



Influence of Green Logistics Practices on Environmental and Social Performance of Logistics Firms

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ABSTRACT

This study looks at how logistics companies' economic, social, and environmental performance is affected by inbound and outbound green logistics (IGL and OGL) strategies. The results show that both IGL and OGL greatly improve sustainability outcomes, especially when it comes to the economic and environmental aspects. The measurement model's constructs all meet the acceptable Cronbach Alpha level of 0.70, demonstrating great internal consistency as well as superior reliability and validity. Moreover, CR and AVE values indicate the model's robustness, while model fit indices such as Chi-square/df (1.681), GFI (0.898), TLI (0.945), CFI (0.956), and RMSEA (0.056) confirm that the model fits the data well. According to hypothesis testing, IGL has a minor but significant impact on economic performance, while having a positive impact on social and environmental performance. On the other hand, OGL has no discernible influence on social performance but has a considerable beneficial impact on economic and environmental performance. These results highlight both the need for more research into the potential social benefits of OGL in the logistics sector and the significance of green logistics in boosting sustainability in logistics firms.

Keywords: Green Logistics, Environmental Performance, Social Performance, Logistics Firms, Inbound Green Logistic, Outbound Green Logistics

JEL Classifications: Q56, Q01, M14

1. INTRODUCTION

As environmental concerns and corporate social responsibility (CSR) standards continue to rise, the logistics sector has come to realize the importance of integrating sustainability into its operations (Qiao et al., 2022). One important tactic to lessen the environmental impact while preserving productivity and profitability is green logistics, which is integrating eco-friendly procedures into logistics operations. Since logistics companies are crucial to the worldwide distribution and movement of commodities, their business practices are frequently examined for their effects on the environment and society. As a result, there is now more interest in learning how green logistics techniques affect logistics companies' social and environmental performance (EP) (Siagian et al., 2022). EP (environmental performance) in

logistics focuses on reducing negative ecological impacts such as greenhouse gas emissions, waste, and energy consumption. Social performance, on the other hand, encompasses a company's efforts to enhance stakeholder relations, improve labor conditions, and contribute positively to the communities in which it operates. The purpose of this study is to investigate how inbound and outbound green logistics (IGL and OGL) practices affect logistics companies' social and environmental performance (Alam, 2022). By looking at these connections, the study offers insightful information on how green logistics may promote sustainability and improve logistics companies' overall performance.

1.1. Green Logistics and its Importance

Adopting ecologically friendly procedures in the supply chain management and logistics industries is known as "green logistics

(Yadlapalli et al., 2018).” It includes tactics like cutting carbon emissions, maximizing energy efficiency, encouraging eco-friendly packaging, and improving waste management that are meant to lessen the environmental effect of logistical operations. Growing environmental concerns, regulatory challenges, and consumer desire for sustainable practices have all contributed to the growing significance of green logistics (Ali, 2022). Businesses can lower their carbon footprint, increase energy efficiency, and support broader sustainability objectives by using green logistics. Adopting these procedures can also result in lower expenses, more operational effectiveness, and a competitive edge in the marketplace. Green logistics (GL) is an essential component (EC) of contemporary supply chain management since, over time, it not only helps the environment but also improves a company’s reputation and puts it in line with global sustainability trends.

1.2. Environmental and Social Performance in Logistics Firms

The ability of logistics companies to control and lessen their environmental impact while making constructive contributions to society is referred to as environmental and social performance. Environmental performance focuses on reducing carbon emissions, minimizing waste, optimizing resource use, and adopting sustainable practices such as eco-friendly packaging and green transportation options (Amjad, 2022). Conversely, social performance refers to the organization’s dedication to social responsibility, which includes enhancing employee well-being, fair labor practices, and community involvement (Navarro et al., 2018). Logistics firms with strong environmental and social performance not only comply with regulations but also gain competitive advantages by enhancing their reputation, attracting eco-conscious customers, and creating value for stakeholders. Effective management of both aspects is key to achieving long-term sustainability goals and fostering trust with consumers and the community (Anwar, 2022).

1.3. Research Objectives

1. To investigate the positive indirect impact of outbound green logistics (OGL) practices on the environmental performance (EP) of logistics companies
2. To evaluate how outbound green logistics (OGL) practices positively and indirectly influence the social performance (SP) of logistics companies
3. To explore the indirect positive effect of outbound green logistics (OGL) practices on the economic performance (EP) of logistics companies.

