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Impact of green innovation on environmental performance and financial performance

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Abstract

In today's world, businesses and organizations should behave appropriately for the environment in order to make a contribution to welfare benefits while also gaining business opportunities and economic development. Green practice's adoption could assist businesses to start saving mineral wealth, and power, avoid environmental damage and even result in the long development of businesses. This study examined the correlation between external environmental factors and green product innovation, as well as the impact of green product innovation on the environmental and financial performance of 400 manufacturing SMEs in Vietnam's primary industrial units. Customer pressure, government pressure, government support, and market changes all had a beneficial effect on green product innovation, according to the findings. Furthermore, this study found a strong positive relationship between green product innovation and environmental and financial performance. Based on the research findings of this research, SME administrators can effectively adapt their business strategies to attain greater financial results and a comparative position in the market while utilizing green initiatives to grow their businesses and preserve the natural environment in a sustainable manner.

Keywords Governmental pressure · Market changes · Government support · Customer pressure Environmental performance · Green innovation · SMEs · Vietnam

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1 Introduction

Manufacturing industries, rapid globalization, and rapid urbanization in developing countries are now thought to have negative environmental consequences such as climate change, environmental damage, the greenhouse effect, and contaminant and hazardous explosions. Manufacturing firms are widely regarded as the primary contributors to environmental issues that every region should indeed address. To align with the green constant evolution, many developed countries around the world are focusing their technological innovation efforts on developing clean, eco-friendly new tech organizations while protecting the environment for minimizing the effect on the environment, cut waste costs, ensure long-term profits for businesses in a highly competitive market with the potential to raise productivity, end up saving product life cycle, promote sustainable development, and government subsidies (Duque-Grisales et al., 2020; Ha & Nguyen, 2022).

In Vietnam, SMEs account for 97.5 percent of all businesses that contribute 40% of GDP, 30% of state budget profit, 33% of industrial output value, and nearly 60% of employment year after year (Tuan, 2019). However, the activities of SMEs also damage detrimentally the environment and community health. SMEs in Vietnam continue to face too many challenges in competing and developing, approaching capital, and expanding their business and production when compared to other nations in the Asian geographical area and around the world because SMEs' manufacturing technology is outdated and consumes a great deal of power. As a result, adopting new technology suitable for green economics has become a significant challenge for SMEs in Vietnam's manufacturing sector (Zhang et al., 2020; Ha et al., 2022).

Despite the Vietnamese government's efforts to promulgate environmental regulations, environmental compliance was found to be low in critical industries such as manufacturing, food, leather, and paper. In reality, many enterprises pay less attention to social and public benefits as well as the environment but focus on their organization's benefit, and simultaneously they are afraid of investing in equipment and manufacturing technology to protect the environment because of consuming their significant expenditure that may affect their benefits (Do & Nguyen, 2020). Furthermore, the majority of waste disposal sites are only operational temporarily when the authorities undertake an investigation.

Understanding the determinants influencing green corporation innovation is another appealing topic that is gaining considerable interest from scholars. In related studies, stakeholder pressure, technical considerations, environmental restrictions, and management qualities have all been discussed (Peng, 2020; Wong et al., 2020; Nguyen & Adomako, 2021). Environmental factors, rather than the natural environment, are used in this study to refer to the typical idea of the external environment that determines company behavior. Environmental variables such as market change, environmental severity, government support, industry type, or competition are frequently discussed in the literature on technological innovation (Lin & Ho, 2011; Qiu et al., 2020). Market changes and external resources have always been considered the two main environmental factors influencing environmental and technical innovation strategies (Jeyaraj et al., 2006; Rothenberg & Zyglidopoulos, 2007); and government plays an important role in supporting resources for innovation adoption (Lee, 2008; Li & Atuahene-Gima, 2002; Scupola, 2003). This paper concentrates primarily on the influence of stakeholder pressure involving customers and government pressure, government support, and market

change because these are the factors that are confirmed by previous studies to affect the implementation of green innovation in enterprises (Guo et al., 2018; Lin & Ho, 2011; Seman et al., 2019; Weng et al., 2015; Zhang et al., 2020).

