http://dx.doi.org/10.18623/rvd.v23.6249

RESEARCH ON THE IMPACT OF CUSTOMER PRESSURE AND GREEN PERCEPTION ON GREEN INNOVATION: AN EMPIRICAL STUDY IN VIETNAM

PESQUISA SOBRE O IMPACTO DA PRESSÃO DOS CLIENTES E DA PERCEPÇÃO ECOLÓGICA NA INOVAÇÃO ECOLÓGICA: UM ESTUDO EMPÍRICO NO VIETNÃ

Article received on: 1/15/2026
Article accepted on: 4/16/2026

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The authors declare that there is no conflict of interest

Abstract
This study aims to evaluate the impact of customer pressure and green perception on green innovation within logistics enterprises in Vietnam, through the mediating role of knowledge sharing. Data were collected from logistics companies operating in Vietnam using a questionnaire - based survey method. The research model was tested using Structural Equation Modeling. The results indicate that both customer pressure and green perception have a positive impact on knowledge sharing within the organization. Furthermore, knowledge sharing significantly influences green innovation. These findings imply that the combination of external market pressures and internal strategic perceptions can drive enterprises to implement green innovation through the internal mechanism of knowledge sharing. Based on these results, the study proposes managerial implications to help logistics firms enhance their green innovation capabilities towards sustainable development.

Resumo
Este estudo tem como objetivo avaliar o impacto da pressão dos clientes e da percepção ecológica na inovação verde dentro de empresas de logística no Vietnã, por meio do papel mediador do compartilhamento de conhecimento. Os dados foram coletados de empresas de logística que operam no Vietnã utilizando um método de pesquisa baseado em questionário. O modelo de pesquisa foi testado utilizando a Modelagem de Equações Estruturais. Os resultados indicam que tanto a pressão dos clientes quanto a percepção ecológica têm um impacto positivo no compartilhamento de conhecimento dentro da organização. Além disso, o compartilhamento de conhecimento influencia significativamente a inovação verde. Essas descobertas implicam que a combinação de pressões de mercado externas e percepções estratégicas internas pode levar as empresas a implementar a inovação verde através do mecanismo interno de compartilhamento de conhecimento. Com base nesses resultados, o estudo propõe implicações gerenciais para ajudar as empresas de logística

Keywords: Pressure. Green Perception. Customers. Knowledge Sharing. Green Innovation. Logistics Services.

Palavras-chave: *Pressão. Percepção Ecológica. Clientes. Compartilhamento de Conhecimento. Inovação Verde. Serviços de Logística.*

a aumentar suas capacidades de inovação verde em direção ao desenvolvimento sustentável.

1 INTRODUCTION

In the context of climate change and the increasingly urgent requirements for sustainable development, logistics is considered one of the industries with a significant environmental impact due to its association with transportation, warehousing, and distribution activities. Statistical insights from the 2024 Vietnam logistics report by the Ministry of Industry and Trade reveal that the logistics industry accounts for roughly 4-5% of the national economic output and maintained an average growth rate of 14-16% per year during the 2018- 2023 period. This rapid development, particularly in major metropolitan areas like Hanoi, Hai Phong, Da Nang, Ho Chi Minh city has brought about increasing pressure regarding energy consumption, greenhouse gas emissions, and environmental pollution. This creates an urgent demand for logistics service providers to transition toward sustainable and environmentally friendly operational models.

In this light, green innovation is seen as a key strategic solution to help logistics enterprises improve environmental efficiency while enhancing long term competitiveness. Green innovation in logistics encompasses not only the adoption of low emission vehicles or the use of renewable energy in warehouses but also involves redesigning service processes, optimizing routes, and digitizing operations to reduce resource consumption and emissions. International studies have indicated that green innovation helps logistics firms improve operational efficiency, strengthen brand image, and increase their ability to meet stakeholder requirements, especially those of customers (Chu *et al.*, 2019).

