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The Impact of Green Logistics Practices On Sustainable Performance: An Empirical Study of Small and Medium Logistics Service Providers in Hanoi

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Abstract
This study explores the influence of green logistics practices on the sustainable performance of small and medium-sized logistics service providers in Hanoi, Vietnam. A quantitative research design was employed, involving a survey of 152 logistics firms, with data analyzed using SPSS and AMOS software. Green logistics practices were categorized into four key activities: reverse logistics, carbon emissions management, green warehousing, and green transportation. The results indicate that these practices exert a significant positive impact on the economic, environmental, and social performance of logistics firms. The findings contribute to the theoretical understanding of green logistics by highlighting its critical role in achieving sustainable performance. Furthermore, the study provides practical implications for logistics service providers in Vietnam, emphasizing the importance of adopting green logistics practices to enhance their long-term sustainability and competitiveness.

Keywords: green logistics practices, sustainable performance, reverse logistics, emissions management, green warehousing, green transport, environmental performance, economic performance, social performance.

1. Introduction

In recent years, growing consumer awareness of environmental issues has led to an increased demand for green products and services. As a result, the logistics industry has come under pressure due to its reliance on fossil fuels and non-renewable resources, which contribute to the emission of greenhouse gases (GHGs) such as CO2. Furthermore, stakeholders are imposing stricter environmental regulations and urging companies to adopt more responsible corporate social responsibility (CSR) practices. These trends have driven businesses to incorporate green logistics into their strategies to enhance competitiveness, promote sustainable development, and demonstrate a stronger commitment to environmental and social responsibility [1], [2], [3]. Previous research has suggested that green logistics can be a key driver of sustainable business performance [4], [5], [6].

Existing studies suggest that integrating green strategies and policies into logistics activities provides a viable solution to the environmental, social, and economic challenges arising from supply chain operations [7]. While numerous studies on green logistics management practices have been conducted globally, a meta-analysis by Vu et al (2024) highlights a significant research gap in the context of developing countries, particularly Vietnam [8]. Furthermore, existing literature on supply chain sustainability predominantly emphasizes environmental sustainability such as Tan (2019), Abareshi (2013), Anh (2024), often overlooking the broader dimensions of social and economic performance [9]; [10]; [11]. These gaps underscore the need for this study, which seeks to examine the impact of green logistics practices on sustainability performance, addressing the multifaceted nature of sustainable development in logistics. However, these studies tend to lack independence, objectivity, and have certain limitations in terms of research methods and focus. While much of the existing research has primarily examined manufacturing industries, very few studies have explored the direct impact of green logistics on the sustainable performance of logistics service providers, particularly in Vietnam.

To address this research gap, this study investigates the impact of implementing green logistics practices on the sustainable performance of small and medium-sized logistics service providers in Hanoi, Vietnam. Through both qualitative and quantitative research methods, data were collected and analyzed to assess the relationship between green logistics practices and key dimensions of sustainable business performance, including environmental, economic, and social outcomes. The findings of this study provide valuable insights into how logistics companies can improve their green logistics practices and, in turn, enhance their long-term sustainability. Based on the results, the paper offers a set of practical management recommendations for logistics service providers to strengthen their green logistics strategies and foster sustainable growth.

2. Materials and methods

2.1 Conceptual background

2.1.1 Natural Resource-Based View (NRBV) and The Dependence Theory

The Natural-Resource-Based View (NRBV) emphasizes the role of the external natural environment as a critical complementary resource to a firm's internal capabilities [12]. This theoretical framework underscores the importance of integrating both internal and external natural resources, thereby enabling firms to protect themselves from competitive pressures. The NRBV further posits that firms can adopt proactive environmental strategies to enhance their overall performance, positioning themselves as leaders in sustainable business practices. This approach not only fosters innovation and improves operational efficiency but also facilitates market differentiation, which ultimately contributes to the long-term success of the firm [13].

