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Sustainable Supply Chain Odyssey: Exploring The Interplay of Green Technology, Green Transportation, and Green Logistics Digitalization on Green Supply Chain Performance

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Abstract: The rapid expansion of the courier service industry in Indonesia has resulted in heightened delivery activities, contributing to elevated carbon emissions and diminished logistics efficiency, particularly in last-mile delivery. This situation emphasizes the urgent need for the development of green supply chain strategies that are predicated not only on environmentally sustainable technologies and transportation but also on the support of logistics digitalization. This study seeks to analyze the impacts of Green Technology (GTH) and Green Transportation (GTP) on Green Supply Chain Performance (GSP), while also assessing the mediating role of Green Logistics Digitalization (GLD). A quantitative approach was employed through an explanatory survey utilizing a cross-sectional design. Data were gathered from 341 supervisors of courier companies across eight major provinces in Indonesia and were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS 3.0. The findings indicate that both GTH and GTP significantly affect GSP, both directly and indirectly through GLD. GTP exhibited the strongest path coefficient ($\beta = 0.462$), followed by GTH ($\beta = 0.350$) and GLD ($\beta = 0.295$). These results extend the Natural Resource-Based View (NRBV) by incorporating digitalization as a strategic environmental capability. Practically, the study advocates for integrated investment in green technologies, sustainable transportation, and digital infrastructure as a key strategy to improve green supply chain performance within the courier industry.

Keywords: Green Technology, Green Transportation, Green Logistics Digitalization, Green Supply Chain Performance, Courier Service Industry

INTRODUCTION

The rapid expansion of Indonesia's logistics and courier services sector has emerged as a focal point in discussions regarding sustainable supply chains. The national logistics and supply chain market is anticipated to attain a valuation of USD 131.2 billion by 2025, exhibiting a

compound annual growth rate (CAGR) of 6.29% through 2030 (Nexdigm, 2025). Notably, the Courier, Express, and Parcel (CEP) market is projected to undergo substantial growth, increasing from USD 9.19 billion in 2025 to USD 15.47 billion by 2029, and approximately USD 11.15 billion by 2030, with a CAGR of 7.24% (Mordor Intelligence, 2025). This growth trajectory is predominantly driven by the significant escalation of e-commerce, with the Business-to-Consumer (B2C) segment commanding a substantial market share of 57% in 2024. Additionally, the express delivery segment is experiencing accelerated growth, projected at approximately 9% annually through 2029. Nevertheless, this promising economic advancement is accompanied by increasingly pressing environmental challenges, particularly stemming from last-mile delivery operations that predominantly depend on land-based transportation modes (Mordor Intelligence, 2025; Nexdigm, 2025).

The expansion of the logistics sector has engendered significant environmental repercussions, particularly concerning carbon emissions and packaging waste. In 2023, carbon dioxide emissions from Indonesia's transportation sector reached 149,538 thousand tons, which constituted 22% of the nation's total emissions. Notably, 90% of these emissions originated from land transportation in (Asian Transport Observatory, 2024; Mordor Intelligence, 2025). This emission data also indicates a structural inefficiency, as evidenced by an intensity of 34.5 gCO_2 per USD, a figure that surpasses that of comparable countries in the region. Furthermore, the proliferation of online shopping has exacerbated the generation of plastic waste from packaging materials that are challenging to decompose, while the capacity for waste management remains limited (Nadi, 2025).This scenario underscores an unsustainable trajectory for the logistics sector and highlights the urgent necessity for the implementation of green logistics strategies within Indonesia's courier industry.

