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Impact of green innovation, green trade barriers, and export performance of Vietnamese enterprises

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ABSTRACT
This study examines the impact of green innovation and green trade barriers on the export performance of Vietnamese enterprises in the context of international trade increasingly emphasizing sustainability. The empirical findings indicate that green innovation exerts a positive influence by enhancing competitiveness, optimizing production processes, and facilitating access to international markets with stringent environmental standards. In contrast, green trade barriers demonstrate a negative effect on export performance by increasing compliance costs and limiting participation in global supply chains. However, when firms proactively implement green innovation practices, these adverse impacts are substantially mitigated and may even be transformed into competitive advantages. The results highlight the central role of green innovation as a long-term strategy that enables Vietnamese exporters not only to overcome challenges posed by green trade barriers but also to seize opportunities for sustainable growth in the global trading environment.
Keywords: Green innovation, green trade barriers, export performance, Vietnamese enterprises, sustainable trade.

1. INTRODUCTION:

In the context of globalization and deepening international economic integration, exports serve as a cornerstone for stimulating sustainable economic growth and development across nations (Zhang, 2022). However, the global trend toward sustainable development, coupled with the proliferation of stringent environmental regulations, has introduced significant new challenges to export activities, primarily through the emergence and expansion of green barriers. These barriers not only exert pressure on compliance costs but also redefine the competitive dynamics for enterprises in the international market (Vu Thi Thanh Huyen, 2022; Nguyen Thi Thu Hien, 2023). In this landscape, green innovation has emerged as an imperative and a strategic orientation for firms to both adapt and thrive (Vu Thi Anh Thu, 2025). It facilitates the transformation of pressures from green barriers into catalysts for enhancing product quality, advancing technological capabilities, and fostering sustainable growth.

Green barriers typically encompass technical regulations, environmental standards, and trade policies designed to minimize the negative ecological impacts of production. Extant research indicates that, on one hand, these regulations may increase production costs and diminish export competitiveness in the short term (Liu et al., 2023; Zhao and Shuxian, 2025). On the other hand, they can function as a driver for green innovation, compelling enterprises to refine processes, upgrade product quality, and thereby consolidate competitive advantages in global markets. Specifically, green innovation can neutralize the adverse effects of green barriers by encouraging the adoption of cleaner technologies and the attainment of international environmental certifications, which in turn strengthens global market access (Zhang, 2022). Consequently, the impact of green barriers on corporate export activities is dual-faceted, presenting both challenges and opportunities.

In Vietnam, exporting is both a primary engine of economic growth and a vital channel for integration into global value chains. This is evidenced by the commodity export turnover in 2024, which reached USD 405.53 billion—a 14.3% increase over the previous year—significantly contributing to national economic expansion (General Statistics Office, 2025). Nevertheless, many Vietnamese exporters are facing escalating green barriers from demanding import markets such as the European Union (EU) and the United States. Requirements concerning carbon emission reductions, the use of recycled materials, compliance with eco-friendly production processes, and the acquisition of international eco-labels are becoming mandatory prerequisites. This reality creates substantial pressure regarding costs, technology, and governance, while simultaneously necessitating urgent green innovation to maintain competitive positioning.

Against this backdrop, the present study is conducted to analyze the impact of green barriers on green innovation and the export performance of Vietnamese enterprises. Specifically, the research adopts a dual approach: (i) examining green barriers as restrictive factors that hinder export activities, and (ii) exploring green innovation as a mechanism to overcome these barriers and enhance the export outcomes of Vietnamese firms. The findings are expected not only to contribute empirical evidence to the theoretical discourse on the relationship between green barriers, green innovation, and export efficiency but also

to offer significant practical implications for policy formulation. These insights will support Vietnamese enterprises in effectively adapting to global environmental regulations while leveraging opportunities for sustainable development and heightened international competitiveness.