Environmental performance could be defined as the degree to which businesses meet their stakeholders' expectations for environmental responsibility (Carroll, 2000; Ruf et al., 1998). Environmental performance is often measured by researchers by reducing emissions, wastewater, solid waste, efficient use of input materials, minimizing the number of environmental incidents, and improving the environmental status of businesses. Concerning long-term environmental problems, corporate regulatory measures, including pollution prevention as well as reduction of resource consumption and emissions, are more effective than the last resort as well as the wastewater treatment system. Previous studies have also demonstrated that improvements in production green processes and productivity increase the chances of improving environmental performance (Costantini et al., 2017; Li et al., 2020; Seman et al., 2019; Wong et al., 2020).

On the contrary, the link between green innovation and financial performance was not immediately apparent. Many studies concluded that green innovation improved enterprise financial performance (Chen, 2008; Guo et al., 2020; Shahzad, 2021), but others found no effect or the opposite (Chen et al., 2021; Le, 2020; Palmer et al., 1995). Some studies failed to discover a link between intention to adopt green practices and firm performance. Based on a few study results, green innovation required significantly more investment in the waste treatment process, which made a financial burden on firms when complying with environmental regulations (Garcia-Sanchez et al., 2012). Even though many empirical studies have been conducted to present the relationship between the adoption of green practices and corporate achievement in a variety of business fields, the conclusions have not been united and controversial (Xue et al., 2019; Duque-Grisales et al., 2020). Additionally, in the age of global integration, Vietnam's production facilities are growing rapidly due to practical demands. As a result, the majority of production companies are required to follow the trend of sustainable development, protect the environment, and enhance social life. As a result, the study's subject is crucial in order to be able to corroborate the scope and mechanism of these relationships for SMEs in Vietnam, which have their own unique mechanisms, policies, and regulations—a new context compared to earlier studies. Therefore, confirming the impact of green innovation on environmental performance and financial performance in the broader dimension is critical for enterprises to perform more effectively in the current competitive environment.

2 Literature review and hypotheses development

2.1 Green innovation

Green innovations are new environmental approaches involving innovative forms, manufacturing, or product lines that contribute to lowering the environmental impact of economic procedures (Chen et al., 2006). Many SMEs are struggling to solve ecological problems in the face of pressure from the government, clients, numerous different agencies, and localities. As a result, green innovation's adoption is a novel approach to addressing existing issues in several business decisions (Hernandez-Vivanco et al., 2018). Green innovation might have recently become such a fast-dissolving topic that has piqued the interest of researchers. It is crucial to assess the factors that influence green innovation, as well as the

extent to which such an innovation influences firm profitability, in order to conform with emission standards, achieve organizational value in the manufacturing industry develop businesses as well as the environment in a sustainable way (Guoyou et al., 2011; Saunila, 2018).

There are three types of green innovation: green management, green processes, and green products. Further, it is proposed that green product innovation and green manufacturing processes are strongly linked to firm competitive advantages. It was also demonstrated that green innovation is important in firm environmental operations and perceived all aspects of environmentally sustainable development (Fernando & Wah, 2017). Therefore, Chiou et al. (2011) concluded in their survey that manufacturers' awareness of the environment had a favorable effect on green practices. Going green also impacted the success of environmental management and competitive advantages. Furthermore, green innovation was found to have a strong connection with green management performance as a significant component of green performance (Xue et al., 2019). Results of recent studies revealed that thorough adopting a green approach could boost resource savings, end up creating extra sustainable methods, provide a competitive advantage, and generate more profit for firm growth (Asadi et al., 2020; Chouaibi et al., 2022; Farza et al., 2021; Lin et al., 2019). This study is focused primarily on the impact of green product innovation on environmental performance and financial performance in the context of manufacturing firms in Vietnam.

2.2 Environmental performance

The economic benefits of managing society and environmental performance include reducing costs, and business risks, increasing reputation, and developing new markets such as the market of green products to compete in the market economics and fast globalization. However, enterprises have to invest significantly to get the requirements to create these benefits. Guo et al., (2021) and Nguyen et al., (2021) argued in their studies that effectiveness in managing the environmental performance could collect more benefits through the image of green products and products which were suitable to the environment, reducing fewer costs to deal with pollution and increasing firm performance because of the inefficient manufacturing process would waste energy and natural resources which polluted the environment more and more.

2.3 Financial performance

Varnas (2009) stated that a company's financial and non-financial performance can be used to assess its performance. Non-financial performance could be evaluated by a firm's image and competitive advantage, whereas financial performance is typically measured by market share, revenue, and profits (Weng et al., 2015). Green innovation may help businesses balance their environmental expenses by increasing resource productivity, which has a positive financial impact (De Burgos-Jimenez et al., 2013; Hoang et al., 2021). In addition, companies can also expand into new areas and enhance their market share by introducing environmental innovation (Guo et al., 2021). According to Chen (2008), green inventors will benefit from a "first-mover advantage," which also includes higher prices of goods, a stronger company image, growing market opportunities, and competitive advantages.