Despite the increasing adoption of Green Technology (GTH) and Green Transportation (GTP) within business practices, their contribution to enhancing Green Supply Chain Performance (GSP) remains constrained due to insufficient integration of digital support for sustainability (Novitasari & Agustia, 2022; Santoso et al., 2022). In addressing this challenge, Green Logistics Digitalization (GLD) emerges as a strategic enabler that can strengthen the connection between green initiatives and operational performance, particularly within Indonesia's rapidly expanding courier sector, which continues to contribute significantly to carbon emissions (Z. Liu et al., 2024; Santoso et al., 2022). The digitalization of logistics promotes energy efficiency, waste reduction, and enhancements in organizational agility and competitiveness in response to increasing sustainability demands (Gossa et al., 2023). However, the existing literature provides limited exploration of GLD's role as a mediator or moderator in the interplay between GTH, GTP, and GSP. This deficiency in comprehensive study regarding the synergy among these three components indicates a notable conceptual gap. Consequently, a thorough scholarly investigation is essential to elucidate GLD's strategic role in shaping green logistics strategies that are both relevant and adaptable to the dynamics of the Indonesian courier industry (Guo et al., 2023; D. Li & Shen, 2021).

Despite the growing adoption of green technology and transportation among courier service companies in Indonesia, a consistent and significant enhancement in Green Supply Chain Performance (GSP) remains elusive. This scenario prompts an inquiry into the effectiveness of various initiatives—Green Technology (GTH), Green Transportation (GTP), and Green Logistics Digitalization (GLD)—in impacting GSP, both directly and indirectly. In particular, the extent to which GLD serves as a moderating variable that may amplify the relationship between GTH and GTP on GSP is currently unclear.

This study seeks to investigate and analyze the direct impact of Green Technology (GTH) and Green Transportation (GTP) on Green Supply Chain Performance (GSP) within the courier industry in Indonesia. Additionally, the research is designed to evaluate the role of Green Logistics Digitalization (GLD) as both a moderating and mediating variable, thereby strengthening or mediating the relationship between GTH and GTP with respect to GSP.

Through this methodological framework, the study aims to develop an interaction model that encapsulates the synergistic contributions of the three components—GTH, GTP, and GLD—in fostering a more optimal and sustainable green supply chain performance in the rapidly expanding courier service sector in Indonesia.

This research presents a novel contribution by developing an interaction model that integrates Green Technology, Green Transportation, and Green Logistics Digitalization—an area that has been infrequently examined concurrently, particularly within the context of green logistics digitalization in the courier industries of developing countries such as Indonesia. Theoretically, this study offers a new conceptual framework that amalgamates environmentally sustainable technology, green transportation, and digitalization to enhance green supply chain performance. The pressing need for a green transition coupled with the relatively low level of digitalization in the courier sector serves as a foundational basis for this inquiry. Practically, the findings provide strategic insights for the effective allocation of green investments and yield data-driven recommendations for policy development in green logistics and supply chain digitalization in Indonesia. In addition to enriching empirical methodologies through moderation and mediation analyses, the study further supports the attainment of the Sustainable Development Goals (SDGs), particularly Goal 9 concerning industry, innovation, and infrastructure, and Goal 13 focused on climate action.

Literature Review

Drawing on the Natural Resource-Based View (NRBV) as the grand theory underpinning this study, a firm's competitive advantage is not solely determined by tangible resources, but also by its strategic orientation toward environmental sustainability. The NRBV extends the traditional Resource-Based View by emphasizing three key pillars: pollution prevention, sustainable product management, and efficient natural resource utilization. Within this framework, green technology, green transportation, and logistics digitalization are conceptualized as environmental competencies that enhance operational efficiency, meet stakeholder expectations, and strengthen green supply chain performance. Accordingly, the NRBV provides a relevant theoretical foundation for analyzing the interrelationships among variables in the courier service industry in Indonesia, while also supporting both national and global sustainability agendas (Baah et al., 2024; Yadav et al., 2023).