In contrast, the Resource Dependence Theory (RDT) highlights the constraints that firms face in terms of resource availability and the necessity of engaging with external stakeholders to secure access to critical resources [14]. According to RDT, a firm’s ability to access and rely on scarce external resources is a primary determinant of its actions and long-term survival [15]. Within the context of a supply chain, RDT suggests that member firms should collaborate and depend on each other to achieve superior long-term performance, as opposed to seeking short-term advantages at the expense of others. A key assumption of RDT is that firms cannot attain full self-sufficiency in strategically vital resources and must rely on external resources to remain competitive [16]. Effective management of these dependencies is crucial, and firms must navigate these relationships carefully to pursue sustainable development objectives [17].

In summary, while the Natural-Resource-Based View focuses on leveraging internal resources and adopting environmental management practices to gain a competitive edge and enhance performance, the Resource Dependence Theory offers insights into the necessity of building collaborative and mutually beneficial relationships with external stakeholders. By integrating these two theoretical perspectives, firms can strategically align their operations and foster effective stakeholder collaboration, thereby promoting sustainable business practices and long-term success.

2.1.2 Green logistics practices

Green Logistics refers to the strategies and practices within supply chain management that aim to reduce environmental and energy impacts associated with the distribution of goods, with a focus on material handling, waste management, packaging, and transportation [18]. Sibihi & Eglese (2009) define logistics as the production and distribution of goods in a sustainable manner, taking into account both environmental and social considerations [19]. Green Logistics Practices (GLP) can be understood as a firm's commitment to integrating environmentally friendly practices into its transportation and distribution activities [20]. Specifically, GLP involves managing the flow of goods, both domestically and internationally, with a focus on minimizing environmental impacts. This includes optimizing processes across transportation, warehousing, inventory management, order processing, the use of eco-friendly materials, and sustainable packaging. These efforts are intended to prevent harm to the environment by reducing the ecological footprint of logistics activities.

Despite numerous studies examining green logistics practices in various contexts and their effects on firm performance [21], inconsistencies remain in the findings due to the diverse approaches employed in these studies [22]. To explore the influence of green logistics on business operations, this study categorizes

GLP into four distinct activities: reverse logistics practices, carbon emissions management, green warehousing, and green transportation practices.

Reverse Logistics Practices: Reverse logistics involves managing the return flow of goods from the end consumer to the point of origin, including the recovery and recycling of materials, packaging waste, and returned products. This process is critical for minimizing waste and supporting sustainable practices within supply chains.

Carbon Emissions Management: According to the Intergovernmental Panel on Climate Change (IPCC), carbon emissions management refers to strategies aimed at reducing the release of greenhouse gases (GHGs), particularly CO2, to mitigate the adverse effects of climate change [23]. It involves policies and measures designed to reduce GHG emissions across various business operations.

Green warehousing: Green warehousing involves adopting sustainable practices within the warehousing and logistics sector. It includes various initiatives such as lowering energy usage, reducing waste, optimizing resource utilization, and improving transparency throughout the supply chain [24].

Green Transportation Practices: Green transportation focuses on the use of eco-friendly modes of transport that minimize or eliminate the use of fossil fuels. It involves employing energy-efficient vehicles and transportation methods to reduce greenhouse gas emissions, lower fuel consumption, and mitigate environmental pollutants [25].

2.1.3 Sustainable Performance

Sustainable performance refers to a company's ability to maintain a balance between its economic, environmental, and social objectives [2]. Corporate sustainability performance involves a company's capacity to minimize harmful emissions, improve financial performance, and maintain a competitive advantage over the long term, while efficiently using resources and contributing to societal well-being [26].

Economic Performance: Economic performance is linked to a company's financial stability, profitability, and ability to reduce costs associated with energy consumption, waste management, and environmental pollution. It emphasizes the creation of value for stakeholders while ensuring that financial success does not compromise environmental or social responsibilities [27].

Environmental Performance: Environmental performance refers to the firm's ability to manage its environmental impact, including the reduction of emissions, waste, and the consumption of harmful materials [28]. It includes the development of strategies and mechanisms that promote corporate responsibility toward environmental sustainability.

