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The Interplay of Green Logistics practices, Social Sustainability, and Government Policy in the Logistics Industry

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Abstract

The logistics industry is under increasing pressure to balance operational efficiency with environmental and social sustainability goals. This study investigates the interplay between green logistics practices, social sustainability outcomes, and the role of government policies within this context. Utilizing a survey of 305 logistics companies in Thailand and structural equation modeling analysis, the research examines three key hypotheses: 1) Adopting green logistics practices positively influences social sustainability; 2) Government policies promote the adoption of green logistics practices; 3) Government policies promoting green logistics practices have a positive impact on social sustainability outcomes. The results provide strong empirical support for all three hypotheses, underscoring the importance of both organizational green practices and enabling government policies in driving improved worker well-being, community engagement, and ethical practices. The findings contribute to theory by elucidating the mechanisms through which green logistics and government interventions shape social sustainability in the industry. For practitioners, the study highlights the value of collaborative efforts between policymakers and logistics companies in fostering a sustainable and socially responsible logistics sector. Key implications, limitations, and avenues for future research are discussed.

Keywords: Green logistics, Social sustainability, Government policy, Structural equation modeling

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1. INTRODUCTION

The global logistics industry faces a crucial challenge: optimizing efficiency while minimizing its environmental and social impact. Green logistics offers a promising solution, focusing on environmentally friendly practices like reduced carbon emissions, optimized routing, and sustainable supply chain management (Shi et al., 2022). Companies are increasingly adopting these practices to gain a competitive advantage, reduce pollution, and address broader sustainability concerns (Patra, 2018).

Social sustainability, encompassing aspects like fair labor practices, ethical sourcing, and community engagement, is another critical dimension (Reyna-Castillo et al., 2023). Studies highlight its positive influence on both social and environmental performance within supply chains (Prieto et al., 2022). However, research also reveals challenges in implementing social sustainability initiatives, including a lack of standardized frameworks and communication strategies (Leal Filho et al., 2022). Integrating green logistics with a focus on social improvements necessitates increased awareness among logistics managers and broader stakeholder involvement (Leung et al., 2023; Prataviera et al., 2023).

Government policies have a demonstrably significant role in fostering this integration. Successful case studies from Pakistan and China illustrate how government incentives, regulations, and circular economy policies can drive green logistics adoption and sustainable development in the logistics sector (Fei et al., 2021; Hashmi, 2023; Khan & Zhang, 2021). Research further suggests that policy design plays a crucial role, influencing strategic decision-making by logistics enterprises and promoting user participation in green practices (Dong & Yang, 2022).

The logistics industry faces mounting pressure from various stakeholders, including governments, consumers, and society at large, to minimize its environmental impact and contribute to sustainable development. This pressure arises from growing concerns about issues such as climate change, resource depletion, and the social consequences of business operations.

Operationally, the logistics industry is energy-intensive and generates significant greenhouse gas emissions through transportation and warehousing activities. As public awareness of environmental issues increases, companies face greater scrutiny and pressure to adopt environmentally friendly practices, such as utilizing alternative fuels, optimizing routes, and implementing energy-efficient technologies.

Additionally, there is an increasing recognition of the social impact of logistics operations, including working conditions, community engagement, and ethical practices throughout the supply chain. Stakeholders expect companies to prioritize the well-being of their employees, contribute positively to the communities they operate in, and uphold ethical standards in their business practices.

The introduction highlights the interconnectedness of operational efficiency, environmental sustainability, and social sustainability. Achieving operational efficiency is essential for logistics companies to remain competitive and viable. However, this operational efficiency must be balanced with environmental and social considerations to meet stakeholder expectations and contribute to sustainable development.

Adopting environmentally friendly practices, such as optimizing routes and utilizing alternative fuels, can not only reduce the industry's environmental footprint but also contribute to operational efficiency by reducing fuel costs and improving resource utilization.

Similarly, prioritizing social sustainability by promoting fair labor practices, community engagement, and ethical sourcing can enhance a company's reputation, attract and retain talent, and

foster positive relationships with local communities, ultimately contributing to long-term operational success.

By emphasizing this interconnectedness, the introduction underscores the need for a holistic approach that integrates operational efficiency with environmental and social sustainability goals, rather than treating them as separate or competing objectives.

Given this complex interplay, this research investigates:

To what extent do government policies promoting green logistics practices influence their impact on social sustainability outcomes within the logistics industry?

This research question delves into the effectiveness of government interventions in promoting environmentally friendly logistics practices and their subsequent impact on social sustainability within the logistics industry as conceptual model as Figure 1. Analyzing the effectiveness of different policy approaches will provide valuable insights for developing strategies to promote a more sustainable future for the logistics sector.