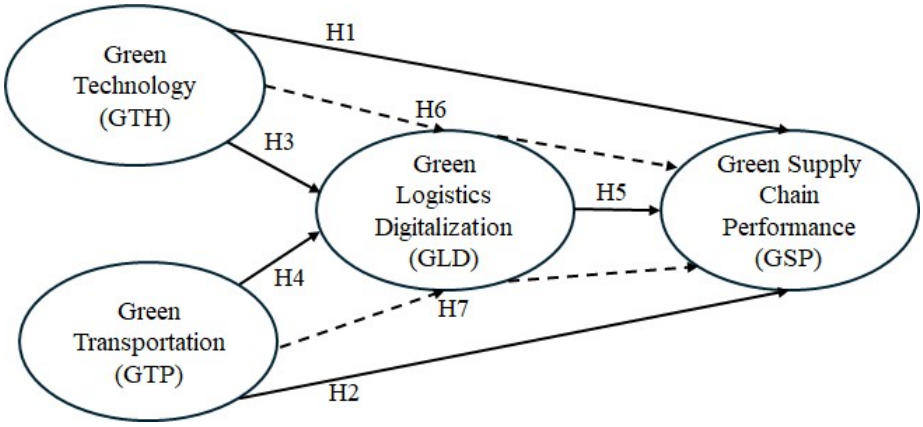
Green Technology (GTH) refers to environmentally sustainable innovations and practices that facilitate sustainable development by improving resource efficiency and minimizing environmental impact (Sarker & Bartok, 2023). GTH encompasses a range of initiatives, including renewable energy systems, waste reduction strategies, and eco-friendly design, all of which serve to enhance organizational sustainability and address the challenges posed by climate change (Li et al., 2022). Conversely, Green Supply Chain Performance (GSP) evaluates the effectiveness of supply chains in meeting environmental, economic, and social objectives through the application of Green Supply Chain Management across all supply chain processes (He, 2021; Terrada et al., 2022). Empirical research suggests that the integration of GTH within logistics and supply chain operations can improve operational efficiency and ensure compliance with environmental regulations, thereby positively impacting GSP, including within the courier service industry in Indonesia (Karia, 2022; Wang et al., 2021).

Green Transportation (GTP) encompasses environmentally sustainable transportation systems that maintain economic viability through the utilization of renewable energy sources, innovative logistical strategies, and low-emission vehicles, thereby facilitating sustainable mobility within the supply chain (Mao et al., 2024). Empirical studies indicate that the implementation of GTP can lead to reductions in fuel consumption, lower operational costs, and improvements in the accuracy of distribution services (Ghadge et al., 2022). Furthermore, the integration of GTP strategies enhances energy efficiency and operational effectiveness across the supply chain, thereby exerting a positive influence on overall Green Supply Chain

Performance (GSP). Consequently, the adoption of GTP plays a direct and significant role in augmenting GSP, particularly within the courier service sector in Indonesia, which is progressively adopting environmentally sustainable logistics practices (Richnák & Gubová, 2021).

Green Logistics Digitalization (GLD) refers to the integration of digital technologies—such as advanced data analytics, artificial intelligence (AI), and the Internet of Things (IoT)—into logistics operations, with the aim of minimizing environmental impact while enhancing operational efficiency (Z. Liu et al., 2024). The implementation of GLD enables more optimal resource allocation, improved communication among stakeholders, and quicker responses to environmental challenges. In this regard, the adoption of Green Technology (GTH) has been shown to have a direct and positive influence on GLD, as it promotes the development of digital infrastructure in support of sustainable logistics practices (Li & Shen, 2021). A similar pattern is observed with Green Transportation (GTP), which focuses on reducing the environmental footprint of the transportation sector, where digital transformation reinforces green strategies by reducing information barriers and increasing operational efficiency (Yu et al., 2024). Furthermore, GLD plays a significant role in enhancing Green Supply Chain Performance (GSP) by aligning with Environmental, Social, and Governance (ESG) standards and fostering a more sustainable logistics ecosystem (Ghadge et al., 2022). Accordingly, the interconnection between GTH, GTP, and GLD forms a comprehensive strategic pathway to improve GSP, particularly in Indonesia's courier service sector.

The following theoretical framework (see Figure 1) is systematically developed based on a rigorous synthesis of prior studies and relevant academic literature.