2. LITERATURE REVIEW

2.2. Green Export Barriers and Export Performance

Green export barriers are defined as obstacles established by importing countries to regulate the environmental impact of products and production processes (Liu et al., 2023; Zhao and Gao, 2025). As a form of non-tariff barrier, they are typically manifested through stringent environmental standards, eco-certification requirements, emission regulations, recycled material content ratios, or eco-friendly manufacturing protocols. Unlike traditional trade protection instruments, green export barriers are constructed under the guise of protecting natural resources, human health, and ecosystems. However, in practice, they can impose significant challenges on exporting firms, particularly those from developing economies. The essence of these barriers extends beyond mere compliance; they represent a transfer of environmental responsibility from importing nations to exporting enterprises, thereby reshaping the "rules of the game" in modern international trade (Zhang, 2022; Zhao and Gao, 2025).

Green barriers adversely affect corporate export performance, especially in export-intensive developing economies. On one hand, rigorous environmental standards impede access to international markets, placing exporting firms at risk of being excluded from global supply chains or restricted from key markets if they fail to meet "green" requirements (Liu et al., 2023). Furthermore, compliance with these regulations significantly increases production and operational costs, as enterprises are compelled to make substantial investments in clean technology, process improvements, or the attainment of international certifications. These incremental costs not only erode profitability but also diminish price competitiveness, making it increasingly difficult for exported products to maintain their market share internationally (Zhao and Gao, 2025). Additionally, the continuous and unpredictable fluctuations in global environmental policies heighten uncertainty in international trade, which may lead to fragmented and inefficient investments, or even stifle the impetus for green innovation (Zhang, 2022). Heterogeneous environmental regulations across different countries further trigger trade conflicts, adding layers of risk to a firm's export activities. Based on the aforementioned analysis, the first hypothesis is proposed:

Hypothesis H1: *Green export barriers have a negative impact on the export performance of enterprises.*

2.2. Green Innovation and Corporate Export Performance

Green innovation (GI) is defined as the process of developing and implementing technologies, products, or production processes designed to optimize natural resource utilization while minimizing adverse environmental impacts (Liu et al., 2024; Hameed et al., 2024). In academic discourse, GI is often used interchangeably with terms such as "eco-innovation," "environmental innovation," or "sustainable innovation" (Zhang, 2022; Liu et al., 2024). Regarding its classification, GI is generally categorized into two primary types: green product innovation and green process innovation (Hojnik and Ruzzier, 2016). Green product innovation focuses on designing and supplying eco-friendly products and services, thereby mitigating pollution at the consumption stage. Conversely, green process innovation involves the adoption of cleaner production technologies, emission reductions during manufacturing, or the implementation of post-generation waste treatment measures. Recent studies further distinguish between high-quality GI and strategic GI, where high-quality innovation reflects the application of advanced technologies that yield sustainable environmental benefits, while strategic innovation aims to bolster long-term competitive advantages (Hojnik and Ruzzier, 2016; Rezende et al., 2019). Consequently, GI is not merely a technical solution but a strategic orientation that aligns economic and environmental objectives within a firm's business strategy.

In the current era of sustainable development, the Porter Hypothesis suggests that green innovation can exert a positive influence on financial performance and overall export outcomes (Liu et al., 2024). Specifically, production processes optimized through cleaner technologies help reduce raw material waste, save costs, and enhance resource efficiency, thereby strengthening price competitiveness in international markets. Furthermore, enterprises adopting GI can avoid environmental non-compliance penalties and reduce long-term operational costs associated with environmental remediation, particularly in foreign jurisdictions. More importantly, GI enables firms to satisfy the stringent environmental import standards of major export markets such as the EU, the US, and Japan, which demand certifications for recycling, emission reductions, or the use of sustainable materials.