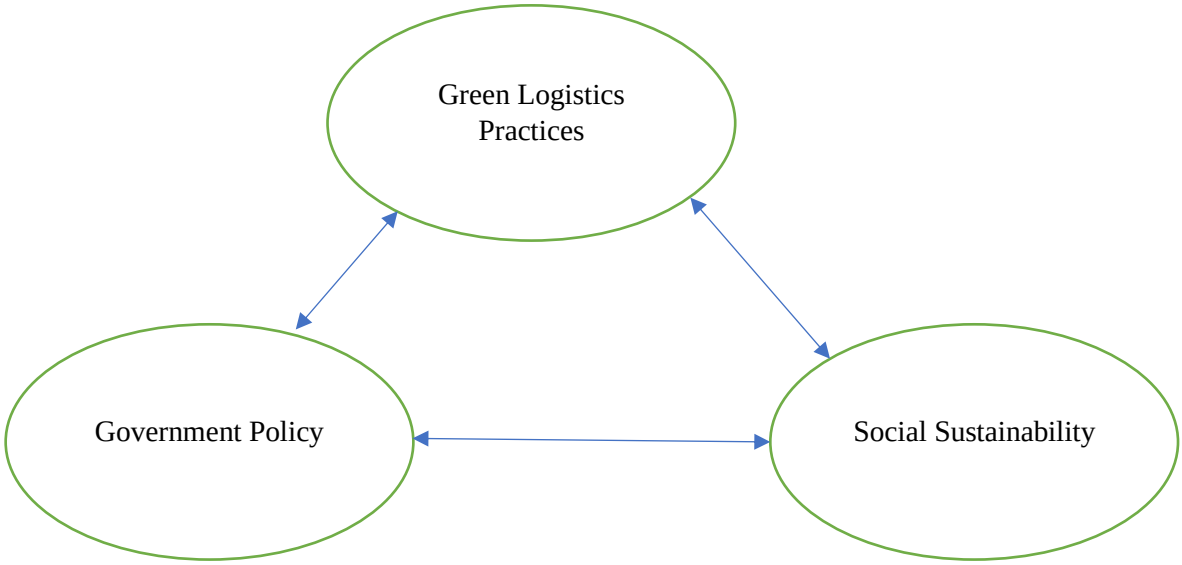

Figure 1 Conceptual Model

2. LITERATURE REVIEW

2.1 Green Logistics Practices: A Multifaceted Approach to Sustainability

Green logistics practices encompass a multifaceted approach to sustainability, involving various stakeholders and factors. Studies highlight the importance of understanding the role of extra-firm stakeholders (Prataviera et al., 2023), management attitudes, external conditions, and major barriers in driving or hindering green logistics adoption (Leung et al., 2023). Additionally, the implementation of green logistics in industries like oil and gas is crucial for environmental improvement, with identified drivers and barriers influencing its success (Maurya et al., 2023). Challenges in green supply chain management, such as the need for knowledge in reverse logistics and workforce shortages, underscore the interconnected hurdles faced in achieving sustainable economic and environmental outcomes (Tianqi et al., 2023). Collaboration among supply chain partners is emphasized as a key strategy to develop innovative green practices and combat environmental threats like the sixth mass extinction (Musau, 2023).

Green logistics practices can be broadly categorized into three key areas as shown in Table 1

By strategically implementing these factors, organizations can achieve a demonstrably more sustainable supply chain, contributing to a healthier planet and potentially reducing overall logistics costs.

Table 1 Categories of Green Logistics Practices

Category	Description	Example Practices	Citation
Environmental Performance Enhancement	Strategies to minimize environmental impact	-Utilizing fuel-efficient/alternative fuel vehicles -Optimizing delivery routes -Implementing intermodal transportation -Utilizing reusable packaging and recycling programs	(Adhikari & Ozarska, 2018; Du et al., 2022; Usmani et al., 2021)
Waste Management	Practices to minimize waste generation and promote responsible disposal	-Implementing efficient product handling procedures -Utilizing energy-efficient equipment in warehouses	(Limon et al., 2020; Mohammed et al., 2022)
Energy Efficiency	Strategies to optimize energy consumption	-Implementing renewable energy solutions -Adopting energy-saving practices in transportation	(Corlu et al., 2020; González-Briones et al., 2018; Ma et al., 2017)

2.2 Optimizing Social Sustainability within Green Logistics Practices

Optimizing social sustainability within green logistics practices involves integrating social aspects effectively alongside environmental and economic considerations (Leung et al., 2023). Stakeholder theory emphasizes the interconnected network of stakeholders influencing green logistics practices adoption, highlighting the role of secondary stakeholders like final consumers (Prataviera et al., 2023). The study on supply chain sustainability in Pakistan underscores the positive impact of social values & ethics on supply chain sustainability, emphasizing the need for fostering good investor views about green management systems (Rasheed, 2022). Additionally, the framework for sustainable development through green logistics practices in Lithuania identifies factors encouraging GL practices, such as legal regulations, business partner requirements, and top management awareness (Martins et al., 2023). By addressing these insights, companies can enhance social sustainability within their green logistics strategies, contributing to overall sustainability goals.

Hypothesis 1: Adopting green logistics practices will have a positive influence on social sustainability outcomes within the logistics industry.

This paper explores key social sustainability factors that can be professionally integrated into green logistics practices for a more holistic and impactful approach, including enhancing worker well-being and safety, contributing to community health and well-being, promoting ethical and sustainable practices, fostering strategic community engagement, and investing in workforce development and capacity building.