One of the vital drivers of green innovation is customer pressure. In the context of globalization and deep integration, customers particularly multinational corporations and large enterprises increasingly impose strict environmental standards on logistics service providers. This pressure is manifested through requirements for carbon emission

reduction, environmental information transparency, and compliance with international standards for green logistics and sustainable development. A vast body of literature indicates that the execution of eco-friendly innovations within the logistics sector is favorably driven by market based requirements from clients (Chu *et al.*, 2019). This connection, however, is often shaped by various intra-organizational elements, including the firm's unique culture. In support of this view, previous research highlights that for businesses operating in developing markets, the environmental standards set by customers represent a primary motivator for integrating sustainable supply chain and logistics operations (Geng *et al.*, 2024).

Nevertheless, practical data in Vietnam reveals a notable discrepancy between the level of environmental consciousness and the actual implementation of sustainable practices within the logistics industry. According to a public survey by the Vietnam Logistics research and development institute, while up to 87.5% of logistics enterprises reported being aware of the importance of sustainable development and have directions to transition to green logistics, only about 34.37% have implemented or are implementing specific measures to reduce environmental impacts, while 65.63% have yet to take clear action. This reality suggests that pressure from customers and the market has not been fully translated into green innovation decisions within logistics firms.

A critical factor explaining this gap is corporate green perception. Green perception reflects the level of understanding, concern, and commitment of an enterprise toward environmental issues during decision making and business implementation. Enterprises with high green perception often proactively integrate environmental factors into their development strategies, thereby effectively and sustainably promoting the adoption of green innovation solutions. Research indicates that green perception plays a foundational role in guiding firm behavior and decisions related to innovation and sustainable development (Nguyen Thi & Vu Dinh, 2025).

In addition to customer pressure and green perception, knowledge sharing is increasingly recognized as a fundamental factor supporting the effective implementation of green innovation. According to knowledge-based theory, knowledge only truly creates value when it is shared, combined, and applied within an organization (Grant, 1996). For logistics service providers, sharing knowledge related to customer environmental requirements, green operational technologies, and practical experiences helps enhance

adaptability and innovation in an increasingly competitive landscape. Nevertheless, current academic studies have yet to comprehensively explain how information exchange functions as a bridge, linking external demands and internal ecological awareness to sustainable innovation outcomes.

Based on an overview of existing research, several notable research gaps exist. First, most green innovation studies focus on the manufacturing sector or focal firms in the supply chain, while logistics service providers have not received adequate attention, especially in the context of developing economies (Zhu & Sarkis, 2004; Zhu *et al.*, 2008). Second, the simultaneous relationship between customer pressure, green perception, knowledge sharing, and green innovation is rarely considered within a single integrated research model (Chu *et al.*, 2019; Geng *et al.*, 2024; Song *et al.*, 2020).Third, there is a lack of empirical evidence in developing countries like Vietnam, where specific logistics density, infrastructure, and environmental requirements create unique challenges for green innovation implementation (Geng *et al.*, 2024).

Stemming from these gaps, this study aims to analyze the influence of customer pressure and green perception on green innovation among logistics service providers in Vietnam. By combining theoretical frameworks with empirical data from enterprises and public reports, the study expects to Enrich the theoretical landscape green innovation theory in the logistics sector while providing managerial and policy implications to promote sustainable logistics development in Vietnam.

2 THEORETICAL FRAMEWORK

2.1 Related theories

This study is built upon an integrated foundation of institutional theory, stakeholder theory, and the Resource Based View (RBV) to explain the external and internal drivers of green innovation behavior in logistics enterprises.