Overall, GI not only assists firms in expanding their export markets but also fosters differentiation, enhances brand value, and attracts environmentally conscious consumers. The significant shift in global consumer awareness toward sustainable consumption has transformed GI into a core competitive advantage, enabling enterprises to capture market share, increase revenue, and achieve higher value-added (Rezende et al., 2019). Supporting this perspective, the study proposes the following hypothesis:

Hypothesis H2: *Green innovation has a positive impact on the export performance of enterprises.*

2.3. The Relationship between Green Barriers, Green Innovation, and Export Performance

In the landscape of international trade, where sustainability is increasingly prioritized, green barriers have emerged as a mechanism that both regulates environmental impacts and reshapes corporate export strategies. According to the Porter Hypothesis, stringent environmental regulations do not merely impose compliance requirements but also create positive pressure

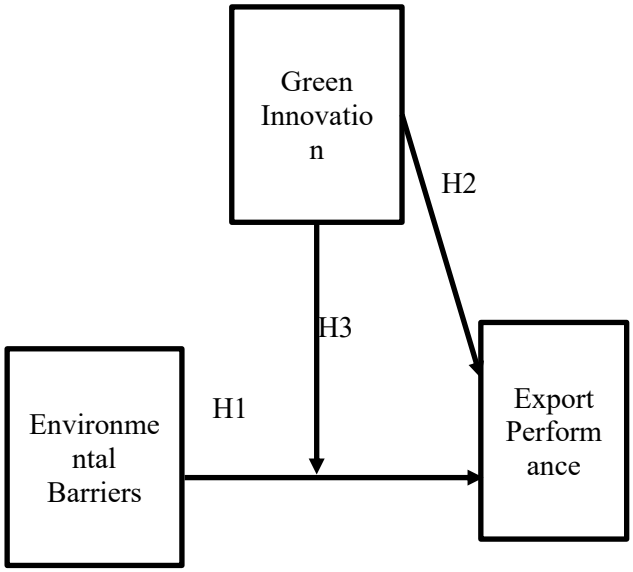
that stimulates green innovation. Numerous empirical studies confirm that when faced with rigorous environmental standards, firms tend to upgrade their technology, adopt eco-friendly production processes, and develop green products, thereby improving commodity quality and expanding their export reach (Zhang, 2022). Thus, green barriers are not only restrictive but also serve as a strategic driver, encouraging enterprises to enhance their innovative capacity and consolidate their international competitive edge.

On this basis, green innovation plays a pivotal role in moderating the impact of green barriers, helping firms transform compliance pressure into opportunities for enhanced export performance. By investing in clean technology, optimizing production processes, and obtaining international eco-certifications, enterprises not only meet demanding market requirements but also increase product value-added, differentiate their brands, and reach environmentally conscious customer segments. GI also helps firms mitigate the risk of being excluded from global supply chains, facilitates market expansion into developed nations, and provides a foundation for sustainable export growth. It can be affirmed that green innovation acts as a "bridge" that transforms green barriers from a challenge into a catalyst, ensuring favorable export outcomes and reinforcing long-term competitiveness. From this viewpoint, the study proposes the third hypothesis:

Hypothesis H3: *Green innovation positively moderates the impact of environmental barriers on the export performance of enterprises.*

Based on the theoretical frameworks analyzed above, the study proposes the following research model:

Figure 1. Research Model



3. METHODOLOGY

To test the proposed conceptual model and hypotheses, this study employs a **quantitative research design**, which is considered highly appropriate for assessing the causal relationships between green barriers, green innovation (GI), and corporate export performance. This approach enables the measurement of abstract constructs through specific measurement scales while facilitating the application of advanced statistical techniques to verify hypotheses objectively and scientifically.

Initially, a comprehensive literature review was conducted to establish a theoretical foundation, from which the research model, related hypotheses, and a set of measurement scales—tailored to the Vietnamese context—were developed. On this basis, a **multiple regression equation** was specified to quantify and test the impact of green barriers on export performance, as well as to analyze the moderating (synergistic) effect of green innovation within this relationship, as follows:

$$EP = \beta_0 + \beta_1*GB + \beta_2*GI + \beta_3*(GBxGI) + \beta_4*AGE + \beta_5*SIZE + \varepsilon$$

In which

EP (Export Performance): The dependent variable representing the export outcomes of Vietnamese enterprises;

$\beta_0, \beta_1, \ldots, \beta_5$: The regression coefficients to be estimated;

GB (Green Barriers) & GI (Green Innovation): The primary independent and moderating variables reflecting the status of green barriers and GI within Vietnamese exporting firms;

AGE, SIZE: Control variables representing the firm's age and labor scale, respectively.;

ε: The standard error term.