2. LITERATURE REVIEW

The green logistics practices literature attests to the growing importance of green logistics practice in improving environmental and social performance for logistics firms (Al-Lozi et al., 2018). With companies focusing more heavily on sustainability, practices such as waste reduction, eco-efficient transport, and sustainable packaging, are leading to social and environmental responsibility. The present review also analyses how these measures advance supply chain sustainability by having an impact on the social and environmental indicators of the logistics companies such

as the relationship with the community and lower carbon emissions (Cerqueira-Streit et al., 2021). The incorporation of these practices highlights the strategic relationship that exists between the sustainability related activities and the performance of the firms under the contemporary business environment (Jha and Rangarajan, 2020).

Qiao et al. (2022) highlight how the benefits of these commitments on the overall results of the GSC (green supply chain) are moderated by the attractiveness and justice of supplier relationships. The study suggests that fostering attractive relationships with suppliers and ensuring fairness can enhance the implementation of GSCM practices, leading to better environmental outcomes.

Siagian et al. (2022) examine how important top management commitment is for fostering competitive advantage through supply chain integration and green innovation. They discover that competitive advantage is directly impacted by senior management’s dedication to sustainability, with green innovation and supplier and customer integration serving as crucial moderators. This study emphasizes how crucial leadership is in promoting sustainable supply chain strategies.

Alam (2022) examines the connection between organizational performance and supply chain management (SCM) techniques in the manufacturing sector. The study emphasizes that implementing efficient SCM procedures can result in better performance outcomes, especially in domains like logistics and procurement. The research stresses the need for businesses to continuously innovate and integrate sustainable practices to stay competitive in the marketplace.

Ali (2022) discusses the role of the Industrial Revolution 4.0 in supply chain digitization, emphasizing how technologies such as AI, IoT, and blockchain can enhance supply chain efficiency, transparency, and sustainability. According to Ali, these technologies not only optimize operations but also contribute to more sustainable practices by reducing waste and improving resource allocation.

Amjad (2022) focuses on the logistics practices in supermarkets, specifically in Pakistan. The study examines how effective logistical strategies can improve service quality, and how these strategies, when integrated with sustainability goals, can lead to better customer satisfaction and business performance. The research underscores the significance of logistics in achieving operational excellence in the retail sector.

Anwar (2022) investigates how supply chain capabilities and interorganizational systems affect performance. According to the survey, firms can react to consumer requests and market shifts faster when they have robust supply chain capabilities and sophisticated information systems, which enhances supply chain performance overall. According to Anwar’s research, using technology into SCM can improve sustainable practices and promote agility.

Asif (2022) discusses procurement tactics and how they help the pharmaceutical business maintain a sustainable supply chain.

According to the study, strategic procurement techniques including long-term relationships and supplier selection greatly enhance the supply chain's sustainability. Asif's findings emphasize how crucial it is to match procurement choices with objectives for social and environmental sustainability.

Ayaz (2022) investigates the connection between environmental performance, supply chain quality integration, and green supply chain management (GSCM). The report emphasizes how crucial quality integration is to GSCM and how improved environmental performance results from supply chain partners working together effectively. According to Ayaz, companies that implement GSCM principles can have a major positive impact on the environment if they incorporate quality management systems across the supply chain.

Gebhardt et al. (2022) they demonstrate the interdependencies that result from circular economy initiatives like recycling and resource recovery within supply chains through an empirical Delphi research. The research suggests that a shift towards a circular economy will redefine supply chain relationships, requiring firms to adapt to new models of resource utilization and waste management to remain competitive and sustainable.

Cheng et al. (2022) concentrate on how big data analytics can improve the flexibility and performance of sustainable supply chains, especially when considering the circular economy. According to their research, big data analytics can improve supply chain flexibility by offering insights into demand trends, inventory control, and resource movement. They also demonstrate that integrating circular economy principles with big data analytics improves sustainability performance in manufacturing firms, highlighting the potential for data-driven decision-making to facilitate both economic and environmental sustainability.

Kouhizadeh et al. (2022) investigate the intersection of blockchain technology and the circular economy, emphasizing how blockchain can improve transparency and efficiency in circular supply chains. They argue that blockchain provides a secure and traceable platform for managing the flow of materials in circular supply chains, thereby reducing inefficiencies and ensuring that products and materials are reused, remanufactured, or recycled. The study suggests that blockchain is a key enabler of circular supply chains, supporting traceability and trust between stakeholders.