The fundamental premise of stakeholder theory is that for an organization to remain legitimate, it must harmonize and satisfy the diverse needs of various actors, including end-users, vendors, and government authorities, and the community, to maintain legitimacy and long term operational efficiency (Freeman, 2010). In the context

of green innovation, customers are identified as one of the key stakeholders that exert pressure and orient the environmental behavior of logistics firms. This theory helps explain why customer pressure and orientation can drive enterprises to invest in knowledge sharing and implement green innovation activities to satisfy stakeholder expectations. From the perspective of stakeholder theory, customers are a vital interest group capable of directly influencing strategic orientation as well as decisions related to investment and the implementation of green innovation (Freeman, 2010). According to institutional theory, customer pressure is viewed as a form of normative pressure, forcing firms to adjust their operations to achieve legitimacy and maintain market position (DiMaggio & Powell, 1983). Moreover, regarding internal aspects, this study also applies the resource based view to clarify the role of green perception as a crucial intangible resource within the firm. Green perception reflects the level of understanding and commitment of the enterprise toward environmental issues. Firms possessing high levels of green perception tend to proactively integrate environmental factors into their development strategies, thereby enhancing their ability to effectively implement green innovation initiatives (Grant, 1996).

2.2 Construct

2.2.1 Green innovation

Green innovation is characterized as the creation or enhancement of corporate procedures, technical systems, and management strategies aimed at reducing a firm's impact on the environment (Rennings, 2000). Green innovation not only helps firms improve environmental efficiency but also creates economic value and long-term competitive advantage (Chen *et al.*, 2006). In the context of logistics and supply chain management, green innovation is manifested through the adoption of clean transportation solutions, network optimization, energy conservation, and carbon emission reduction. Thus, green innovation is regarded as a vital strategy helping logistics firms adapt to market pressures and escalating sustainability requirements (Nguyen, Lei, Vu, & Le, 2019).

2.2.2 Customer pressure

Customer pressure is understood as a form of normative pressure within the framework of institutional theory, reflecting the extent to which a firm is influenced by customer expectations, requirements, and standards regarding behavior and performance outcomes (DiMaggio & Powell, 1983; Zhu & Sarkis, 2007). In supply chain and logistics management, customer pressure often manifests through requirements for service quality and cost, as well as increasingly through criteria related to the environment and sustainable development (Zhu & Sarkis, 2004). Subsequent studies have expanded this concept by viewing customer pressure as an exogenous driver that motivates firms to align their strategies and implement green innovation practices to maintain legitimacy and competitive advantage (Chu *et al.*, 2019; Zhu *et al.*, 2008). As customers demand higher standards for green logistics services, firms are compelled to strengthen the sharing of information, experience, and specialized knowledge across departments to seek appropriate solutions (Chen, 2013; DiMaggio & Powell, 1983; Huang & Li, 2017). Consequently, the study proposes hypothesis H1:

H1: Customer pressure has a positive impact on knowledge sharing.

2.2.3 Green perception

Corporate green perception is defined as the degree to which an enterprise recognizes, cares for, and commits to environmental issues during the decision-making and operational implementation processes. This concept reflects not only an understanding of the environmental impact of logistics activities but also the proactive attitude of the firm toward sustainable development (Chen, 2013). Following a behavioral approach, green perception serves as an orientation for specific corporate actions by integrating environmental factors into operational processes, strategies, and service innovation (Chen & Chang, 2013). In the logistics and supply chain management industry, green perception is increasingly becoming a key factor driving firms to transition toward environmentally friendly operational models.

Previous studies have shown that green perception positively influences the implementation of green innovation activities by increasing corporate commitment to

environmental and sustainable development goals (Song *et al.*, 2020). Given that logistics enterprises in developing countries are facing mounting environmental pressure, green perception is expected to play a significant role in fostering green innovation initiatives (Zailani, Jumadi, 2011). Therefore, hypothesis H2 is proposed:

H2: Green perception has a positive impact on knowledge sharing.

2.2.4 Knowledge sharing

The concept of disseminating expertise is rooted in the knowledge based view (KBV), a theoretical perspective that regards intellectual assets as the primary strategic foundation for achieving long-term market superiority (Grant, 1996). This practice is defined as a collaborative mechanism where members and functional units of a company distribute and utilize their collective insights to enhance organizational performance and strategic choices. Within the logistics and supply chain sector, the exchange of information is essential for spreading technical know-how and operational standards derived from stakeholders, particularly concerning the effectiveness of eco-innovation initiatives (Nonaka, 2009; Nguyen Thi & Vu Dinh, 2025). In logistics and supply chain management, knowledge sharing plays a pivotal role in disseminating information about technologies, processes, and requirements from customers and partners (Huang & Li, 2017; Wainstein *et al.*, 2019) regarding green innovation efficiency. Additionally, knowledge sharing is considered an essential foundation for fostering organizational learning and enhancing innovation capabilities, including green innovation (Xie *et al.*, 2019). Accordingly, hypotheses H3, H4, and H5 are proposed:

H3: Knowledge sharing has a positive impact on green innovation.