1) Enhancing Worker Well-being and Safety

Green logistics practices offer a path towards improved worker well-being and safety. By optimizing workloads through route optimization and efficient warehouse design, logistics companies can potentially reduce the strain on their personnel. This translates to lower stress levels and a safer work environment. Additionally, investments in green technologies like electric vehicles contribute to quieter and healthier workspaces, minimizing exposure to harmful emissions and noise pollution for warehouse staff.(Cheng et al., 2023; McKinnon et al., 2015)

2) Contributing to Community Health and Well-being

The benefits of green logistics extend beyond the company walls. Lower emissions from green transportation directly translate to cleaner air and reduced noise pollution in communities surrounding logistics hubs. This has a direct impact on public health outcomes. Moreover, green practices that emphasize recycling and responsible waste disposal contribute to cleaner communities. Not only does this create a more aesthetically pleasing environment, but it can also lead to the creation of local job opportunities in the waste management sector. Furthermore, it fosters a culture of environmental stewardship within the community, encouraging residents to embrace sustainable practices.(Jayarathna et al., 2023; Larson, 2021)

3) Promoting Ethical and Sustainable Practices

Companies committed to green logistics can leverage their influence to promote ethical and sustainable practices throughout the supply chain. This can be achieved by extending their sustainability focus to encompass ethical sourcing practices. By ensuring fair labor conditions and responsible material procurement upstream, these companies minimize their environmental impact and contribute to a more just and equitable global supply chain. Additionally, green initiatives can be a catalyst for promoting Diversity, Equity, and Inclusion (DE&I) within the logistics workforce. Targeted recruitment programs, training initiatives, and a culture of inclusion fostered through green initiatives can create a more diverse and engaged workforce.(Mejías et al., 2016)

4) Fostering Strategic Community Engagement

Green logistics initiatives can be even more impactful when coupled with strategic partnerships with local communities. Collaboration on issues like sustainable infrastructure development, green space creation, and educational outreach programs promoting environmental awareness can lead to a more sustainable and vibrant community surrounding the logistics hub. Additionally, prioritizing local suppliers and service providers for green logistics needs strengthens local economies by creating job opportunities and fostering a collaborative ecosystem.(Piecyk & Björklund, 2015)

By integrating these social sustainability considerations into green logistics practices, organizations can create a more positive impact on all stakeholders. This holistic approach strengthens a company's commitment to responsible business practices, fostering a just and equitable work environment, and contributing to the well-being of the communities they serve.

2.3 Government Policy as a Catalyst for Green Logistics and Social Sustainability in Supply Chains

Government policy plays a crucial role in influencing green logistics practices and subsequently impacting business performance (Kalubanga & Mbekeka, 2023). Research indicates that compliance with government policies positively influences firm environmental performance, both directly and indirectly through fostering reverse logistics practices (Pradeep & Alisherova, 2023). The government can use coercion to enforce green supply chain practices, which can lead to improved business

performance (Pradeep & Alisherova, 2023). Additionally, the lack of promotion and adoption of green techniques in logistics by developing nations has been highlighted, emphasizing the importance of government policies in driving sustainable practices (Maurya et al., 2023). Therefore, government policies act as a significant driver for the adoption of green logistics practices, ultimately contributing to environmental sustainability and improved business outcomes.

Hypothesis 2: Government policies will have a positive influence on adopting green logistics practice within the logistics industry.

Beyond environmental considerations, government policies can also promote social sustainability within the logistics sector. Labor laws and regulations (Li et al., 2021) play a vital role in ensuring fair treatment of workers. These include establishing minimum wage standards, regulating working hours and overtime pay, enforcing occupational safety standards, and enacting anti-discrimination laws to create a more diverse and inclusive work environment.

Social programs (Klumpp, 2016) can provide support for workers impacted by industry changes. Government-funded unemployment benefits can offer a safety net for those experiencing job transitions due to automation or other industry shifts. Investing in skills training programs can equip workers with the necessary skills to adapt to evolving technologies and secure new opportunities.

Community development initiatives (Pradeep & Alisherova, 2023). can encourage positive social contributions by logistics companies. Directing infrastructure investments towards underserved communities where logistics hubs are located can promote regional development and benefit local residents. Offering tax breaks or incentives for companies that invest in community development projects within their operating areas can further incentivize positive social impacts.

Public awareness campaigns (Maurya et al., 2023) can also play a role in promoting social sustainability. Raising consumer awareness about the social and environmental implications of logistics choices can create market pressure, encouraging businesses to adopt sustainable practices that consider the well-being of workers and communities.

Table 2 Policy Type and Impact on Green Logistics and Social Sustainability

Policy Type	Strengths	Weaknesses
Incentives	Encourage investment in green technologies	May not be enough for widespread change, Potential for inefficiencies
Regulations	Create mandatory framework for change, Ensure baseline environmental performance	Potential for industry resistance, Requires effective enforcement
Infrastructure Development	Address logistical challenges of green technologies, Facilitate smooth transition	High upfront costs and time investment, Unequal impact across regions

Hypothesis 3: Government policies promoting green logistics practices will have a positive influence on social sustainability outcomes within the logistics industry.

The most effective approach often involves combining policy instruments. For example, regulations can be coupled with incentives to create a stronger push towards green practices while minimizing the financial burden on companies.

3. RESEARCH METHODOLOGY

This study employs a quantitative approach to investigate the influence of government policies promoting green logistics practices on social sustainability outcomes within the Thai logistics industry. A survey-based methodology was adopted to gather data from logistics companies.