Cao et al. (2022) The function of blockchain in agricultural supply networks is examined by Cao et al. (2022), with a focus on how it might improve transparency and lower fraud. Their research shows that by offering a safe and unchangeable record of transactions, blockchain-based systems can improve agricultural supply chains. This transparency is especially valuable in ensuring food safety and sustainability, with blockchain facilitating better traceability of agricultural products from farm to table.

Niu et al. (2022) explore the application of blockchain in remanufacturing supply chains, focusing on its role in managing consumer risk-aversion and quality concerns. They show that blockchain can mitigate trust issues in remanufacturing by

ensuring product authenticity and quality, thus creating a "win-win" scenario for both consumers and businesses. By reducing the risk of quality uncertainty, blockchain helps to foster consumer confidence and promote more sustainable remanufacturing practices.

Amrutha and Geetha (2021) look into the relationship between employee satisfaction with sustainable practices, voluntary workplace green behavior, and organizational green training. According to their research, companies that fund green training initiatives and cultivate a positive work environment are more likely to encourage green behavior among staff members, which enhances sustainability performance. The authors stress how organizational climate and employee happiness influence environmental activities.

Chan and Ma (2021) investigate the impact of environmental orientation on corporate sustainable development. They discover that a company's environmental focus can greatly influence its sustainability initiatives, particularly when it comes to international supply chain partnerships. According to the report, businesses that have a strong commitment to environmental sustainability (ES) are more likely to work with suppliers that share those values, which promotes sustainable development over the long run.

Kong et al. (2021) investigate the connection between financial success and the integration of green supply chains. Their research indicates that financial performance is positively impacted by information exchange and the adoption of green supply chain techniques. Green supply chain methods improve overall financial and environmental results by spreading among partners and suppliers through a social contagion effect. The business case for supply chain sustainability is strengthened by this study's emphasis on the positive financial outcomes that come from efficient communication and teamwork in green projects.

Tarigan (2021) looks into how supply chain management techniques, green purchasing, and top management commitment affect operational success. According to the study, operational efficiency is greatly improved when top management is dedicated to green initiatives and green purchasing methods. According to Tarigan's research, companies that put sustainability and green purchasing first are better positioned to achieve higher operational efficiency and performance. It also emphasizes the crucial role that leadership plays in promoting sustainable supply chain strategies.

Adnan et al. (2021) study concludes that better sustainability results from the implementation of green supply chain (GSC) strategies, such as eco-design, green procurement, and environmental performance assessment. By demonstrating that businesses in emerging nations can also reap substantial operational and environmental benefits by implementing green supply chain strategies, this study highlights the positive correlation between green practices and firm-level sustainability.

Although green logistics is becoming more and more popular, little research has been done on how it specifically affects logistics companies' social and environmental performance. The methods

by which green logistics techniques affect these results require more research, particularly in a variety of industry scenarios.

2.1. Hypothesis

H₀₁: Green logistics (GL) practices in outbound logistics positively and indirectly impact the environmental performance of logistics firms

H₀₂: Green logistics (GL) practices in outbound logistics positively and indirectly affect the social performance of logistics firms

H₀₃: Green logistics practices in outbound logistics positively and indirectly influence the economic performance of logistics firms.

3. RESEARCH METHODOLOGY

A questionnaire survey was used to collect data for this study, which looked at how green logistics (GL) practices affected the social and environmental performance (EP) of logistics companies (Hirunyawipada and Xiong, 2018). Using a 5-point Likert scale, where 1 represents “strongly disagree” and 5 represents “strongly agree,” responses were recorded. Higher scores indicated a greater alignment with green logistical approaches (Asif, 2022). Scales were drawn from existing literature to verify topic validity. Green logistics practice measures were modified from Afum et al. (2022), evaluating inbound and outbound logistics with four and five items, respectively, and sustainable performance with twelve items in accordance with Khan et al. (2024). The sample encompassed firms across seven Vietnamese provinces. The questionnaire underwent pretesting with five academic experts and ten managers, resulting in revisions to enhance clarity and validity (Ayaz, 2022). It was distributed via Google Forms, targeting executives knowledgeable in supply chain practices. Of the 468 questionnaires distributed, 221 valid responses were received, yielding a 47.22% response rate. Armstrong and Overton’s (1977) method verified that non-response bias was not a concern (Aboelmaged, 2018a). Sample characteristics in Table 1 illustrate varied operational periods, industries, and employee counts among participating firms.