Source: Research Results
Figure 1. Theoretical framework

Based on Figure 1, the formulation of the research hypotheses is delineated as follows:

Hypothesis 1: Green Technology (GTH) has a direct and positive effect on Green Supply Chain Performance (GSP)

Hypothesis 2: Green Transportation (GTP) has a direct and positive effect on Green Supply Chain Performance (GSP)

Hypothesis 3: Green Technology (GTH) has a direct and positive effect on Green Logistics Digitalization (GLD)

Hypothesis 4: Green Transportation (GTP) has a direct and positive effect on Green Logistics Digitalization (GLD)

Hypothesis 5: Green Logistics Digitalization (GLD) has a direct and positive effect on Green Supply Chain Performance

Hypothesis 6: Green Technology (GTH) exerts an indirect positive influence on Green Supply Chain Performance (GSP) mediated by Green Logistics Digitalization (GLD)

Hypothesis 7: Green Transportation (GTP) exerts an indirect positive influence on Green Supply Chain Performance (GSP) mediated by Green Logistics Digitalization (GLD)

METHOD

This study employs an explanatory survey methodology characterized by a cross-sectional design enabling efficient causal relationship analysis among variables in terms of time and cost by collecting data at a singular point in time, thereby avoiding repeated measurements (Hunziker & Blankenagel, 2024). The research instrument was meticulously developed based on the indicators associated with each construct within the conceptual model, culminating in 28 structured items utilizing a five-point Likert scale. The questionnaire was translated into Bahasa Indonesia and subjected to a pretest involving 10 respondents to ensure clarity and comprehensibility. Subsequently, the survey was disseminated online to 400 supervisors of courier service companies across eight major provinces—Banten, DKI Jakarta, West Java, East Java, Central Java, North Sumatra, West Sumatra, and South Sulawesi—collectively representing over 60% of national e-commerce activity (Mordor Intelligence, 2025; Nexdigm, 2025). Of the 400 questionnaires distributed, a total of 341 valid responses were obtained and utilized for subsequent analysis.

In order to test the hypotheses and structural model, this study utilizes variance-based Partial Least Squares Structural Equation Modeling (PLS-SEM) through SmartPLS 3.0. This methodological approach was selected due to its efficacy with small sample sizes and non-normally distributed data (Hair et al., 2022). The analysis encompasses assessments of reliability and construct validity, demonstrating robustness in validating conceptual models under such data conditions (Hair et al., 2022; Ringle et al., 2022).

RESULTS AND DISCUSSION

Partial Least Squares Structural Equation Modeling (PLS-SEM) enables comprehensive testing of the proposed research framework through two stages: the measurement model (outer model) and the structural model (inner model).

Outer Structural Model Results

The outer model evaluation ensures that indicators reliably and validly represent their respective constructs. Convergent validity is confirmed when factor loadings are ≥ 0.70 and AVE exceeds 0.50, while discriminant validity is supported using the Fornell-Larcker criterion, which requires the square root of AVE to be greater than inter-construct correlations. Construct reliability is demonstrated when both composite reliability and Cronbach's alpha exceed the threshold of 0.70. As presented in Table 1, the PLS-SEM results confirm that all indicators meet the required standards for convergent validity and internal consistency, indicating strong correlations among indicators within each latent variable.

Table 1. Validity and Reliability of the variables

Vabl	Idcr	FLod	CB_α	Cps_Ri	AV_E
Green Technology (GTH)			.938	.949	.728
H1	Energy Efficiency Improvements (Savina et al., 2021)	.871			
H2	Emissions Reduction Technologies (Savina et al., 2021)	.864			
H3	Renewable Resource Utilization (Wu et al., 2024)	.883			
H4	Waste Minimization Strategies (Wu et al., 2024)	.857			
H5	Lifecycle Assessment Implementation (Wu et al., 2024)	.836			
H6	Advanced Material Usage (Gao et	.824			