2.4 Relationship between the environmental factors and green product innovation

The most important factor influencing a company's environmental strategy is stakeholder demand (Buysse & Verbeke, 2003). Customers and regulators are two of the most significant corporate stakeholders among the different stakeholders (Christmann, 2004; Etzion, 2007). Numerous pieces of research have looked into the effect of customer pressure on company environmental policies and found that it has a favorable impact (Chu et al., 2018; Wong et al., 2020; Zhu & Sarkis, 2004). Furthermore, past research has explored the correlation between legal requirements and environmental practices, and they have revealed that one of the external players affecting green innovation positively is government pressure (Qi et al., 2020; Raza, 2020; Zhang et al., 2019).

Support from the government is an important environmental factor that influences technical innovation. Several supportive policies, such as financial incentives, technical resources, pilot projects, and tax breaks, can help governments improve technology (Bai et al., 2019; Guo et al., 2018). Governments can boost confidence, according to Aragon-Correa and Sharma (2003), by giving subsidies or tax incentives for alternative energy technologies, as well as reduced premiums for lesser environmental hazards. Changes in the business environment are thought to be the most important environmental factor influencing a company's choice (Li & Atuahene-Gima, 2002;). It has to do with how executives perceive frequent and unpredictably changing client preferences, developing technology, and competition action. Several studies also imply that in uncertain business contexts, organizations are more motivated to embrace green innovations to improve environmental performance (Dangelico et al., 2017; Shahzad et al., 2020).

2.5 Relationship between green product innovation, environmental performance, and financial performance

Green innovation activities have been shown in previous empirical studies to help firms improve financial performance by conserving energy, safeguarding the environment, and enabling recycling programs. Many studies had concluded that green innovation improved enterprise financial performance, but others found no effect or the opposite (Xie et al., 2019; Duque-Grisales et al., 2020; Singh et al., 2020a, 2020b; Zhang & Ma, 2021). Contrastingly, the majority of studies provided empirical evidence that innovation strategy had a substantial positive impact on organizational advancement and corporate value because it was critical for businesses to encourage business productivity and expand value for the firm and its customers or create a competitive advantage (Lin et al., 2019; Thatrak, 2021; Weng et al., 2015).

Additionally, various empirical studies investigating the link between green innovation and environmental performance have been undertaken. Green product innovation and green manufacturing process innovation are favorably connected with a company's competitive advantage, according to Chen et al. (2006), Raza (2020) and Li et al., (2020). Similarly, the results of the study by Chang (2011) and Wong et al. (2020) demonstrated that green products and green process innovation play an important role in the environmental performance and competitive advantage of enterprises and the overall perception of the environment on environmentally sustainable development. However, the study by Tariyan (2016) and Chiou et al. (2011) found a link between green marketing innovation as having the highest impact on environmental performance while innovating green processes and

green products and green management innovation has very little impact on environmental performance. Green management innovation, on the other hand, has a minor impact on company environmental performance, according to Lee and Min (2015), but the green product and process innovation has a significant effect on the environmental performance.

The purpose of this study, based on the foregoing findings, is to determine the impact of environmental factors on green product innovation, as well as the relationship between green product innovation and environmental and financial performance in Vietnamese manufacturing organizations, despite the fact that neither previous research has been done in this area.

3 Hypotheses

Stakeholders, according to Freeman (1984), are persons or organizations (such as consumers, workers, company owners, communities, shareholders, etc.) that can influence or be affected by the accomplishment of an organization's objective. This stakeholder theory argued that in order to ensure the long-term success of the company, the organization must treat its stakeholders equally and, in the event of a conflict of interest, must find a mutually beneficial compromise. In order to assess the impact of environmental stakeholders participating in green innovation of Vietnamese manufacturing businesses, this study employed stakeholder theory.