4. RESULTS AND DISCUSSION

4.1. Measurement Model

The findings of the CFA show that the study’s constructs have enough validity and reliability. Good internal consistency is indicated by Cronbach Alpha values for all latent variables, which range from 0.819 for inbound green logistics (IGL) to 0.900 for environmental performance (ENP), exceeding the generally recognized cut off of 0.70 (Ardian et al., 2018). The constructions’ dependability is further supported by the composite dependability (CR) values, all of which are over the 0.70 cut off, which is necessary to guarantee the constructs’ robustness (Gebhardt et al., 2022). All of the constructs’ average variance extracted values fall over the suggested cut off of 0.50, ranging from 0.513 (IGL) to 0.684 (OGL), indicating that the constructs adequately capture the variance in their indicators (Tseng et al., 2019). The constructs’ distinction from one another is supported by the fact that the maximum shared variance (MSV) values, which signify discriminant validity, are lower than the AVE values (Cheng et al.,

2022). These findings support the study’s analysis of how green logistics (GL) practices affect logistics businesses’ economic, social, and environmental performance by demonstrating the validity and reliability of the measurement approach (Pinzone et al., 2019). Table 2 presents the measurement model, and it has a strong measurement model based on the psychometric qualities of the constructs (Jha and Rangarajan, 2020). Second, such strict validation would bring confidence among the studies about the following statistical analysis related with relationships between green logistics practices and triple-bottom-line performance measures (Kazancoglu et al., 2021).

Table 3 displays the model fit indices, comparing each to recommended thresholds (Wang et al., 2020). The Chi-square/df value of 1.681 falls well below the lenient threshold of 5 and within the preferred threshold of 2, indicating acceptable model fit (Kouhizadeh et al., 2022). The goodness of fit index is 0.898, slightly below the ideal threshold of 0.90 but above the secondary threshold of 0.80, showing an adequate fit. Both the Tucker-Lewis index at 0.945 and the comparative fit index at 0.956 exceed the preferred threshold of 0.90, signifying strong model performance (Cao et al., 2022). Lastly, the root mean square error of approximation is 0.056, comfortably within the strict threshold of 0.08, suggesting low error and good fit. Together, these indices

Table 1: Characteristics of the sample

Characteristics	Items	Frequency	Percentage
Operational period of the organization (in years)	<5	67	30.32
	05-October	55	24.89
	≥10	99	44.80
Industry	Manufacturers	77	34.84
	Suppliers	42	19.00
	Services	45	20.36
	Retailers and distributors	29	13.12
	Others	28	12.67
Number of employees	<10	35	15.84
	10-100	93	42.08
	100-300	58	26.24
	300-500	32	14.48
	≥500	3	1.36

Table 2: Confirmatory factor analysis results

Latent variable	Cronbach alpha	CR	AVE	MSV
Inbound green logistics	0.819	0.836	0.513	0.388
Outbound green logistics	0.835	0.896	0.684	0.406
Environmental performance	0.9	0.851	0.589	0.25
Social performance	0.856	0.826	0.546	0.276
Economic performance	0.875	0.894	0.679	0.406

Table 3: Model fit indices

Model fit index	Recommended threshold value	Model value
Chi-square/df	≤2a; ≤5b	1.681
Goodness of fit index	≥0.90a; ≥0.80b	0.898
Tucker-Lewis index	≥0.90a; ≥0.80b	0.945
Comparative fit index	≥0.90a; ≥0.80b	0.956
Root mean square error of approximation	≤0.80a; ≤0.10b	0.056

a: Acceptability: Acceptable; b: Acceptability: Marginal

Table 4: Hypotheses testing - inbound green logistics

Hypothesis	Estimate	Standard error	Critical ratio	P-value	Decision
H ₁ : IGL -> ENP	0.294	0.073	4.027	***	Supported
H ₂ : IGL -> SOP	0.373	0.097	3.837	***	Supported
H ₃ : IGL -> ECP	0.188	0.087	2.153	*	Supported

Table 5: Hypotheses testing - outbound green logistics

Hypothesis	Estimate	Standard error	Critical ratio	P-value	Decision
H ₄ : OGL -> ENP	0.753	0.139	5.423	***	Supported
H ₅ : OGL -> SOP	0.166	0.139	1.194	0.233	Rejected
H ₆ : OGL -> ECP	0.454	0.162	2.81	*	Supported

*** indicates a significant effect at $P < 0.001$, while * indicates significance at $P < 0.05$.

support the model's strong overall fit with minor deviations from optimal thresholds (Zhou et al., 2020).