H4: Knowledge sharing plays a mediating role in the relationship between customer pressure and green innovation.

H5: Knowledge sharing plays a mediating role in the relationship between green perception and green innovation.

3 METHODOLOGY

3.1 Measurement

Based on a comprehensive review of relevant literature in the field, the authors developed a research model and adopted measurement scales from previous studies. Specifically: (1) Customer pressure (AL) is measured by 5 items (AL1, AL2, AL3, AL4, AL5) generated by DiMaggio & Powell, (1983) and Zhu & Sarkis, 2007; (2) green perception (NT) is measured by 5 items (NT1, NT2, NT3, NT4, Nt5) adopted from Chen (2013); (3) knowledge sharing (CS) is measured by 5 items (CS1, CS2, CS3, CS4, CS5) adopted from Song *et al.*, (2020) and (4) green innovation (DM) is measured by 5 items (DM1, DM2, DM3, DM4, DM5) adopted from Chen & Chang, (2013) and Xie *et al.*, (2019).

3.2 Sampling

To investigate the factors influencing eco-friendly practices, this research utilizes a quantitative methodological approach to analyze the key drivers of green innovation among logistics service providers operating in Hanoi, Hai Phong, Da Nang, and Ho Chi Minh city. The target population comprises directors, operations managers, and department heads who possess sufficient knowledge of their firms' strategic orientation, environmental practices, and innovation activities. Focusing on this group is consistent with prior studies, which suggests that senior and middle managers are well-positioned to provide reliable assessments of organizational capabilities and external pressures. Data were collected using a structured survey instrument administered through a combination of online and email based distribution channels. Specifically, the research instrument was developed using a web based survey platform and sent to participants through electronic mailing lists to ensure efficient and broad outreach. This approach not only improved response accessibility but also helped reduce item non response, as the digital format required completion of key questions before submission. The use of mixed electronic distribution channels is widely supported in recent methodological literature as an effective means of enhancing response rates and data quality in organizational research.

Prior to the official survey, the questionnaire was developed through a two-stage-process. In the first stage, a preliminary questionnaire was sent to 10 experts in the fields of innovation and logistics to evaluate its clarity, logic, and content validity, ensuring its suitability for the research subjects. Their feedback was utilized to refine the language and layout of the instrument to better fit the specific research context of logistics service providers in Vietnam. In the second stage, a pilot test was conducted with 10 business managers to ensure its appropriateness before the official data collection began.

The research team collaborated with the Vietnam Logistics Association to access member enterprises and distribute the survey. The official survey was conducted for two months. At the end of the collection period, a total of 200 responses were retrieved, of which 166 valid responses were utilized for analysis. Responses that were incomplete or showed signs of random answering were excluded from the dataset.

The collected data were processed using SPSS 26 and AMOS 20 software. These tools were employed for scale reliability testing, exploratory factor analysis (EFA), confirmatory factor analysis (CFA), and hypothesis testing.

4 RESULTS AND DISCUSSIONS

4.1 Descriptive statistics

The descriptive results are presented in table 1. Regarding the scale of labor, the group of enterprises with fewer than 50 employees accounts for the largest proportion at 48.80%, indicating that the majority of logistics enterprises in the research sample are small-scale. The group with 50 to under 100 employees accounts for 36.75%, while the group with over 100 employees represents the lowest proportion at 14.46%. This reflects the common characteristic of the logistics industry in Vietnam, where small and medium-sized enterprises (SMEs) still predominate.