3.1 Data Collection

3.1.1 Sample Selection: A purposive sampling strategy targeted logistics companies in Thailand that expressed willingness to participate. Each company represents a single unit of analysis.

3.1.2 Sample Size Determination: The A-priori Sample Size Calculator for Structural Equation Models software (Leyrat et al., 2024) determined a minimum sample size of 296 for effect size detection and 156 for model structure. To ensure robustness, data from 305 companies were collected.

A survey questionnaire was developed based on literature review and pilot testing to capture information on:

1. Green Logistics Practices

2. Government Policies Promoting Green Logistics

3. Social Sustainability Outcomes

The questionnaire was distributed electronically (Google Forms) and via telephone surveys.

3.2 Data Analysis

Structural Equation Modeling (SEM) with Jamovi software was used to analyze the data:

1. Measurement Model Evaluation: Confirmatory factor analysis (CFA) assessed the reliability and validity of the measurement scales.

2. Structural Model Evaluation: The hypothesized relationships between green logistics practices, government policies, and social sustainability outcomes were tested.

3. Model Fit Evaluation: Goodness-of-fit indices (Chi-square, CFI, TLI, RMSEA) assessed the overall model fit.

3.3 Justification

This methodology provides a structured approach for investigating the interplay between these constructs. SEM allows for examining complex relationships, offering valuable insights for both academics and industry professionals.

4. RESULTS

The results indicate that the model provides a significantly better fit to the data compared to the criteria. The model's chi-square value of 29.5 with 26 degrees of freedom and a p-value of 0.290 suggests that the model is not significantly different from the observed data, meaning it fits the data well.

From table 3, the non-significant p-value ($p = 0.290$) for the model suggests that the null hypothesis, which states that the model fits the data, cannot be rejected. This further supports the conclusion that the model provides a good fit to the observed data.

Table 3 Model Test Result

Label	X^2	df	p
Model	29.5	26	0.290
Baseline Model	2624.9	45	< .001

These results suggest that the model is a more accurate representation of the underlying relationships and processes being studied compared to the criteria. The model's superior fit indicates that the variables and their interrelationships specified in the model are better able to explain the observed data.

The Structural Equation Modeling (SEM) analysis in this study examined the interplay between green logistics practices, social sustainability, and government policy in the logistics industry. The model fit indices provided valuable insights into the overall quality and appropriateness of the proposed model.

4.1 Model Fit Evaluation

The study compared the fit of the model against a criteria model to assess the explanatory power of the hypothesized relationships. Several key fit indices were evaluated that shown in Table 4.

Table 4 SEM Fit Index Summary Table

Model Versus Criteria	Model	Criteria	Fit Situation
Root Mean Square Error of Approximation (RMSEA)	0.021	0.05 or less (Browne & Cudeck, 1992)	Acceptable
Comparative Fit Index (CFI)	0.999	≥ 0.95 for good fit. (Hu & Bentler, 1999)	Acceptable
Tucker-Lewis Index (TLI)	0.998	≥ 0.95 is often considered indicative of good fit (Bentler & Bonett, 1980)	Acceptable
Bentler-Bonett Non-normed Fit Index (NNFI)	0.998	≥ 0.95 suggests good fit. (Bentler & Bonett, 1980)	Acceptable
Bentler-Bonett Normed Fit Index (NFI)	0.989	NFI ≥ 0.90 is often considered indicative of good fit. (Bentler & Bonett, 1980)	Acceptable
Bollen's Incremental Fit Index (IFI)	0.999	IFI ≥ 0.95 suggests good fit. (Bollen, 1989)	Acceptable

This model demonstrated significantly better fit across all the reported indices compared to the criteria. This indicates that the model, which incorporates the hypothesized relationships between green logistics practices, social sustainability, and government policy, provides a more accurate representation of the data than criteria.

The results of the SEM model fit evaluation provide strong empirical support for the validity and appropriateness of the model in explaining the interplay between the key constructs of interest. The consistently high fit indices, which exceed the recommended thresholds, suggest the model is well-specified and able to capture the complex relationships within the logistics industry. These findings offer a solid foundation for further interpretation and discussion of the structural relationships among the variables. Reliability indices

Table 5 Reliability Indices Result

Variable	α	AVE
Government Policy	0.877	0.665
Green Logistics	0.886	0.63
Social Sustainability	0.887	0.783

Table 5, Cronbach's alpha (α) is used to assess the internal consistency reliability of the constructs. All three constructs have Cronbach's alpha values above the commonly accepted threshold of 0.70, indicating good internal consistency reliability.

Average Variance Extracted (AVE) is used to assess the convergent validity of the constructs. The AVE values for Government Policy and Green Logistics are above the recommended threshold of 0.50, suggesting adequate convergent validity for these constructs. The AVE value for Social Sustainability is well above the 0.50 threshold, indicating strong convergent validity for this construct.

The reliability and convergent validity results provide support for the quality of the measurement model used in the SEM analysis. The high Cronbach's alpha values suggest that the items within each construct are measuring the same underlying concept consistently. The AVE values above 0.50 for all three constructs indicate that the items within each construct are, on average, explaining more than 50% of the variance in the construct, which is a common threshold for demonstrating convergent validity.