For data collection, a survey questionnaire was designed with specific indicators reflecting the status of green barriers, the degree of green innovation, and export performance over the last three years. The survey was targeted at reputable Vietnamese exporters listed in the **Annual Import-Export Reports** of the **Ministry of Industry and Trade (MoIT)** for the 2020–2025 period. The data collection process was implemented simultaneously through two channels—email and postal services—to maximize the response rate. Upon collection, the data underwent a rigorous cleaning and screening process; only enterprises actively implementing green innovation were retained, while questionnaires with significant missing information were excluded to ensure data quality. The final dataset comprised **289 exporting enterprises**, the key characteristics of which are presented in Table 1. A sample size of $n = 289$ is considered highly representative and well exceeds the minimum thresholds required for quantitative analysis, such as the criteria:

$50 + 8k = 50 + 8*5 = 90$

$104 + k = 104 + 5 = 109$

Consequently, the sample size ensures the statistical power, reliability, and validity of the subsequent empirical analyses.

Table 1: Profile of Research Sample

Criteria	Frequency	Percentage (%)	Criteria	Frequency	Percentage (%)

Firm Ownership	*289*	*100*	*Quy mô lao động*	*289*	*100*
State-owned enterprises (SOEs)	38	13.15	< 10 employees	46	15.92
Joint-stock companies	96	33.22	10 to 49 employees	74	25.61
Private / Limited Liability Companies (LLCs)	70	24.22	50 to 99 employees	75	25.95
Foreign-invested enterprises (FIEs)	48	16.61	100 to 199 employees	72	24.91
Others	37	12.80	≥ 200 employees	22	7.61
Export Sector	*289*	*100*	*Annual Revenue*	*289*	*100*
Agriculture, Forestry, and Fisheries	71	24.57	< 3 billion VND	39	13.49
Textiles, Footwear, and Handicrafts	90	31.14	3 to < 50 billion VND	63	21.80
Machinery, Electronics, and Components	62	21.45	50 to < 100 billion VND	94	32.53
Energy, Minerals, and Chemicals	33	11.42	100 to < 500 billion VND	58	20.07
Others	33	11.42	≥ 500 billion VND	35	12.11

Source: Compiled from the author's survey data.

Data in Table 1 show that the sample of 289 exporting enterprises possesses the following key characteristics: in terms of ownership type, the highest proportion is represented by joint-stock companies (33.22%), followed by private and limited liability companies (24.22%), foreign-invested enterprises (16.61%), and state-owned enterprises (13.15%), while other groups account for 12.80%. Regarding export sectors, textiles, footwear, and handicrafts are dominant (31.14%), followed by agriculture, forestry, and fishery (24.57%) and machinery, electronics, and components (21.45%), whereas energy, minerals, chemicals, and other groups each account for 11.42%.

In terms of revenue, the 50–100 billion VND group is the most prominent (32.53%), followed by 3–50 billion VND (21.80%) and 100–500 billion VND (20.07%), while the < 3 billion VND (13.49%) and ≥ 500 billion VND (12.11%) groups are smaller. Regarding labor size, the groups of 50–99 employees (25.95%), 10–49 employees (25.61%), and 100–199 employees (24.91%) constitute the majority, while the < 10 employees (15.92%) and ≥ 200 employees (7.61%) groups are less frequent. Overall, the research sample accurately reflects the common characteristics of Vietnamese exporting enterprises, which are primarily concentrated in traditional industries and medium-sized categories.