Vabl	Idcr	FLod	CB_α	Cps_Ri	AV_E
	al., 2021)				
H7	Technology Adoption Rate (Gao et al., 2021)	.833			
Green Transportation (GTP)			.957	.965	.798
T1	Adoption of Electric Vehicles (Buenavista et al., 2024)	.877			
T2	Public Transit Utilization Rates (Buenavista et al., 2024)	.923			
T3	Modal Shift to Sustainable Transportation (Reshetnikova et al., 2021)	.918			
T4	Infrastructure for Non-Motorized Transport (Reshetnikova et al., 2021)	.924			
T5	Fuel Efficiency Metrics (L. Liu et al., 2023)	.910			
T6	Alternative Fuel Uptake (L. Liu et al., 2023)	.873			
T7	Transportation Emissions Reduction (Gao et al., 2021)	.824			
Green Logistics Digitalization (GLD)			.915	.932	.662
D1	Supply Chain Visibility Enhancements (Savina et al., 2021)	.792			
D2	Automation in Logistics Processes (Xu et al., 2023)	.799			
D3	Data Analytics Utilization (Savina et al., 2021)	.811			
D4	Digital Collaboration Platforms (Xu et al., 2023)	.819			
D5	Real-Time Tracking Systems (Zhang et al., 2022)	.828			
D6	Use of IoT in Logistics (Zhang et al., 2022)	.827			
D7	Sustainability Reporting Tools (L. Liu et al., 2023)	.821			
Green Supply Chain Performance (GSP)			.910	.929	.651
P1	Overall Waste Reduction Metrics (Savina et al., 2021)	.799			
P2	Supplier Sustainability Compliance (Wu et al., 2024)	.737			
P3	Carbon Footprint Reduction (Gao et al., 2021)	.814			
P4	Enhanced Customer Satisfaction (Gao et al., 2021)	.834			
P5	Return on Investment in Sustainable Initiatives (Wu et al., 2024)	.861			
P6	Level of Compliance with Environmental Standards (Terrada et al., 2022)	.822			
P7	Innovation in Sustainable Practices (Terrada et al., 2022)	.774			

Source: Authors' analysis using SmartPLS 3.0 (2025)

Vabl = Variables; Idcr = Indicators; FLod = Factor Loading; CB_α = Cronbach's alpha; Cps_Ri = Composite Reliability; AV_E = AVE

Table 2 shows that discriminant validity is achieved, as the square root of AVE (Fornell-Larcker Criterion) exceeds inter-construct correlations. The model also meets reliability criteria, with both Composite Reliability and Cronbach's Alpha ≥ 0.70. These findings indicate that each construct is conceptually distinct, with minimal overlap among indicators.

Table 2. Fornell–Larcker criterion (discriminant validity)

	GLD	GSP	GTH	GTP
GLD	.814			
GSP	.710	.807		
GTH	.500	.517	.853	
GTP	.520	.630	.042	.893

Source: Authors' analysis using SmartPLS 3.0 (2025)

Inner Structural Model Results

In assessing the inner model, the strength and significance of construct relationships are evaluated using T-values, P-values, and R-squared values. Based on Hair et al. (2022), a relationship is statistically significant at the 5% level when the T-value exceeds 1.65 and the P-value is below 0.05. R-squared values of 0.75, 0.50, and 0.25 indicate substantial, moderate, and weak predictive power, respectively.

The structural model was assessed using key statistical indicators including R^2 values, T-statistics, P-values, and effect sizes. Based on the data presented in Table 3, the R^2 (coefficient of determination) results elucidate the explanatory power of the independent variables within the model concerning the dependent variables. For the GLD variable, the R^2 value is 0.499, and the Adjusted R^2 is 0.496, indicating that approximately 49.9% (or 49.6% when adjusted) of the variance in GLD can be attributed to the predictor variables within the model. In contrast, for the GSP variable, the R^2 value is 0.682, and the Adjusted R^2 is 0.679, suggesting that roughly 68.2% (or 67.9% when adjusted) of the variance in GSP can be accounted for by the predictor variables. Overall, the model demonstrates an adequate to substantial explanatory capability, particularly for GSP, which exhibits a robust level of explained variance.