These results strengthen the confidence in the validity and reliability of the measures used in the SEM model. The constructs appear to be well-defined and measured, which increases the trustworthiness of the model's findings and the inferences that can be drawn from the SEM analysis.

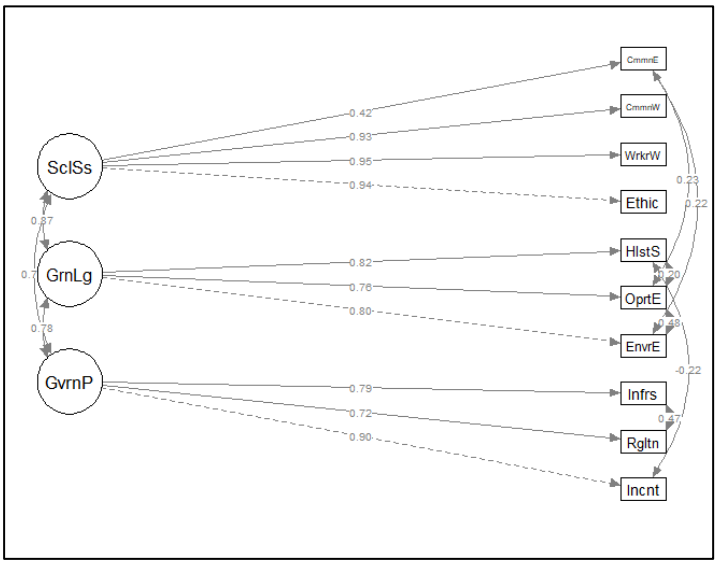

Figure 2 SEM Model

Remark SclSs= Social Sustainability, GrnLg= Green Logistics, GvrnP= Government Policy, CommE=Community Engagement, CommW=Community Well-being, WrkrW= Worker Well-being, Ethic= Ethic, HlstS= Holistic Sustainability, OprtE= Operation Efficiency, EnvrE= Environment Enhancement, Infrs = Infrastructure, Rgltn= Regulation, Incnt= Incentives

4.2 Measurement Model

The measurement model in this study consists of three latent constructs: Government Policy, Green Logistics, and Social Sustainability. Each latent construct is measured by a set of observed indicators, and the results provide valuable insights into the structure and validity of these measurement models.

Table 6 Measurement Model Result

Latent	Observed	Estimate	SE	β	z	p	R^2
Government Policy	Incentives	1	0	0.896			0.803
	Regulation	0.683	0.052	0.72	13.13	< .001	0.518
	Infrastructure	0.84	0.0562	0.794	14.95	< .001	0.631
Green Logistics	Environment Enhancement	1	0	0.796			0.633
	Operation Efficiency	0.914	0.0496	0.761	18.43	< .001	0.58
	Holistic Sustainability	1.024	0.0697	0.821	14.68	< .001	0.675
Social Sustainability	Ethic	1	0	0.938			0.88
	Worker Well being	0.994	0.0297	0.949	33.41	< .001	0.901
	Community Wellbeing	0.925	0.0294	0.934	31.5	< .001	0.872
	Community Engage	0.306	0.0395	0.417	7.74	< .001	0.174

Government Policy: The latent construct of Government Policy is measured by three observed indicators: Incentives, Regulation, and Infrastructure. The standardized factor loadings for these indicators are 0.896, 0.72, and 0.794, respectively, all of which are statistically significant at the $p < 0.001$ level. These results suggest that the three indicators are strongly related to the underlying government policy construct, with the latent construct explaining 80.3%, 51.8%, and 63.1% of the variance in Incentives, Regulation, and Infrastructure, respectively.

Green Logistics: The latent construct of Green Logistics is measured by three observed indicators: Environment Enhancement, Operation Efficiency, and Holistic Sustainability. The standardized factor loadings for these indicators are 0.796, 0.761, and 0.821, respectively, all of which are statistically significant at the $p < 0.001$ level. The latent construct explains 63.3%, 58.0%, and 67.5% of the variance in the respective observed indicators.

Social Sustainability: The latent construct of Social Sustainability is measured by four observed indicators: Ethic, Worker Well-being, Community Wellbeing, and Community Engagement. The standardized factor loadings for these indicators are 0.938, 0.949, 0.934, and 0.417, respectively, all of which are statistically significant at the $p < 0.001$ level. The latent construct explains 88.0%, 90.1%, 87.2%, and 17.4% of the variance in the respective observed indicators.

These measurement model results provide strong evidence for the validity and reliability of the constructs and their associated indicators. The high factor loadings and R-squared values suggest that the observed indicators are well-aligned with the underlying latent constructs, supporting the theoretical framework and the overall structural model.

The findings from this SEM analysis have important implications for both theory and practice. From a theoretical perspective, the study contributes to the understanding of the complex relationships between government policy, green logistics, and social sustainability in the logistics industry. Practically, the results can inform policymakers and industry stakeholders on the critical levers of government policy and green logistics practices that can be leveraged to promote more sustainable and socially responsible logistics operations.

4.3 Hypothesis test

Hypothesis 1: Adopting green logistics practices will have a positive influence on social sustainability outcomes within the logistics industry. The results support this hypothesis. The standardized path coefficient between the Green Logistics construct and the Social Sustainability construct was positive and statistically significant ($\beta = 0.821$, $p < .001$). This indicates that as logistics companies adopt more green practices, such as environmental enhancement, operational efficiency, and holistic sustainability, it leads to improved social sustainability outcomes, including worker well-being, community well-being, community engagement, and ethical practices.