Table 2: Scale Reliability Analysis of Research Variables

Constructs / Items	***Code***	***Cronbach's Alpha***	***KMO and Bartlett's Test***	***Variance Explained by the First Component (%)***	***Source***
Green Barriers	GB	0.852	0.765	69.823 (%)	Zhang (2022); Liu et

Environmental standards	GB1		(Sig, =0.000)		al. (2023); Zhao and Gao (2025)
International green certification	GB2				
Environmental compliance costs	GB3				
Customer pressure	GB4				
Green Innovation	GI	0.843	0.745 (Sig, =0.000)	62.231 (%)	Rezende et al. (2019); Hameed et al. (2024); Liu et al. (2024)
Green product innovation	GI1				
Green process innovation	GI2				
Green strategic innovation	GI3				
Green management system	GI4				
Green R&D investment	GI5				
Export Performance	EP	0.925	0.792 (Sig, =0.000)	81.711 (%)	Rezende et al. (2019); Liu et al. (2024); Hameed et al. (2024); Zhang (2022)
Export revenue	EP1				
Export profit	EP2				
Export market share	EP3				
Export competitiveness	EP4				

The scale testing results in Table 2 indicate that all research variables achieve sufficient reliability and validity for inclusion in subsequent analyses. Specifically, the Cronbach's Alpha coefficients for the three main variables (GB - Green Barriers, GI - Green Innovation, and EP - Export Performance) are all greater than 0.7, confirming high scale reliability and strong internal consistency among the observed variables within each group. Additionally, the KMO and Bartlett's test results all exceed 0.7 and achieve statistical significance at the 95% confidence level (Sig. = 0.000), proving that the collected data are suitable for Exploratory Factor Analysis (EFA). Furthermore, the variance extracted values of the first component for each variable exceed the 50% threshold (ranging from 62.231% to 81.711%), indicating that the identified factors can explain over 50% of the information from the set of constituent observed variables. Consequently, it can be affirmed that the research scales utilized in this study possess high reliability and validity, ensuring a solid foundation for conducting multiple regression analysis to test the research model and hypotheses. The results of the multiple regression analysis are presented in Table 3 and discussed in the following section.

4. RESULTS

The results of the multiple regression model testing, summarized in Table 3, show that the model possesses high reliability and explanatory value. Specifically, the F-value = 30.931 with a p-value (Sig.) = 0.000 confirms that the model is statistically significant at the 99% confidence level, meaning that the independent variables collectively provide a significant explanation for the dependent variable. The adjusted R-squared value = 0.473 indicates that the variables explain approximately 47.3% of the variation in the enterprises' export performance, a level considered appropriate in empirical studies on organizational behavior.

The Durbin–Watson statistic = 2.021 falls within the acceptable range (approximately 1.5–2.5), demonstrating that the model does not suffer from autocorrelation of residuals. In addition, all VIF values are less than 2, confirming the absence of multicollinearity among the independent variables. Thus, the consistent statistical indicators show that the regression model has high reliability, ensuring the validity to draw conclusions regarding the impacts of green barriers and green innovation on the export performance of Vietnamese enterprises.

Table 3: Multiple regression results for the impact of green barriers and green innovation on the export performance of Vietnamese enterprises

Research Variables	**Unstandardized Coefficients**		**t**	**Sig.**	**Multicollinearity**	
	B	***Std. Error***			***Tolerance***	***VIF***
(hệ số)	0.127	0.170	0.749	0.455		
GB	-0.237***	0.051	-4.675	0.000	0.892	1.122
GI	0.181**	0.052	3.463	0.001	0.834	1.199

GB* GI	0.463***	0.050	9.232	0.000	0.888	1.127
AGE	0.011	0.050	0.224	0.823	0.988	1.012
SIZE	-0.010	0.040	-0.255	0.799	0.988	1.012

R = 0.694; R^2 = 0.482; Adjusted R^2 = 0.473; Durbin-Watson = 2.021

Std. Error of the Estimate = 0.811; F = 30.931; Sig.= 0.000.

* Statistically significant with $p < 0.05$;

** Statistically significant with $p < 0.01$;

*** Statistically significant with $p < 0.001$.

Source: SPSS analysis results

In general, the regression analysis reveals that all research variables significantly influence the export performance of enterprises. Green barriers exhibit a two-way effect: they create cost pressures while simultaneously forcing enterprises to adapt. Meanwhile, green innovation plays a vital role in enhancing competitiveness and increasing export value. Furthermore, the interaction between green barriers and green innovation confirms that green innovation not only directly improves export efficiency but also contributes to moderating and transforming the negative impact of green barriers into a driver for innovation. Details are analyzed and discussed specifically in the following sections.