Resources can be widely defined to include assets, organizational processes, firm qualities, information, or knowledge that is within the control of the organization and that can be utilized to develop and carry out organizational plans. According to Barney (1986), a valuable resource must allow a business to act and perform in a way that increases sales, lowers expenses, increases profits, or adds value in other ways financially contribute to the business and help a business create or put into practice plans to enhance performance. The theory of resource-based view emphasizes the importance of a company's resources to success and uses it to explain sustainable and successful competition (Barney et al., 2011). The resource-based view theory is commonly studied by authors to learn more about how corporate image and performance results of enterprises are related, as well as how environmental performance positively affects financial performance (Ma et al., 2017; Andersen, 2021; Mishra & Yadav, 2021). Green innovation is viewed as a significant intangible resource that is challenging to replicate by an organization (Fernando & Wah, 2017). Therefore, the resource-based view theory of Barney (1991) was applied in this study to propose hypotheses about the impact of green innovation on environmental performance and firm performance.

The theory of stakeholder and resource-based view was applied to observe the influence between external environmental factors and green innovation and the effect of green innovation on environmental performance and firm performance. This study's hypotheses are as follows:

H_1 Customer pressure and green product innovation among SMEs in the manufacturing sector have a positive relationship.

H_2 Government pressure and green product innovation by SMEs in the manufacturing sector have a positive relationship.

H_3 Government support and green product innovation by SMEs in the manufacturing sector have a positive relationship.

H_4 Market change and green product innovation among SMEs in the manufacturing sector have a positive relationship.

H_5 Green product innovation and the environmental performance of SMEs in the manufacturing sector have a positive relationship.

H_6 Green product innovation and the financial performance of SMEs in the manufacturing sector have a positive relationship.

4 Research model and methodology

4.1 Proposed research model

Earlier research has concentrated on a variety of variables influencing green innovation, which include organizational factors or technological factors (Lee, 2008; Kousar et al., 2017; Guo et al., 2018; Borsatto and Amui, 2019; Ha & Nguyen, 2022; Ha et al., 2022); the mono connection among green innovation, the environmental performance, and firms performances (Chiou et al., 2011; Fernando & Wah, 2017; Raza, 2020; Muangmee et al., 2021; Zhang & Ma, 2021). This research will apply stakeholder and resource-based view theory to discover the influence of environmental factors and green product innovation and the association of green product innovation towards environmental performance and financial performances within Vietnamese manufacturing organizations ' the context. The following is the research framework for this study:

To quantify the relationship between environmental factors and green innovation as well as the relationship between green innovation, environmental performance and financial performance, this study used the Cooper and Kleinschmidt (1994), Wen and Chen, (1997), Avlonitis et al., (2001), Lai et al., (2003), Zhu and Sarkis (2004), Lee (2008), Liu (2009), Lopez-Gamero et al., (2010), Lin and Ho (2011), Ehrgott et al., (2011) and Zhao et al., (2015)'s scales as well as qualitative scales. The measurement items for each factor were listed in Appendix A.

4.2 Methodology

4.2.1 Research method

This study employed the quantitative research approach to investigate the relationship between environmental conditions and green product innovation, as well as the influence of green product innovation on environmental and financial performance. The next step was to analyze the information gathered from the responders. The Exploratory Factor Analysis (EFA) will be utilized in this stage to investigate the factor structure of a collection of observed variables in the investigation. Lastly, using Structural Equation Modeling (SEM), the theories offered were evaluated. PLS-SEM was utilized in this research to evaluate the author's proposed research model's measurement and structural equation modeling.

4.2.2 Sample of the study

The respondents to this questionnaire were directors of the company of SMEs in the manufacturing industries situated in Vietnam's large industrial regions, as approached by employees working on industrial park management boards. The directors have been picked as data capture participants as they have a thorough overview of the actual business and are engaged in decision-making. As a result, the questionnaire was undertaken in a sample population that varied in sexual identity, education level, professional experience, working seniority in the present organization, business type, and regularity with using eco-friendly goods to represent the entire population. The appropriate size for samples when using Structural Equation Modeling, According to Hair et al. (2010), was in the range of 300 to 500 to avoid data processing complexities in statistical analysis. As a result, this questionnaire sample was taken from 400 participants working in industrial spots throughout the Vietnam area. Moreover, the convenience sampling method was used because it assisted the author in collecting information from the respondents that were readily accessible to take part in this study.