Social Performance: Social performance addresses a firm's social responsibility, encompassing its policies and actions that support the community, provide employment opportunities, and contribute to social welfare programs. It includes commitments to environmental protection, the sustainability of human resources, and the improvement of living conditions for communities [29].

2.2 Hypothesis Development

Reverse logistics is widely regarded as a critical element of sustainability efforts in supply chain management [30], [31]. Narayana et al. (1985) highlight the importance of reverse logistics in achieving sustainable development goals by improving economic efficiency and reducing environmental impact. Firms that excel in reverse logistics can significantly enhance their profitability by optimizing inventory management, reducing waste, and lowering transportation costs [32], [33], [34]. Furthermore, reverse logistics practices contribute positively to environmental performance by reducing carbon footprints through product recovery and recycling, thereby promoting resource conservation and waste reduction [35]. In terms of social performance, reverse logistics creates employment opportunities, improves health and safety conditions, and enhances stakeholder satisfaction [36]. Based on these considerations, the following hypotheses are proposed:

H1a: Reverse logistics practices positively impact economic performance.

H1b: Reverse logistics practices positively impact environmental performance.

H1c: Reverse logistics practices positively impact social performance.

Managing carbon emissions is both an environmental necessity and a driver of sustainable business practices. Implementing carbon emission reduction measures can optimize energy usage, reduce operational costs, and enhance a firm's competitiveness by meeting regulatory requirements and customer expectations

[37]. The reduction of carbon emissions also helps mitigate the risks associated with extreme weather events and protect global ecosystems [38]. Furthermore, effective carbon management positively affects social performance by improving public health, creating job opportunities, and ensuring energy security [39], [40]. Based on these insights, the following hypotheses are proposed:

H2a: Carbon emission management positively impacts economic performance.

H2b: Carbon emission management positively impacts environmental performance.

H2c: Carbon emission management positively impacts social performance.

Green warehousing plays a pivotal role in advancing sustainable logistics practices. Green warehousing serves as a cornerstone of sustainable logistics, as evidenced by extensive research. McKinnon et al. (2015) highlight that adopting energy-saving technologies and waste minimization initiatives in warehouses plays a vital role in lowering the environmental impact of logistics operations [41]. Similarly, Zhu et al. (2016) point out that practices such as efficient inventory management and the use of sustainable materials not only enhance environmental outcomes but also boost overall operational efficiency [42]. Furthermore, Agyabeng-Mensah et al. (2020) emphasize that green warehousing fosters greater transparency and collaboration within the supply chain, both of which are crucial for achieving comprehensive sustainability objectives [43]. Together, these studies illustrate the essential role green warehousing plays in advancing more environmentally and operationally sustainable logistics practices. Based on these arguments, the following hypotheses are proposed:

H3a: Green warehousing positively impact economic performance.

H3b: Green warehousing ositively impact environmental performance.

H3c: Green warehousing positively impact social performance.

Green transportation plays a crucial role in reducing the environmental footprint of logistics activities by minimizing emissions and pollutant levels [44]. Economically, green transportation reduces costs by improving fuel efficiency and reducing maintenance expenses [45]. In terms of social performance, green transportation enhances public health by improving air quality and creating employment opportunities in eco-friendly transportation sectors. This contributes to the overall well-being of communities and supports the growth of green initiatives [46]. Based on these insights, the following hypotheses are proposed:

H4a: Green transportation practices positively impact economic performance.

H4b: Green transportation practices positively impact environmental performance.

H4c: Green transportation practices positively impact social performance.