Table 1

Descriptive statistics of the study sample

Group Category	**Indicator**	**Quantity**	**Percentage**
	Under 10 years	97	58.43%

Years of operation	From 10 to under 20 years	67	40.36%
	Over 20 years	2	1.20%
Type of service	International freight forwarding and transportation	32	19.28%
	Warehousing and distribution	38	22.89%
	Domestic transportation	43	25.90%
	Integrated logistics services (3PL/4PL)	40	24.10%
	Other services	13	7.83%
Number of employees	Under 50 employees	81	48.80%
	From 50 to under 100 employees	61	36.75%
	Over 100 employees	24	14.46%

Source: Compiled by the authors

In terms of service types, the enterprises in the research sample are relatively evenly distributed across different service groups. Among them, domestic transportation accounts for the highest rate at 25.90%, followed by integrated logistics services (3PL/4PL) at 24.10%, and warehousing and distribution at 22.89%. International freight forwarding services account for 19.28%, while other services represent the lowest rate at 7.83%. This distribution demonstrates that logistics activities in Vietnam are quite diverse, with services related to transportation and supply chain integration playing a leading role.

4.2 Measurement model

4.2.1 Scale reliability

According to the reliability test, every construct demonstrated a Cronbach's Alpha value exceeding the 0.7 threshold. Furthermore, since the corrected item-total correlation for each item stayed above 0.3, the measurement scales are deemed internally consistent and suitable for further exploratory and confirmatory factor analysis.

Table 2

KMO Coefficient and Bartlett's Test Results

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.865
Bartlett's Test of Sphericity	Approx. Chi-Square	682 5.291
	Df	182
	Sig.	.000

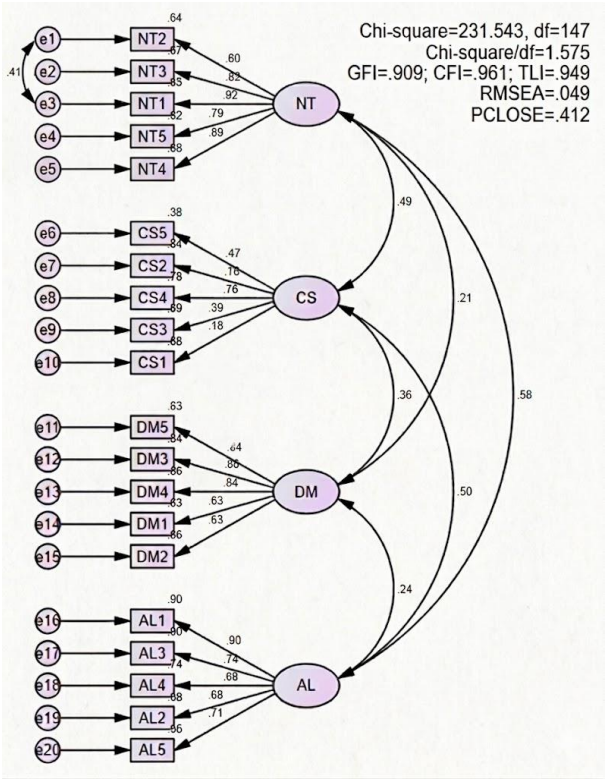
Source: Data processing results by the authors

The KMO coefficient = 0.865 > 0.5, which meets the requirement, indicating that factor analysis is appropriate. The Sig. value of Bartlett's Test = 0.000 < 0.05, showing that Bartlett's test is statistically significant and that the observed variables are correlated. Consequently, there is a correlation among the observed variables in the population, and exploratory factor analysis (EFA) is deemed suitable. The results are presented in table 2.

4.2.2 Confirmatory factor analysis (CFA)

Figure 1

Results of CFA for the measurement scales



Source: Data analysis results

The results of the confirmatory factor analysis (CFA) indicate that the saturated model is standardized (figure 1). The model fit indices, including Chi-square/df = 1.575 < 3, TLI = 0.949 > 0.8, CFI = 0.961 > 0.9, GFI = 0.909 > 0.8, and RMSEA = 0.049 < 0.08, all meet the required thresholds. Consequently, the CFA results ensure the necessary level of significance, and the measurement scales demonstrate reliable performance.