Table 3. R-Squares (determinant coefficient)

	R_Sqr	R_Sq_Adj
GLD	.499	.496
GSP	.682	.679

Source: Authors' analysis using SmartPLS 3.0 (2025)
R_Sqr = R Square; R_Sq_Adj = R Square Adjusted

Based on Figure 2 and Table 4, the results from the evaluation of the inner structural model indicate significant support for all proposed research hypotheses. This is consistently evidenced by P-values of 0.000 across all hypothesized paths, which are substantially below the conventional significance threshold of 0.05, and corresponding T-statistics that uniformly exceed the critical threshold of 1.96. Specifically, Green Technology (GTH) and Green Transportation (GTP) are confirmed to have a significant direct positive influence on Green Logistics Digitalization (GLD), with respective path coefficients of 0.479 and 0.500. Furthermore, GLD also exerts a significant and positive effect on Green Supply Chain Performance (GSP), as indicated by a path coefficient of 0.295. Notably, GTH and GTP further demonstrate significant direct impacts on GSP, with their respective path coefficients being 0.350 and 0.462.

Table 4. Hypothesis Testing Conclusion for all research hypotheses

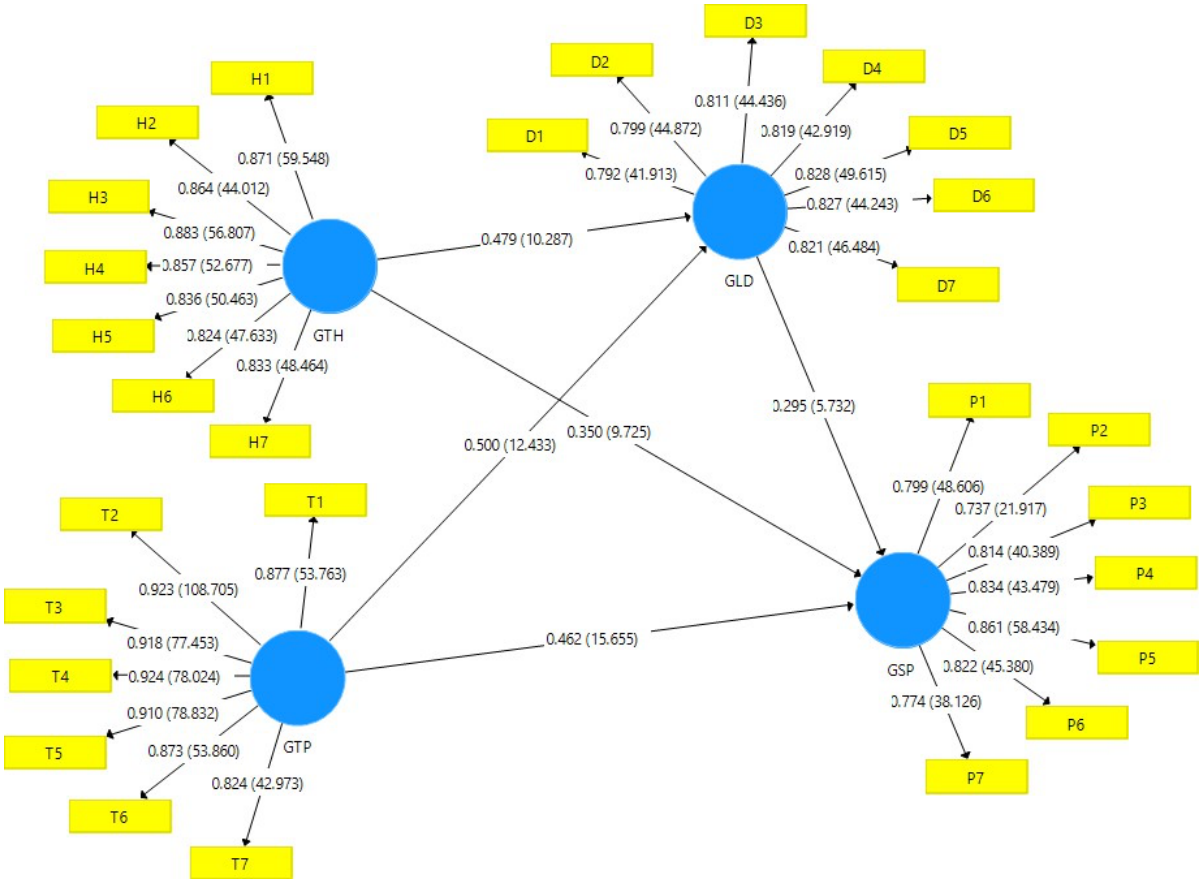
Hypoth	β	SaM	SnDv	T_Stat	P_Vau	Hyp_TC
GLD -> GSP	.295	.294	.051	5.732	.000	Accpt
GTH -> GLD	.479	.482	.047	10.287	.000	Accpt