The proposed research model is presented in Figure 1

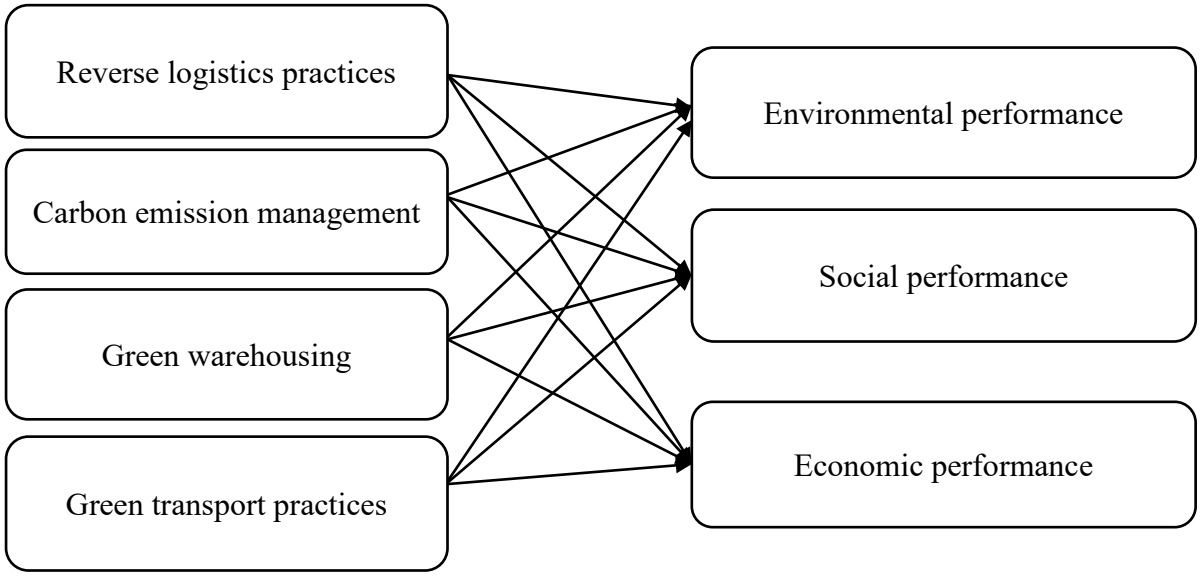

Figure 1: The proposed research model

2.3 Research Methodology

2.3.1 Measures

Through an extensive review of research documents and consultations with subject matter experts, the initial research model has been developed, building upon the framework proposed by Noorliza Karia (2020), Hassan Younis, Balan Sundarakani, and Barry O'Mahony (2019), along with relevant studies both domestically and internationally. The model incorporates various observations to assess the factors that constitute green logistics practices and the sustainable performance of enterprises.

The factors that constitute green logistics practices are represented by four primary dimensions: (1) Reverse Logistics Practices**,** which are evaluated using four scales proposed by Agyabeng-Mensah (2020) and Baah (2020); (2) Carbon Emission Management**,** measured with three scales generated by Paul Hawken (2016); (3) Green warehousing, assessed using four scales proposed by Agyabeng-Mensah et al. (2020); and (4) Green Transport Practices**,** measured using three scales suggested by Yongrok Choi and Ninh Zhang (2011), and Noorliza Karia (2020). Three aspects of sustainable performance were measured by items adopted from Khan et al. (2024). Each aspects was measured by four items.

2.3.2 Data collection

The data for this study was collected from logistics service provider firms in Hanoi, Vietnam, through a questionnaire survey. To ensure the questionnaire's contextual relevance, a rigorous pretesting and sampling process was conducted. The pretesting involved a two-phase pilot test. In the first phase, the questionnaire was reviewed by five academic experts in the field, who provided feedback on its clarity and readability. Their suggestions were incorporated into revised versions of the instrument. In the second phase, the revised questionnaire was pilot-tested with 10 managers. The insights gained from this phase led to further refinements to enhance its accuracy and relevance.

Following the pretesting and final adjustments, the questionnaire was distributed via Google Forms. The target respondents included managers or team leaders—such as general managers, CEOs, senior executives, operations managers, marketing managers, and supply chain managers—who possessed in-depth knowledge of inbound, outbound, and supply chain activities. A total of 228 questionnaires were distributed, yielding 152 valid responses, resulting in a response rate of approximately 66.67%.