4.1. Impact of Green Export Barriers

Regression results from Table 3 show that the variable GB (Green Barriers) has a negative impact on the dependent variable EP (Export Performance) at a 95% confidence level (Coef. = -0.237 and P = 0.000), thereby confirming that hypothesis H1 is supported: higher green export barriers lead to lower export performance for Vietnamese enterprises. This finding is entirely consistent with previous studies (Zhang, 2022; Liu et al., 2023; Zhao and Gao, 2025), which emphasize that strict environmental requirements increase compliance costs and hinder export results, particularly for enterprises from developing economies. Thus, the regression model reinforces empirical evidence regarding the restrictive impact of green barriers on export efficiency.

In a practical context, green barriers are becoming a significant challenge for Vietnamese exporting enterprises, especially for agricultural exports (Nguyen Thi Thu Hien, 2023). Key markets such as the EU, US, and Japan are increasingly applying strict standards on emissions, recycling, and eco-certification, forcing businesses to invest in green technology, clean production processes, and environmental management systems. While large enterprises may view this as an opportunity to enhance brand image and increase competitive advantage, small and medium-sized enterprises (SMEs) face limitations in capital, technology, and management, making these standards a burden. In reality, many industries such as seafood, textiles, and wood have made efforts to implement FSC, GlobalGAP, or OEKO-TEX certifications to maintain market share, yet many businesses still face difficulties due to policy fluctuations and cost pressures. Overall, green barriers act as both a pressure and a motivator, creating an urgent need for Vietnamese enterprises to innovate, invest in clean technology, and build sustainable export strategies to adapt to and overcome challenges in the global trade environment.

4.2. Impact of Green Innovation

Regression results in Table 3 indicate that the variable GI (Green Innovation) has a positive impact on the dependent variable EP at a 95% confidence level (Coef. = 0.181; P = 0.001), thus confirming hypothesis H2. This implies that a higher level of green innovation implementation leads to improved export performance. This finding aligns with prior research (Rezende et al., 2019; Hameed et al., 2024; Liu et al., 2024), which emphasizes the positive role of green innovation in enhancing competitiveness, optimizing production processes, improving product quality, and meeting increasingly stringent international market requirements. Thus, the empirical model provides further evidence affirming that green innovation is a key factor helping businesses increase export results in a context of globalization linked to sustainable development.

In practice, green innovation has brought tangible benefits to Vietnamese enterprises, ranging from optimizing long-term costs and meeting strict environmental standards in the EU, US, and Japan, to building a sustainable brand image and avoiding the risk of being excluded from global supply chains. Typical cases such as Vinamilk or Minh Phu show that green production strategies not only help expand international market share but also create long-term competitive advantages. However, challenges remain significant, especially for SMEs, where initial investment costs, technological limitations, human resources, and lack of awareness remain major hurdles (Tran Thi Hang and Lam Hung Tan, 2024). To overcome these, businesses need a proactive approach, viewing green innovation as a long-term strategy rather than a cost burden, while leveraging support from the government, international organizations, and inter-industry cooperation to share technology and experience. Overall, green innovation not only helps businesses adapt to green barriers but also creates a foundation for sustainable competitiveness in a global trade environment that increasingly emphasizes environmental factors (Vu Thi Anh Thu, 2025).

4.3. Positive Moderating Effect of Green Innovation

Regression results in Table 3 show that the interaction variable GB*GI has a positive impact on the dependent variable EP at a 95% confidence level (Coef. = 0.463 and p = 0.000), confirming that hypothesis H3 is supported. This implies that the negative impact of green barriers on export activities can be moderated and transformed into a positive impact when businesses proactively implement green innovation activities. Specifically, investing in environmentally friendly production technology, using recycled materials, and achieving international certifications help businesses not only minimize

compliance costs but also enhance competitiveness, maintain market access, and take advantage of incentive policies from advanced markets. Thus, green innovation acts as a moderating factor, helping businesses mitigate negative impacts and even utilize green barriers as a motivator to increase export efficiency.