GTH -> GSP	.350	.351	.036	9.725	.000	Accpt
GTP -> GLD	.500	.500	.040	12.433	.000	Accpt
GTP -> GSP	.462	.463	.030	15.655	.000	Accpt
GTH -> GLD -> GSP	.141	.142	.028	4.986	.000	Accpt
GTP -> GLD -> GSP	.147	.147	.029	5.077	.000	Accpt

Source: Authors' analysis using SmartPLS 3.0 (2025)

Hypoth= Hypothesis; β = Path Coefficients; SaM= Sample Mean; SnDv= Standard Deviation; T_Stat= T Statistics; P_Vau = P Value; Hyp_TC = Hypothesis Testing Conclusion; Accpt = Accepted

A more comprehensive analysis of indirect effects underscores the crucial mediating role of Green Logistics Digitalization (GLD). GLD is found to significantly mediate the relationship between Green Technology (GTH) and Green Supply Chain Performance (GSP) (path coefficient 0.141), as well as between Green Transportation (GTP) and Green Supply Chain Performance (GSP) (path coefficient 0.147). This suggests that initiatives in green technology and green transportation not only directly influence green supply chain performance but also indirectly enhance performance through advancements in green logistics digitalization. Consequently, all hypothesized paths, encompassing both direct and indirect relationships, are accepted. This signifies the presence of robust and significant interrelationships among the variables within the research model, with GLD playing a pivotal role in elucidating the indirect effects of Green Technology and Green Transportation on Green Supply Chain Performance.



Source: Authors' analysis using SmartPLS 3.0 (2025)

Figure 2. Overview of the Structural Model Based on Bootstrapping Results: Includes T-Statistics, Factor Loadings, and Path Coefficients

Discussion

This study investigates the impact of Green Technology (GTH) and Green Transportation (GTP) on Green Supply Chain Performance (GSP) within Indonesia's rapidly developing courier industry, which is increasingly confronted with environmental challenges. All

hypotheses were statistically validated, underscoring the essential role of green initiatives in promoting sustainable supply chain performance. GTH positively influences GSP through enhancements in energy efficiency, the utilization of renewable resources, and waste minimization (Karia, 2022; Wang et al., 2021; Savina et al., 2021). Conversely, GTP exhibited a more pronounced effect on GSP, particularly through the adoption of low-emission vehicles and improved efficiency in last-mile delivery. These findings highlight the imperative for logistics strategies that not only respond to the growth of e-commerce but also proactively address carbon footprint reduction—a strategic priority for courier companies aiming to enhance their competitiveness while fulfilling sustainability requirements.

Green Logistics Digitalization (GLD) has been shown to significantly enhance Green Supply Chain Performance (GSP) through the integration of technologies such as the Internet of Things (IoT), real-time tracking, and collaborative platforms, which collectively improve visibility and operational agility (Liu et al., 2024; Zhang et al., 2022). Furthermore, digitalization serves as a strategic response to the increasing demands for sustainability reporting and adherence to Environmental, Social, and Governance (ESG) standards. The findings of this study indicate that Green Technology (GTH) and Green Transportation (GTP) not only have a direct impact on GSP but also facilitate the adoption of GLD as an essential operational complement. GLD significantly mediates the relationship, transforming green initiatives into more substantial performance outcomes. In the absence of digitalization, the contributions of GTH and GTP to GSP would be markedly less effective, thereby underscoring digital transformation as a critical enabler for the development of a synergistic and effective sustainability strategy.