Hypothesis 2: Government policies will have a positive influence on adopting green logistics practices within the logistics industry. The findings provide support for this hypothesis. The standardized path coefficient between the Government Policy construct and the Green Logistics construct was positive and statistically significant ($\beta = 0.794$, $p < .001$). This suggests that government policies, such as incentives, regulations, and infrastructure development, are effective in promoting the adoption of green logistics practices among logistics companies.

Hypothesis 3: Government policies promoting green logistics practices will have a positive influence on social sustainability outcomes within the logistics industry. The results also support this hypothesis. The standardized path coefficient between the Government Policy construct and the Social Sustainability construct was positive and statistically significant ($\beta = 0.938$, $p < .001$). This indicates that government policies that encourage the adoption of green logistics practices have a direct positive impact on improving social sustainability outcomes in the logistics industry.

Overall, the SEM analysis provides strong empirical evidence for the hypothesized relationships between government policies, green logistics practices, and social sustainability outcomes. The findings suggest that a multipronged approach, involving both governmental support and the adoption of green logistics practices, is crucial for enhancing the social sustainability of the logistics industry.

These results have important implications for policymakers, logistics companies, and supply chain stakeholders, underscoring the need for collaborative efforts to promote sustainable logistics practices and foster positive social impact within the industry.

5. DISCUSSION

The present study employed Structural Equation Modeling (SEM) to investigate the interplay between green logistics practices, social sustainability, and government policy within the logistics industry. The findings provide valuable insights into the complex relationships among these key constructs and offer important theoretical and practical implications.

5.1 Theoretical Implications

The results of this study contribute to the existing literature on sustainable logistics management by elucidating the mechanisms through which green logistics practices and government policies influence social sustainability outcomes. The strong support for the hypothesized relationships suggests

that a holistic approach, integrating both organizational practices and governmental initiatives, is crucial for enhancing the social sustainability of logistics operations.

The positive and significant relationship between green logistics practices and social sustainability outcomes aligns with the growing body of research emphasizing the importance of environmental stewardship and operational efficiency in driving positive societal impacts (Khan, 2019). This finding underscores the notion that the adoption of green logistics practices, such as environmental enhancement, operational efficiency, and holistic sustainability, can lead to tangible improvements in worker well-being, community engagement, and ethical practices within the logistics industry.

Moreover, the study's results highlight the pivotal role of government policies in promoting the adoption of green logistics practices and, consequently, enhancing social sustainability. The positive relationship between government policies and green logistics practices corroborates the existing literature on the effectiveness of policy instruments, such as incentives, regulations, and infrastructure development, in driving sustainable logistics initiatives (Evangelista et al., 2018). This finding contributes to the understanding of how strategic government interventions can serve as a catalyst for the transition towards more sustainable and socially responsible logistics operations.

The analysis revealed a positive and significant relationship between government policies and the adoption of green logistics practices ($\beta = 0.794$, $p < .001$). This finding underscores the pivotal role of government support in driving the transition towards environmentally friendly logistics operations.

More specifically, the results suggest that government policies in the form of incentives, regulations, and infrastructure development can effectively promote the adoption of green logistics practices among companies in the logistics sector.

5.2 Practical Implications

The findings of this study offer important insights for policymakers, logistics companies, and supply chain stakeholders. The empirical evidence suggests that a collaborative approach, involving both governmental support and the adoption of green logistics practices, is crucial for improving the social sustainability of the logistics industry.

For policymakers, the results underscore the need to develop and implement a comprehensive set of policy instruments that incentivize, regulate, and support the adoption of green logistics practices among logistics companies. Effective policy measures, such as tax incentives, environmental regulations, and investments in sustainable logistics infrastructure, can serve as powerful levers in driving the industry towards more socially responsible operations.

1) Role of Government Incentives:

Government incentives, such as tax credits, subsidies, or low-interest loans, can encourage logistics companies to invest in green technologies and infrastructure. These incentives can help offset the initial capital costs associated with transitioning to more sustainable practices, such as acquiring energy-efficient vehicles, implementing route optimization software, or building eco-friendly warehouses.

2) Role of Government Regulations:

Regulations play a crucial role in setting mandatory standards and creating a level playing field for sustainable logistics practices. Government policies can mandate emissions targets, impose limits on noise and air pollution levels, or require companies to adopt circular economy principles in

their operations. Stringent regulations can act as a driving force, compelling logistics companies to innovate and adopt greener practices to comply with environmental standards.

3) Role of Infrastructure Development:

Government investments in sustainable infrastructure can facilitate the smooth adoption of green logistics practices. For instance, developing alternative fuel infrastructure, such as electric vehicle charging stations or hydrogen refueling stations, can enable logistics companies to transition their fleets to cleaner transportation options. Additionally, investments in intermodal transportation hubs and efficient logistics networks can optimize supply chain operations, reducing overall environmental impacts.