5 Analysis and results

5.1 Measurement modeling

Hulland (1999) asserted that indicators that required to be assessed in the measurement modeling while analyzing data with Smart-PLS included outer loadings, reliability, convergent validity, and discriminant validity. Nunnally (1978) recommended that a good scale have a Cronbach's Alpha reliability of 0.7 or greater. A scale that guarantees unidirectionality and reliability should also, according to Hair et al. (2009), meet the Cronbach's Alpha threshold of 0.7 or higher; however, in the context of an initial exploratory research. All observed variables had outer loadings more than 0.7 (>0.7) in this investigation, indicating that all observed variables had relevance in the modeling. Furthermore, Cronbach's Alpha was greater than 0.7 (>0.7) for all scales, indicating that they were all dependable. All scales indicated convergent validity, as shown in Table 1 since their Composite Reliability was greater than 0.7 and their Average Variance Extracted was greater than 0.5.

All values of discriminant validity in this survey were addressed using the rule of Fornell et al. while assessing the Measurement modeling using observed variables and measurement error of Fornell and Larker (1981). The least-square root of AVE (0.576)

Table 1 Construct Factor Reliability and Validity. *Source* The researcher's data analysis

	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
ACP	0.884	0.886	0.910	0.590
AKH	0.895	0.897	0.916	0.576
DSP	0.859	0.859	0.904	0.703
DTT	0.878	0.892	0.905	0.577
HCP	0.884	0.889	0.910	0.590
HQC	0.862	0.863	0.906	0.707
SMT	0.906	0.907	0.927	0.679

Table 2 Fornell-Larcker Criterion. *Source* The researcher's data analysis

	ACP	AKH	DSP	DTT	HCP	HQC	SMT
ACP	0.768						
AKH	0.466	0.759					
DSP	0.376	0.363	0.838				
DTT	0.251	0.312	0.311	0.759			
HCP	0.283	0.259	0.325	0.470	0.768		
HQC	0.260	0.240	0.585	0.218	0.244	0.841	
SMT	0.279	0.246	0.559	0.196	0.242	0.437	0.824

Table 3 R Square. *Source* The researcher's data analysis

	R Square	R Square Adjusted
DSP	0.238	0.230
HQC	0.343	0.341
SMT	0.312	0.311

was bigger than the largest significant value of correlations (0.679) across latent variables, demonstrating that discriminant validity was retained, as shown in Table 2.

5.1.1 Testing the research hypothesis

The criteria for judging the quality of PLS-SEM and the techniques for testing hypotheses of this research were based on Hair et al.'s recommendations (2016). Hair et al. (2016) used R square, Variance Inflation Factor (VIF), Path Coefficients, and Effect Size to assess the model's quality because there was no adequate assessment for the entire PLS-SEM (f2). R square (R^2) was determined to be in the 0 to 1 range in Table 3. Structural modeling of the highest grade was applied.

Table 3 indicates that the R square adjusted of the independent factor Green product innovation (DSP) was 0.230, implying that the observed variables explained 23 percent of the DSP upheaval. Simultaneously, R square adjusted for the dependent factor Environmental Performance (SMT) was 0.311, implying that the independent factor explained 31.1 percent of SMT upheaval, and R square adjusted for the dependent factor Financial Performance of SMEs (HQC) was 0.341, implying that the independent factor explained 34.1 percent of HQC upheaval.

The author utilized the Variance Inflation Factor (VIF) result to determine multicollinearity when analyzing PLS-SEM. A VIF of 5 or greater indicates that the model is likely to exhibit multicollinearity (Hair et al., 2016). The research results revealed that all VIF indexes were less than 5, enabling the author to reach the conclusion that there had been no multicollinearity in the structural modeling, as shown in Table 4. To determine the Impact Size of variables, the author utilized Cohen's (1988) criterion: if f2 0.02: very small or no effect; f2 0.02: small effect, 0.15: medium effects, 0.35: large effects (Table 5).

It can be concluded that *Green product innovation* (DSP) had a large effect on SMEs' environmental (SMT) and financial (Financial) performance (HQC) with $f^2 = 0.521$ and

Table 4 Inner VIF values. *Source* The researcher's data analysis

	ACP	AKH	DSP	DTT	HCP	HQC	SMT
ACP			1.329				
AKH			1.352				
DSP						1.000	1.000
DTT			1.355				
HCP			1.338				
HQC							
SMT							

Table 5 f Square. *Source* The researcher's data analysis

	DSP	HQC	SMT
ACP	0.046		
AKH	0.032		
DSP		0.521	0.454
DTT	0.015		
HCP	0.024		

Table 6 Hypotheses results' testing. *Source* The researcher's data analysis

Hypothesis	Hypothesis path	Path coefficients	P Values	Result
H_2	ACP—> DSP	0.215	0.000	Accepted
H_1	AKH—> DSP	0.182	0.002	Accepted
H_6	DSP—> HQC	0.585	0.000	Accepted
H_5	DSP—> SMT	0.559	0.000	Accepted
H_4	DTT—> DSP	0.126	0.013	Accepted
H_3	HCP—> DSP	0.158	0.002	Accepted

$f^2 = 0.454 (> 0.035)$ while other factors had a small effect on DSP with f^2 range from 0.015 to 0.046.

