	0.688
Last Mile Delivery Performance	0.958	0.959	0.965	0.774
Logistics Customer Satisfaction	0.958	0.958	0.964	0.747
Transportation	0.920	0.972	0.935	0.707

Source: Questionnaire data

From Table 3 above, we can see that the Cronbach's Alpha, rho_A, and Composite Reliability values for the five tested variables are above 0.700, while the Average Variance Extracted (AVE) value is above 0.500. Therefore, it can be concluded that the data collected for the 5 variables is reliable. Reliable data indicate that the questionnaire is a high-quality instrument for data collection. Data that are valid and reliable, along with questionnaires that meet quality standards, will be eligible for research and analysis using simple linear regression, multiple linear regression, path analysis, and finally, structural equation modeling.

Descriptive Test

Table 4. Mean Scores of Each Variable (Likert Scale)

No	Variable	Mean Score	Interpretation	Decision
1	Green Logistics Practices	2.99	Fairly good	Can be researched
2	Digital Order Tracking Transparency	3.06	Fairly good	Can be researched
3	Transportation	3.06	Fairly good	Can be researched
4	Last Mile Delivery Performance	3.04	Fairly good	Can be researched
5	Logistics Customer Satisfaction	3.14	Fairly good	Can be researched

Source: Questionnaire data processed using Ms. Excel

Based on the Likert scale, the value of variables considered suitable for research ranges from 0.10 to 3.3999 and are categorized as very poor, poor, or fairly good. Average values classified as very poor, poor, or fairly good indicate conditions that are not yet optimal, thereby providing opportunities for researchers to conduct studies and improve the average values of the variables examined (Iman Supriadi, 2025). The information in Table 4. shows that all variables have mean values categorized as fairly good, thus meeting the criteria to be examined further in order to improve the average values of each variable.

Hypothesis Testing

The research results are presented in the figure below.

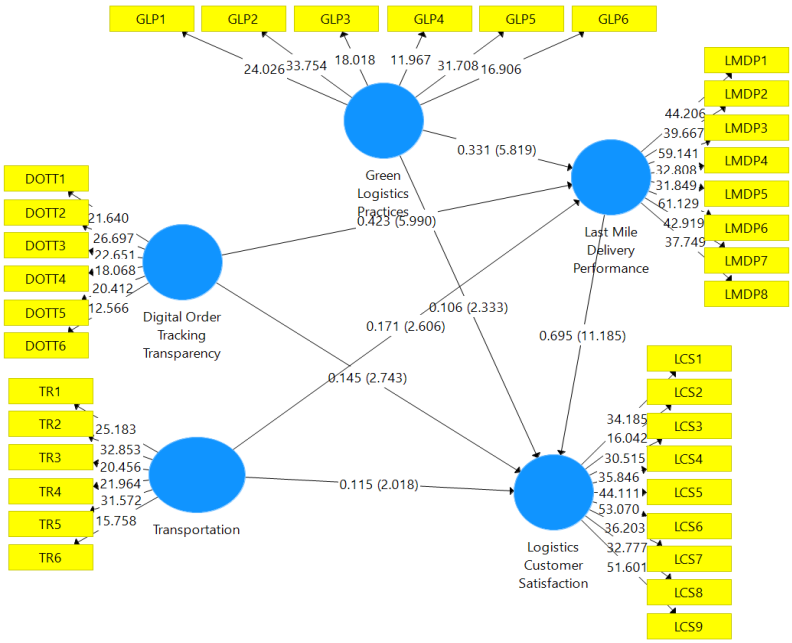

Figure 2. Research Results

The results confirm that all measurement indicators are valid and reliable. Descriptive analysis shows that all variables fall within the "fairly good" category.

Hypothesis testing indicates that Green Logistics Practices, Digital Order Tracking Transparency, and Transportation have positive and significant effects on Last Mile Delivery Performance and Logistics Customer Satisfaction. Last-Mile Delivery Performance also has a strong positive value and impact on Logistics Customer Satisfaction ($t = 12.074$; $p < 0.05$).

Mediation analysis demonstrates that Last-Mile Delivery Performance significantly mediates the relationships between Green Logistics Practices, Digital Order Tracking Transparency, Transportation, and Logistics Customer Satisfaction.

The coefficient of determination shows that Green Logistics Practices, Digital Order Tracking Transparency, and Transportation explain 44.90 percent of the variance in Last-Mile Delivery Performance, while Last-Mile Delivery Performance explains 79.10 percent of the variance in Logistics Customer Satisfaction.

Coefficient of Determination Test (R^2)

The R^2 value offers a clear picture of how much weight the exogenous variables carry in shaping the intervening variable. Furthermore, it reveals how strongly that intervening factors, in turn, drive the final endogenous outcome.

Table 5. Adjusted R-Square Test Results

Variable	R Square	Adjusted R Square
Last-Mile Delivery Performance	0.462	0.449
Logistics Customer Satisfaction	0.798	0.791

Source: Questionnaire data processed using SmartPLS

The information in the first row of Table 5. shows that the Adjusted R-Square for the positive and significant effects of Green Logistics Practices, Digital Order Tracking Transparency, and Transportation on Last-Mile Delivery Performance is 0.449. This indicates that the coefficient of determination is 0.449 × 100% = 44.90%. In other words, Green Logistics Practices, Digital Order Tracking Transparency, and Transportation contribute 44.90% to the

variation in Last Mile Delivery Performance, while the remaining 55.10% (100% − 44.90%) is influenced by other variables, such as distribution and courier and logistics service tariffs.

The information in the second row of Table 5. indicates that the Adjusted R-Square for the positive and significant effect of Last Mile Delivery Performance on Logistics Customer Satisfaction is 0.791. This means that the coefficient of determination is 0.791 × 100% = 79.10%. Thus, Last Mile Delivery Performance contributes 79.10% to Logistics Customer Satisfaction, while the remaining 20.90% (100% − 79.10%) is influenced by other variables, such as distribution and courier and logistics service tariffs.

From the tests we have carried out above, we can understand that the results of this study are a synergy between sustainable logistics initiatives, transparent digital tracking frameworks, and robust transportation reliability serving as the fundamental cornerstone for elevating last-mile delivery performance and overall customer contentment. While the current operational benchmarks are categorized as "fairly good," the data reveals critical opportunities for growth, particularly in maximizing the utility of eco-friendly fleets, ensuring uninterrupted visibility in digital tracking, and addressing the punctuality of transport schedules alongside the quality of courier–customer interactions. Furthermore, the pivotal role of Last Mile Delivery Performance as a mediating factor confirms that any strategic operational refinement must first manifest as tangible delivery reliability and superior service quality before it can authentically resonate with customers and optimize their long-term satisfaction

CONCLUSION

This study confirms that Green Logistics Practices, Digital Order Tracking Transparency, and Transportation have positive and significant effects on Last Mile Delivery Performance and Logistics Customer Satisfaction. Last Mile Delivery performance plays a crucial role in mediation, strengthening operational variables and influencing customer satisfaction. Improving final-stage delivery reliability is therefore essential for enhancing overall logistics service performance.

Recommendations

PT Pos Indonesia Situbondo Branch should prioritize improving environmentally friendly transportation, enhancing real-time digital order tracking transparency, and strengthening transportation reliability. Improvements in courier–customer communication and delivery coordination are also essential to optimize last-mile delivery performance. An integrated and sustainable logistics improvement strategy is expected to enhance customer satisfaction and stabilize logistics service revenue.

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