Logistics companies, on the other hand, should recognize the strategic importance of aligning their operations with green logistics practices. By embracing environmental enhancement, operational efficiency, and holistic sustainability, these companies can not only contribute to improved social outcomes but also enhance their competitiveness and reputation within the industry.

Furthermore, the findings highlight the importance of cross-stakeholder collaboration and engagement. Supply chain partners, community organizations, and other relevant stakeholders should work closely with logistics companies and policymakers to identify and address the social challenges faced by the industry. This collaborative approach can facilitate the development of tailored solutions and foster a shared commitment to sustainable and socially responsible logistics practices.

5.3 Limitations and Future Research

While the present study provides valuable insights, it is not without limitations. The research was conducted in a specific geographical context, and the generalizability of the findings to other regions or industries may be limited. Future studies could expand the scope of the investigation to different countries or sectors, allowing for more comprehensive understanding of the interplay between green logistics, social sustainability, and government policy.

Additionally, this study focused on the direct relationships between the key constructs. Future research could explore the potential mediating or moderating mechanisms that may further elucidate the complex dynamics within the logistics industry. Investigating the role of organizational culture, leadership, or stakeholder engagement, for instance, may offer additional insights into the pathways through which green logistics practices and government policies influence social sustainability outcomes.

6. CONCLUSIONS

The study's findings emphasize the need for a collaborative and multifaceted approach involving both government support and organizational commitment to green logistics practices. Governments can leverage a combination of incentives, regulations, and infrastructure development to create an enabling environment that encourages and supports the logistics industry's transition towards environmental and social sustainability.

By providing financial incentives, logistics companies can overcome the initial barriers to adopting green practices, while regulations ensure a minimum level of compliance and accountability. Simultaneously, investments in sustainable infrastructure address logistical challenges and facilitate the seamless integration of green technologies and processes within the industry.

Ultimately, a synergistic effort between policymakers and logistics companies is crucial for fostering a sustainable and socially responsible logistics sector. Governments play a vital role in catalyzing this

transformation by implementing supportive policies and creating an environment conducive to the adoption of green logistics practices, which in turn can contribute to improved social sustainability outcomes.

REFERENCES

Adhikari, S., & Ozarska, B. (2018). Minimizing environmental impacts of timber products through the production process "From Sawmill to Final Products". *Environmental Systems Research, 7*(1), 6.

Bentler, P. M., & Bonett, D. G. (1980). Significance tests and goodness of fit in the analysis of covariance structures. *Psychological bulletin, 88*(3), 588.

Bollen, K. A. (1989). *Structural equations with latent variables (Vol. 210)*. John Wiley & Sons.

Browne, M. W., & Cudeck, R. (1992). *Alternative ways of assessing model fit. Sociological methods & research, 21*(2), 230-258.

Cheng, Y., Masukujjaman, M., Sobhani, F. A., Hamayun, M., & Alam, S. S. (2023). Green logistics, green human capital, and circular economy: the mediating role of sustainable production. *Sustainability, 15*(2), 1045.

Corlu, C. G., de la Torre, R., Serrano-Hernandez, A., Juan, A. A., & Faulin, J. (2020). Optimizing energy consumption in transportation: Literature review, insights, and research opportunities. *Energies, 13*(5), 1115.

Dong, Y., & Yang, T. (2022). Evolutionary game analysis of promoting the development of green logistics under government regulation. *JUSTC, 52*(9), 4-1-4-13.

Du, Y., Ge, Y., & Chang, J. (2022). Global strategies to minimize environmental impacts of ruminant production. *Annual Review of Animal Biosciences, 10*, 227-240.

Evangelista, P., Santoro, L., & Thomas, A. (2018). Environmental sustainability in third-party logistics service providers: A systematic literature review from 2000–2016. *Sustainability, 10*(5), 1627.

Fei, Y., Zhou, G., Chen, B., & Jia, Y. (2021). Resource allocation optimization in incentive policies on green supply chain. *Journal of Statistics and Management Systems, 24*(6), 1323-1338.

González-Briones, A., Prieto, J., De La Prieta, F., Herrera-Viedma, E., & Corchado, J. M. (2018). Energy optimization using a case-based reasoning strategy. *Sensors, 18*(3), 865.

Hashmi, R. (2023). Business Performance Through Government Policies, Green Purchasing, and Reverse Logistics: Business Performance and Green Supply Chain Practices. *South Asian Journal of Operations and Logistics, 2*(1), 1-10.

Hu, L. t., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural equation modeling: a multidisciplinary journal, 6*(1), 1-55.

Jayarathna, C. P., Agdas, D., & Dawes, L. (2023). Exploring sustainable logistics practices toward a circular economy: A value creation perspective. *Business Strategy and the environment, 32*(1), 704-720.

Kalubanga, M., & Mbekeka, W. (2023). Compliance with government and firm's own policy, reverse logistics practices and firm environmental performance. International Journal of Productivity and Performance Management, ahead-of-print(ahead-of-print).

Khan, S. A. R. (2019). *The Effect of Green logistics on Economic growth, Social and Environmental sustainability: An Empirical study of Developing countries in Asia*.

Khan, S. A. R., & Zhang, Y. (2021). Development of green logistics and circular economy theory. *2020 3rd International Seminar on Education Research and Social Science (ISERSS 2020)*.