This study extends the Natural Resource-Based View (NRBV) framework by integrating digitalization as a critical environmental capability for achieving sustainable competitive advantage. The findings indicate that Green Logistics Digitalization (GLD) not only emerges as a result of green initiatives but also serves as a strategic resource that enhances efficiency, innovation, and adaptability within supply chains (Liu et al., 2024; Li & Shen, 2021). The interaction model developed in this study—linking Green Technology, Green Transportation, and GLD—provides a novel conceptual approach that is particularly pertinent to the transformation of the logistics industry in developing countries. Consequently, the theoretical contribution of this research lies in its provision of a more nuanced understanding of the synergy between digitalization and sustainability as a foundational pathway towards more resilient and competitive green supply chains.

The findings of this study provide strategic guidance for courier companies in the allocation of investments in an integrated manner across green technologies, sustainable transportation systems, and operational digitalization, thereby enhancing supply chain performance. Additionally, it is anticipated that governments will promote a green-digital ecosystem through supportive policies, sustainable digital infrastructure, and regulations that facilitate the adoption of green innovations. The alignment of such policies with the Sustainable Development Goals (SDGs)—particularly Goal 9 (Industry, Innovation, and Infrastructure) and Goal 13 (Climate Action)—constitutes a critical foundation. Nonetheless, it is important to acknowledge the limitations of this study, including its cross-sectional design and its focus on a single country. Future research should consider adopting a longitudinal and cross-country approach to capture long-term dynamics and explore moderating factors such as firm size and digital readiness. Furthermore, such studies could provide opportunities to investigate potential reverse causal relationships.

CONCLUSION

This study effectively fulfilled its objective of analyzing the impacts of Green Technology (GTH) and Green Transportation (GTP) on Green Supply Chain Performance (GSP), while also assessing the mediating role of Green Logistics Digitalization (GLD) within Indonesia's courier

service sector. The empirical findings demonstrate that all three key variables—GTH, GTP, and GLD—substantially contribute to the enhancement of GSP, both directly and indirectly. GTP exhibited the most significant direct effect on GSP, followed by GTH. Furthermore, GLD was identified not only as having a direct positive influence on GSP but also as significantly mediating the relationship between the two green variables and supply chain performance. Consequently, green logistics digitalization emerges as an essential component in bolstering the effectiveness of sustainability initiatives within the courier industry.

This study presents several limitations that merit consideration. The cross-sectional design constrains the ability to elucidate the dynamic relationships among variables over time. Furthermore, the study's scope—restricted to courier companies in Indonesia—requires caution in generalizing the findings to a global context. Given these limitations, future research is recommended to employ a longitudinal approach and to broaden the analysis to include countries with diverse logistical characteristics, thereby enhancing the external validity of the model. Additionally, subsequent studies could incorporate moderating variables such as firm size, levels of digital readiness, or local government policies. More broadly, the findings of this study underscore that green and digital transformation is not merely a domestic imperative but also an essential component of global adaptation to climate challenges and sustainable logistics.

This study significantly contributes to the scientific discourse by extending the Natural Resource-Based View (NRBV) framework through the incorporation of digitalization as a strategic capability for attaining environmental advantages. The findings augment the existing literature by presenting a synergistic model that integrates green technology, sustainable transportation, and logistics digitalization to improve green supply chain performance in developing countries. From a practical standpoint, the results provide actionable insights for courier companies in formulating comprehensive, data-driven sustainability strategies. Furthermore, the study offers valuable perspectives for policymakers in crafting incentives, regulations, and digital ecosystems that facilitate the acceleration of green logistics transitions at both national and regional levels.

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