Reality in Vietnam shows that an increasing number of exporting enterprises are beginning to recognize the synergistic role between green barriers and green innovation. Some key industries such as textiles, footwear, and seafood have applied sustainable production processes, such as bio-dyeing, renewable energy usage, and ecological farming models, to meet strict standards from the EU, US, and Japan. However, this transformation remains uneven, particularly for SMEs struggling with capital, technology, and human resources. Furthermore, a lack of synchronization in support policies and domestic certification systems continues to limit access to international green incentives. Therefore, to promote the positive moderating role of green innovation, stronger support is needed from the government and relevant organizations, while businesses must view this as a long-term strategy to turn challenges into competitive advantages in a global trade environment oriented toward sustainable development.

5. MANAGERIAL AND POLICY IMPLICATIONS

Research results confirm the positive role of green innovation in enhancing export efficiency and show that while green barriers create pressure, they can also become a motivator forcing businesses to adapt. Therefore, Vietnamese exporting enterprises should build long-term green innovation strategies linked to sustainable development goals, technological improvements, and the adoption of cleaner production. Investing in green technology not only helps minimize environmental impacts but also creates a competitive advantage and maintains international market access. Simultaneously, businesses need to proactively update environmental standards from major export markets and establish specialized departments to monitor policies for timely adjustments. Additionally, leveraging international certifications such as FSC, GlobalGAP, or OEKO-TEX will enhance brand reputation and increase opportunities to participate in global supply chains.

Another important implication for Vietnamese exporting enterprises is the need to strengthen intra-industry cooperation to share resources, reduce financial burdens, and promote the adoption of green technology. Business alliances or industry associations can serve as platforms for spreading sustainable production models and sharing experiences. In practice, associations like VITAS have encouraged textile enterprises to participate in technology innovation programs, thereby reducing costs and improving efficiency. Such collaborative efforts will help businesses, especially SMEs, overcome green barriers while taking advantage of opportunities to enhance their global competitive position.

Regarding state management agencies, to support and promote export activities, it is necessary to perfect the policy framework and establish support mechanisms for businesses transitioning to green production. This can be achieved through technology innovation support funds, preferential credit for sustainable production, and specialized human resource training programs. At the same time, the government should play a more active role in international negotiations to reduce pressure from green barriers, establish trade agreements with green transition support provisions, and expand cooperation to access global green capital and technology. These policies will not only create a favorable environment for enterprises to adapt to sustainability trends but also enhance Vietnam's image as a country committed to green growth.

6. CONCLUSION

This study clarifies the relationship between green innovation, green barriers, and the export performance of Vietnamese enterprises. Analysis shows that green innovation positively impacts export efficiency, contributing to competitiveness, optimized production, and meeting international standards. Conversely, green export barriers create negative impacts, particularly for businesses with limited technology and finance. However, when businesses proactively implement green innovation to adapt, these challenges can transform into opportunities, improving market adaptability and export results. Based on these findings, the study proposes several solutions to support Vietnamese enterprises in developing sustainable export strategies.

The article makes significant contributions. Theoretically, it adds empirical evidence regarding the impact of green innovation and green barriers on export efficiency, affirming the positive moderating role of green innovation. These findings consolidate and extend existing theories on green innovation and environmental management in international trade. Practically, the study provides important suggestions for enterprises in building green innovation strategies and assists state agencies in designing policies to encourage sustainable exports. These contributions help businesses enhance competitiveness and contribute to the green growth goals of the national economy.

Despite these meaningful results, the study has certain limitations. First, data were primarily collected from 239 exporting enterprises in Vietnam, which may not fully reflect the entire export economy. Additionally, the study did not consider differences between specific industries, whereas the impacts of green innovation and barriers may vary across sectors. Future research could expand the sample size, conduct comparative industry analysis, and combine qualitative data from expert interviews to clarify impact mechanisms. These directions will help perfect the theoretical and practical basis, leading to more specific policy solutions and strategies to support exporting enterprises in developing sustainably..

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