4.3 Testing hypotheses

4.3.1 Model fit testing

The structural model yielded the following fit indices: Chi-square/df = 1.531 < 3, TLI = 0.902 ≥ 0.8, CFI = 0.955 > 0.9, GFI = 0.895 > 0.8, and RMSEA = 0.048 < 0.08. All indicators meet the established requirements; therefore, the model demonstrates a good fit with the market data.

4.3.2 Hypothesis testing results

Table 3

Results of direct effects

Hypotheses	Estimate	S.E.	C.R.	P	Decision
AL->CS	0,321	0,082	3,832	***	accepted
NT->CS	0,425	0,091	4,513	***	accepted
CS->DM	0,362	0,083	4,121	***	accepted

Note: * = P < 0.05; *** = P < 0.001
Source: Data analysis results

The results of direct effects presented in Table 3 indicate that the majority of the hypotheses are supported with high statistical significance. Specifically, hypothesis H1 shows that customer pressure has a positive impact on knowledge sharing within the enterprise (Estimate = 0.321; C.R. = 3.832; P < 0.001); therefore, hypothesis H1 is accepted. This result suggests that when enterprises face increasing pressure from customers regarding environmental issues and social responsibility, they tend to enhance internal exchange and knowledge sharing to meet those requirements.

Similarly, hypothesis H2 is also accepted as green perception has a positive influence on knowledge sharing (Estimate = 0.425; C.R. = 4.513; P < 0.001). This result affirms that enterprises with high levels of awareness regarding environmental issues will be more proactive in integrating green factors into their strategies and business activities, thereby effectively promoting green innovation initiatives.

For hypothesis H3, the analysis results show that knowledge sharing has a positive and statistically significant impact on green innovation (Estimate = 0.362; C.R. = 4.121; P < 0.001). This result confirms the critical role of knowledge sharing in fostering innovation activities toward environmental friendliness within the enterprise.

Mediating variable testing results. To test the mediating role (hypotheses H4 and H5), the study applies the bootstrapping method as recommended. The conditions to establish a mediating role include: (i) the independent variables have a statistically significant influence on the mediating variable, and (ii) the mediating variable has a significant influence on the dependent variable. The mediating role is confirmed when the indirect effect reaches statistical significance. The testing results are presented in Table 4.

Table 4

Results of testing the mediating role of knowledge sharing

Indirect Relationship	**Standardized Estimate**	**P**	**Confidence**		**Result**
			Lower	***Upper***	
H4: AL->CS->DM	0,085	0,000	0,032	0,221	accepted
H5: NT->CS->DM	0,164	0,000	0,002	0,272	accepted

Source: Data analysis results

Specifically, the indirect relationship between AL and DM through CS (AL → CS → DM) shows a standardized estimate coefficient of 0.085, with a p-value of 0.000 < 0.05. This indicates that the indirect effect of AL on DM through knowledge sharing is statistically significant; therefore, Hypothesis H4 is accepted.

Similarly, the indirect relationship between NT and DM through CS (NT → CS → DM) has a standardized estimate coefficient of 0.164, with a p-value of 0.000 < 0.05, indicating statistical significance. In addition, the 95% confidence interval does not include the value 0, confirming the existence of an indirect effect. Therefore, Hypothesis H5 is also accepted.

Overall, these results indicate that knowledge sharing (CS) plays a statistically significant mediating role in both research relationships. Although the magnitude of the indirect effects is not large, all effects are positive, helping to clarify the mechanism through which AL and NT influence DM via knowledge sharing.