To address potential respondent bias, the method proposed by Armstrong and Overton (1977) was applied, which involves comparing the responses of early and late respondents [47]. A t-test revealed no significant differences between these groups, indicating that non-response bias was not a concern in this study.

3. Results

3.1 Measurement model

Our study used SPSS 23 and AMOS 23 to analyze the data. We followed three steps to evaluate the measurement model: Step 1, we assessed the reliability of the scale using Cronbach's Alpha coefficient. The results showed that the Cronbach's Alpha values for all constructs exceeded 0.7, confirming their reliability [48]. In Step 2, we conducted an Exploratory Factor Analysis (EFA) to remove items with factor loadings and commonality scores below 0.5. In Step 3, Confirmatory Factor Analysis (CFA) was used to verify the model's fit with the factors and item variables. The CFA results indicated that the model's fit indices were acceptable (see Table 2). All factor loadings exceeded 0.5, the Construct Reliability (CR) values were all above 0.7, and the Average Variance Extracted (AVE) exceeded the Maximum Shared Variance (MSV), confirming the convergent validity of the constructs [49]. Additionally, the AVE of each construct was greater than the MSV, indicating strong discriminant validity [50]. The model fit was also assessed using the following indices: GFI exceeded 0.8, TLI and CFI exceeded 0.9, and RMSEA ranged from 0.05 to 0.07. The results in Table 3 demonstrate that the fit of our model is satisfactory.

Table 1: Confirmatory factor analysis

Latent Variable		Cronbach's Alpha	CR	AVE	MSV
Reverse logistics practices	LN	0,835	0,846	0,582	0,154
Carbon emission	CB	0,813	0,817	0,529	0,050

management					
Green warehousing	LX	0,814	0,817	0,600	0,147
Green transport practices	CX	0,772	0,774	0,533	0,117
Environmental performance	MT	0,879	0,856	0,602	0,141
Social performance	XH	0,851	0,812	0,521	0,154
Economic performance	KT	0,806	0,884	0,658	0,147

Table 2: Model fit testing

Model fit	**Chi-square/df**	**GFI**	**TLI**	**CFI**	**RMSEA**
Recommended threshold value	$\leq 2^a$; $\leq 5^b$	$\geq 0.90^a$; $\geq 0.80^b$	$\geq 0.90^a$; $\geq 0.80^b$	$\geq 0.90^a$; $\geq 0.80^b$	$\leq 0.80^a$; $\leq 0.10^b$
Model	1,308	0,838	0,933	0,942	0,049

Note: a: acceptable; b: marginal

3.2 Hypotheses testing

The results show that the correlation between CX and KT has a significance level of P = 0.064 > 0.05, indicating that the CX variable has no impact on KT. Similarly, the correlation between LX and XH is 0.058 > 0.05, meaning that the LX variable has no impact on XH. Therefore, H3c and H4a are eliminated. The remaining variables all have P < 0.05 (AMOS indicates *** as sig = 0.000), so these relationships are significant. Thus, hypotheses H1a, H1b, H1c, H2a, H2b, H2c, H3a, H3b, H4b, and H4c are all accepted.

Table 3: Hypotheses testing

Hypotheses	***Est***	***S.E.***	***C.R.***	***P***	**Decision**
H1a: KT <- LN	0,301	0,088	3,427	***	Supported
H1b: MT <- LN	0,379	0,099	3,824	***	Supported
H1c XH <- LN	0,283	0,076	3,730	***	Supported
H2a: KT <- CB	0,359	0,102	3,512	***	Supported
H3a: KT <- LX	0,254	0,104	2,453	0,014	Supported
H4a: KT <- CX	0,240	0,129	1,854	0,064	Rejected
H2b: MT <- CB	0,349	0,114	3,069	0,002	Supported
H3c: XH <- LX	0,166	0,087	1,894	0,058	Rejected
H2c: XH <- CB	0,271	0,087	3,114	0,002	Supported
H4c: XH <- CX	0,386	0,117	3,310	***	Supported
H4b: MT <- CX	0,480	0,151	3,174	0,002	Supported
H3b: MT <- LX	0,288	0,116	2,471	0,013	Supported

Note: *=P<0.5; ***=P<0.001

4. Discussion

4.1 Discussion

This study examines the impact of green logistics practices—reverse logistics, carbon emission management, green warehousing, and green transportation—on the sustainability performance of firms in

Vietnam. The findings confirm the significant role of these practices in enhancing economic, environmental, and social performance, with notable variations in their contributions to specific sustainability dimensions.