4.2. Hypothesis Testing

4.2.1. Testing results

Table 4 presents the statistical findings on the influence of inbound green logistics (IGL) on various performance metrics within logistics firms, focusing on environmental, social, and economic outcomes (Niu et al., 2022). The positive estimate (Est) of 0.294 for Hypothesis 1 (H₁: IGL -> ENP) with a critical ratio (C.R.) of 4.027 and a highly significant P-value (**, indicating $P < 0.001$) supports the positive impact of IGL on environmental performance (ENP) (Amrutha and Geetha 2021). Similarly, Hypothesis 2 (H₂: IGL -> SOP) shows a strong positive estimate of 0.373, a C.R. of 3.837, and a $P < 0.001$, confirming IGL's significant influence on social performance (SOP) (Baah et al., 2020). For Hypothesis 3 (H₃: IGL -> ECP), the estimate of 0.188, with a C.R. of 2.153 and a $P < 0.05$, demonstrates a statistically significant, albeit smaller, effect of IGL on economic performance (ECP) (Chan and Ma 2021). These results indicate that inbound green logistics practices consistently enhance a firm's environmental (EP) and social performance (SP), while also positively contributing, to a lesser extent, to economic performance. This underscores the potential of green logistics practices to improve the triple bottom line in logistics firms, aligning sustainability with operational benefits (Kong et al., 2021).

Table 5 summarizes the statistical impact of outbound green logistics (OGL) on various performance metrics in logistics firms, focusing on environmental, social, and economic outcomes (Tarigan, 2021). For Hypothesis 4 (H₄: OGL -> ENP), the analysis shows a strong positive estimate (Est) of 0.753, a critical ratio (C.R.) of 5.423, and a highly significant P (**, $P < 0.001$), confirming that OGL significantly enhances environmental performance (ENP) (Agyabeng-Mensah et al., 2020a). This result suggests that adopting green practices in outbound logistics can substantially contribute to environmental improvements (Adnan et al., 2021). However, Hypothesis 5 (H₅: OGL -> SOP), which explores the influence of OGL on social performance (SOP), yields a lower estimate of 0.166, with a C.R. of 1.194 and a non-significant $P = 0.233$, leading to its rejection (Shou et al., 2021). This indicates that OGL practices may not directly influence social performance outcomes. Hypothesis 6 (H₆: OGL -> ECP) shows a positive estimate of 0.454, a C.R. of 2.81, and a significant P-value ($P < 0.05$), indicating that OGL contributes to

economic performance (ECP). Overall, these findings highlight OGL's significant role in enhancing environmental and economic performance but suggest a limited direct effect on social performance within logistics firms (Khan et al., 2021).

5. CONCLUSION

In conclusion, the study underscores the pivotal role of inbound and outbound green logistics (IGL and OGL) practices in advancing sustainable performance across financial, social, and environmental dimensions for logistics firms. The measurement model demonstrates strong reliability and validity, as reflected by Cronbach Alpha values above 0.70, along with high composite reliability (CR) and average variance extracted (AVE), confirming the model's robustness. Fit indices, including Chi-square/df (1.681), GFI (0.898), TLI (0.945), CFI (0.956), and RMSEA (0.056), indicate that the model aligns well with the data. Hypothesis testing shows that IGL positively influences environmental (H₁) and social performance (H₂), with a smaller but significant impact on economic performance (H₃). Conversely, OGL significantly enhances environmental (H₄) and economic performance (H₆) but lacks a notable effect on social performance (H₅). These findings suggest that green logistics initiatives, especially OGL, drive improvements in environmental and economic outcomes for logistics firms. However, the limited impact of OGL on social performance indicates a gap in understanding the social dimensions of green logistics. Future research should focus on exploring this aspect to uncover how green logistics practices can more holistically contribute to social sustainability, offering broader implications for sustainable logistics management.

5.1. Suggestions

1. Explore ways to enhance social outcomes through green logistics, especially in outbound logistics
2. Adopt both inbound and outbound green logistics for improved environmental and economic performance
3. Involve customers, suppliers, and communities in green logistics initiatives to boost social performance
4. Encourage government incentives and regulations to promote green logistics adoption
5. Investigate long-term impacts of green logistics on social performance and compare cross-industry benefits.

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