Following the testing of concepts for reliability and validity, structural models were utilized for examining the connection among study hypotheses. Table 6 displays the testing hypothesis outcomes, which include Path coefficients and *P* values, all hypotheses were approved. Furthermore, it proved that *Green product innovation* affected both *Environmental performance* and *Firm performance of* SMEs with path coefficients of 0.571 and 0.566 (Sig. = 0.000 < 0.05) at the strongest effect (Figs. 1 and 2).

All of the factor path coefficients are depicted in the structural modeling figure below:

5.2 Findings discussions

With an impact of $\beta = 0.182$ and *P* values = 0.002 < 0.05, it is possible to conclude that H_1 has been accepted, implying that customer pressure had a significant impact on green product innovation. The study's findings are consistent with the hypothesis proposed. The research results are in alignment with Vietnam's reality and other countries around

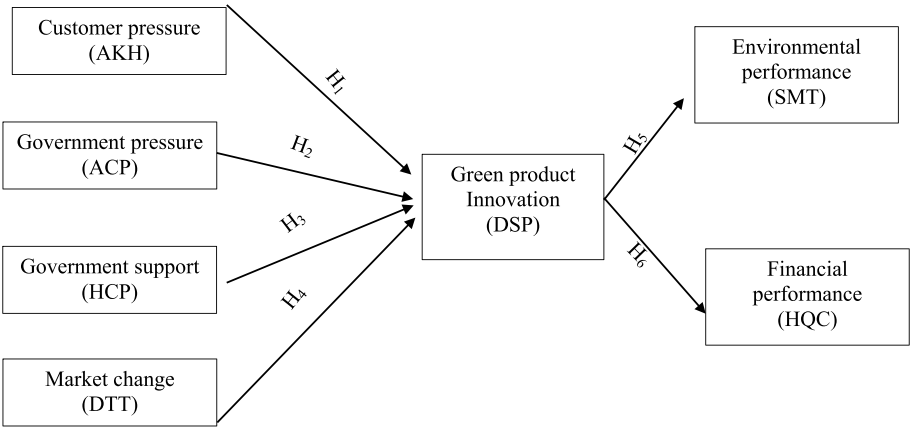

Fig. 1 Proposed research model

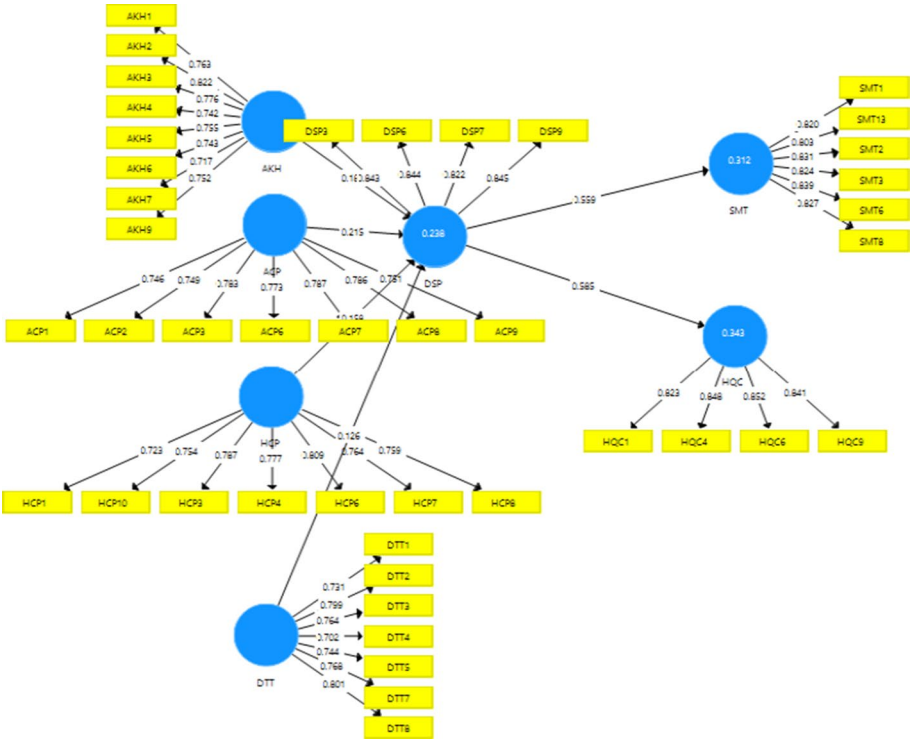

Fig. 2 The study's structural equation modeling

the world. Customers are essential stakeholders for businesses, according to the majority of study findings in the manufacturing sector, and their pressure has a big impact on businesses' green innovation initiatives (Chu et al., 2018; Etzion, 2007; Guoyou, et al., 2011; Wong et al., 2020). Therefore, manufacturing companies that want to optimize their

success in implementing green innovation have to rely on the preferences and needs of customers and partners to diversify products and business forms to create profits for businesses and comply with the Government's regulations on environmental protection.

It is possible to conclude that H_2 was supported, implying that government pressure had a favorable effect on a green product innovation of manufacturing businesses when the impact of $\beta = 0.215$ and P values $= 0.000 < 0.05$. The research result was also the same as the proposed hypothesis. However, this study had indicated contrasting outcomes with previous studies by Naila (2013), Nham (2012), and Chen et al. (2021) revealing that enterprises had to bear additional costs in production and frequently invest in temporary waste treatment facilities to deal with environmental aspects when complying with regulation. This study's result reinforces the findings of Christmann (2004), Zhang et al. (2019), Qiu et al. (2020) stated that regulatory pressure is related to firms' decisions to undertake green innovation activities.