Reverse logistics practices (LN) emerge as a crucial driver of all three dimensions of sustainability performance. The strong and statistically significant relationships (H1a, H1b, H1c) emphasize their ability to optimize resource utilization and extend the lifecycle of goods, thereby promoting economic efficiency, environmental stewardship, and social value. Similarly, carbon emission management (CB) is shown to positively influence economic, environmental, and social outcomes (H2a, H2b, H2c), underlining its critical role in achieving sustainability through emission reduction initiatives.

Green warehousing (LX) contributes significantly to economic and environmental performance (H3a, H3b), illustrating its potential to reduce costs and attract environmentally conscious customers. However, the absence of a statistically significant relationship with social performance (H3c) suggests that green warehousing initiatives may require further refinement or complementary strategies to achieve broader societal benefits. Green transport practices (CX) demonstrate a strong positive impact on environmental and social performance (H4b, H4c), reinforcing their importance for sustainable logistics operations. However, their lack of impact on economic performance indicates that cost challenges associated with these practices might limit their financial viability in the short term.

These findings align with prior research by Abareshi and Molla (2013, Anh and Khoa, (2024), Asamoah et al., (2024), reinforcing the literature on the multidimensional benefits of green logistics practices [10]; [8] [51]. The results contribute to the growing body of evidence supporting the integration of green logistics practices into corporate sustainability strategies and offer clarity on the mixed findings of earlier studies.

This study makes notable theoretical and practical contributions to the field of sustainable logistics by exploring the influence of green logistics practices on the sustainability performance of firms in Vietnam.

Theoretically**,** the study enhances the understanding of the distinct effects of specific green logistics practices—reverse logistics, carbon emission management, green warehousing, and green transportation—on the three pillars of sustainability: economic, environmental, and social performance. It also provides empirical evidence that addresses existing gaps in the literature and resolves discrepancies in previous findings. For example, while reverse logistics positively impacts all three dimensions of sustainability, green warehousing and green transportation practices have varying effects on social and economic outcomes, indicating that each practice plays a unique role. These insights emphasize the multifaceted nature of green logistics and the need to develop tailored strategies for achieving holistic sustainability.

Practically**,** the study offers valuable guidance for firms looking to incorporate green logistics practices into their operations. By highlighting the most impactful practices, such as reverse logistics and carbon emission management, the research helps managers prioritize initiatives that generate the most significant sustainability benefits. The study also suggests that green warehousing and green transportation practices may require additional measures or complementary strategies to optimize their economic and social impacts. This provides a roadmap for refining these practices and ensuring they contribute effectively to sustainability goals. Furthermore, the study underscores the crucial role of green logistics in aligning corporate operations with global sustainability standards, while simultaneously enhancing competitiveness, offering practical insights for managers seeking to balance environmental, social, and financial objectives.

4.2 Limitations and future research

Despite its contributions, this study has certain limitations. First, the geographic focus on Vietnam may limit the generalizability of findings to other cultural, regulatory, or economic contexts. Second, the cross-sectional design captures results at a single point in time, leaving room for future research to examine longitudinal effects and dynamic trends. Additionally, the study does not explore the synergies or potential trade-offs between different green logistics practices.

Future research should expand to diverse geographic regions, include longitudinal data to assess changes over time, and investigate interactions among green logistics practices. Such efforts would deepen our understanding of green logistics' role in sustainable performance and provide comprehensive insights for managers and policymakers navigating the complexities of sustainable development.

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