5 DISSCUSSION AND CONCLUSION

This research was conducted with the primary goal of investigating the extent to which market-driven environmental demands and internal ecological mindfulness influence sustainable transformation among Vietnamese logistics firms. Drawing on a sample of firms operating in a rapidly developing urban context, the findings demonstrate that both external stakeholder pressure and internally embedded environmental awareness exert significant and positive influences on firms' green innovation activities. These results provide a coherent empirical account of how market driven and capability based factors jointly contribute to environmentally oriented innovation outcomes in the logistics sector. Consistent with existing literature within institutional and stakeholder frameworks, these results confirm that external environmental expectations from clients act as a key driver for implementing sustainable transformations, which emphasise the role of external demands in shaping corporate environmental strategies (Hanim *et al.*, 2012; Osei & Cobbinah, 2026). In line with these studies, the findings suggest that increasingly stringent customer expectations regarding environmental performance act as a catalyst for firms to adopt greener technologies and practices. However, unlike some earlier studies that report indirect or mediated pathways (e.g., through organizational learning or regulatory alignment), the present study finds a direct and robust relationship. This divergence may be explained by the specific characteristics of logistics enterprises in emerging economies, where competitive pressures are immediate and resource constraints necessitate more straightforward strategic responses rather than complex capability-building processes.

Similarly, the significant role of green awareness corroborates arguments from the resource based view and dynamic capabilities theory, which posit that intangible internal resources such as environmental commitment and managerial cognition are critical drivers of innovation (Liboni at al, 2023; Sadenova at et, 2026). The findings are

consistent with empirical evidence reported by Chen *et al.*, (2006) and Tseng & Chen (2019) who highlight the importance of environmental orientation in fostering green innovation. Notably, this study extends these insights by demonstrating that, within the logistics sector, green awareness not only complements but may independently stimulate innovation activities without requiring intermediary mechanisms. This nuance adds depth to the existing literature, suggesting that in contexts where formal environmental systems are still evolving, cognitive and attitudinal factors may play a more immediate and decisive role.

From a theoretical standpoint, this study contributes to the literature by integrating stakeholder theory, institutional theory, and the resource based view into a unified analytical framework. By empirically validating the simultaneous effects of external pressure and internal awareness, the research advances current understanding of how multiple theoretical lenses can be combined to explain green innovation in service-oriented industries. Moreover, the study enriches the relatively limited body of knowledge on logistics enterprises in developing economies, a context that has received less scholarly attention compared to manufacturing sectors or firms in developed countries.

From a practical perspective, the findings offer actionable implications for managers and policymakers. For logistics firms, the results underscore the importance of proactively responding to customer expectations while simultaneously fostering an internal culture of environmental responsibility. Investments in employee training, awareness building programs, and sustainability oriented leadership may therefore be instrumental in enhancing innovation outcomes. For policymakers, the evidence suggests that policies aimed at increasing market transparency and encouraging environmentally conscious consumption could indirectly stimulate green innovation by intensifying customer pressure.

While this research offers valuable insights, certain constraints must be recognized. Due to the cross-sectional nature of the study, it is challenging to track the temporal evolution of market pressures, ecological mindfulness, and innovative actions. Moreover, because the data collection was concentrated in major Vietnamese hubs like Hanoi, Hai Phong, Da Nang, and Ho Chi Minh City, applying these results to different regions with unique market and institutional environments may be difficult. Lastly, since

the study utilized self-reported information from managerial staff, the potential for common method bias cannot be entirely ruled out, despite the rigorous reliability assessments performed.

Future research could address these limitations by employing longitudinal or panel data to better capture causal dynamics and temporal variations. Expanding the empirical setting to include multiple regions or conducting cross-country comparisons would also enhance the external validity of the findings. In addition, incorporating moderating variables such as technological capability, organizational culture, or regulatory support could provide a more nuanced understanding of the boundary conditions under which customer pressure and green awareness translate into green innovation. Such extensions would not only refine theoretical insights but also offer more targeted guidance for practitioners seeking to advance sustainable innovation in the logistics industry.

ACKNOWLEDGEMENTS

This research is funded by Hanoi University of Industry under Contract no. 69-2025-RD/HĐ-ĐHCN. The authors would like to express their gratitude to the university for providing the financial support and resources necessary to conduct this study.

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