Klumpp, M. (2016). To green or not to green: a political, economic and social analysis for the past failure of green logistics. *Sustainability, 8*(5), 441.

Larson, P. D. (2021). Relationships between logistics performance and aspects of sustainability: A cross-country analysis. *Sustainability, 13*(2), 623.

Leal Filho, W., Salvia, A. L., Vasconcelos, C. R. P., Anholon, R., Rampasso, I. S., Eustachio, J. H. P. P., Liakh, O., Dinis, M. A. P., Olpoc, R. C., & Bandanaa, J. (2022). Barriers to institutional social sustainability. *Sustainability Science, 17*(6), 2615-2630.

Leung, T. C. H., Guan, J., & Lau, Y.-Y. (2023). Exploring environmental sustainability and green management practices: evidence from logistics service providers. *Sustainability Accounting, Management and Policy Journal, 14*(3), 461-489.

Li, X., Sohail, S., Majeed, M. T., & Ahmad, W. (2021). Green logistics, economic growth, and environmental quality: evidence from one belt and road initiative economies. *Environmental Science and Pollution Research, 28,* 30664-30674.

Limon, M. R., Vallente, J. P. C., & Corales, N. C. T. (2020). Solid waste management beliefs and practices in rural households towards sustainable development and pro-environmental citizenship. *Global Journal of Environmental Science and Management, 6*(4), 441-456.

Ma, F., Zhang, H., Cao, H., & Hon, K. (2017). An energy consumption optimization strategy for CNC milling. *The International Journal of Advanced Manufacturing Technology, 90,* 1715-1726.

Martins, V. W. B., Anholon, R., Quelhas, O. L. G., & Leal Filho, W. (2023). Roadmap to enhance the insertion of social sustainability in logistics systems. *International Journal of Productivity and Performance Management, 72*(10), 2838-2858. https://doi.org/10.1108/IJPPM-03-2022-0132

Maurya, A. M., Padval, B., Kumar, M., & Pant, A. (2023). To Study and Explore the Adoption of Green Logistic Practices and Performance in Manufacturing Industries in India. *Management, 1*(2), 207-232.

McKinnon, A., Browne, M., Whiteing, A., & Piecyk, M. (2015). *Green logistics: Improving the environmental sustainability of logistics*. Kogan Page Publishers.

Mejías, A. M., Paz, E., & Pardo, J. E. (2016). Efficiency and sustainability through the best practices in the logistics social responsibility framework. *International Journal of Operations & Production Management, 36*(2), 164-199.

Mohammed, M., Shafiq, N., Al-Mekhlafi, A.-B. A., Rashed, E. F., Khalil, M. H., Zawawi, N. A., Muhammad, A., & Sadis, A. M. (2022). The mediating role of policy-related factors in the relationship between practice of waste generation and sustainable construction waste minimisation: PLS-SEM. *Sustainability, 14*(2), 656.

Musau, E. G. (2023). Green Logistics and Transport Processes: Mitigating the Sixth Extinction. In *Z. Fields (Ed.), Multidisciplinary Approaches in AI, Creativity, Innovation, and Green Collaboration* (pp. 252-274). IGI Global. https://doi.org/10.4018/978-1-6684-6366-6.ch013

Patra, P. K. (2018). Green logistics: Eco-friendly measure in supply-chain. *Management Insight, 14*(1), 65-71.

Piecyk, M. I., & Björklund, M. (2015). Logistics service providers and corporate social responsibility: sustainability reporting in the logistics industry. *International Journal of Physical Distribution & Logistics Management, 45*(5), 459-485.

Pradeep, A., & Alisherova, Z. (2023, 9-10 March 2023). Green Logistics and E-commerce. *2023 International Conference on Computational Intelligence and Knowledge Economy (ICCIKE)*.

Prataviera, L. B., Creazza, A., & Perotti, S. (2023). A call to action: a stakeholder analysis of green logistics practices. The international journal of logistics management, 35(3), 979-1008.

Prieto, L., Amin, M. R., & Canatay, A. (2022). Examining social sustainability in organizations. *Sustainability, 14*(19), 12111.

Rasheed, T. (2022). Supply chain sustainability through green practices in manufacturing: a case study from Pakistan: supply chain sustainability. *South Asian Journal of Operations and Logistics, 1*(1), 57-71.

Reyna-Castillo, M., Vera Martínez, P. S., Farah-Simón, L., & Simón, N. (2023). Social sustainability orientation and supply chain performance in Mexico, Colombia and Chile: a social-resource-based view (SRBV). *Sustainability, 15*(4), 3751.

Shi, W., Zhang, M., Wang, N., & Jiang, B. (2022). Green Logistics. In *Enterprises' Green Growth Model and Value Chain Reconstruction: Theory and Method* (pp. 271-302). Springer Nature Singapore.

Tianqi, L., Pertheban, T. R., & Gao, X. (2023). *Driving Environmental Sustainability and Supply Chain Competitiveness through Green Logistics Management*.

Usmani, Z., Sharma, M., Awasthi, A. K., Sivakumar, N., Lukk, T., Pecoraro, L., Thakur, V. K., Roberts, D., Newbold, J., & Gupta, V. K. (2021). Bioprocessing of waste biomass for sustainable product development and minimizing environmental impact. *Bioresource Technology*, *322*, 124548.