With an impact of $\beta = 0.158$ and P values $= 0.002 < 0.05$, it is possible to conclude that H_3 has been accepted, implying that government support had a significant impact on green product innovation. The study's findings are consistent with the hypothesis proposed. The research results are in alignment with Vietnam's reality and other countries around the world. The findings of the study are also similar to those of Scupola (2003), Guo et al. (2018) and Bai et al., 2019, since government assistance is a significant environmental element influencing the green innovation applied by the government. The results show that the supportive policies of the Government have encouraged enterprises and have the effect of promoting enterprises to implement green innovation. Therefore, production enterprises that want to implement innovation and green growth should request the Government to support incentive policies such as financial provision, technical resources, pilot projects, tax reduction, and provision of tax incentives. provide training programs to support enterprises to carry out their innovation effectively.

It is possible to conclude that H_4 was supported, implying that market change had a favorable effect on a green product innovation of manufacturing businesses when the impact of $\beta = 0.126$ and P values $= 0.000 < 0.05$. The study's findings are consistent with the hypothesis proposed. The research results are in alignment with Vietnam's reality and other countries around the world. The findings of the study support prior research that shows that in the face of frequent market shifts, firms are expected to use green innovations to build the ability to enhance environmental performance (Rothenberg & Zyglidopoulos, 2007; Sivathaasan et al., 2013). If a firm is inefficient, with insufficient revenue to pay expenditures, it will almost certainly be going out of business and go bankrupt, especially in the ever-changing market economy and severe competition. Therefore, the factor of market change must be considered by production enterprises as a key factor and pay special attention to when they want to implement the innovation of enterprises. Businesses can devote more resources to improving their core businesses rather than improving their environmental performance when they recognize a great deal of uncertainty in their corporate environment, so green activities will be postponed until other changes to the manufacturing process are completed.

With an impact of $\beta = 0.559$ and P values $= 0.00 < 0.05$, H_5 has been approved, meaning that green product innovation has had a major influence on environmental performance. The study's findings are consistent with the hypothesis proposed. The research results are in alignment with Vietnam's reality and other countries around the world. Innovating, investing in green technology innovation, using resources and energy efficiently, and minimizing impacts on the environment can create competitive advantages and create trust in society and consumers. For businesses, the products they create and their contributions

to environmental preservation are the unavoidable way to green and sustainable growth. Previous research has demonstrated that green innovation activities, such as green product invention, can help businesses save energy, reduce pollution, enable waste recycling, and improve environmental management levels, all of which can help businesses run more efficiently (Chiou et al., 2011; Fernando & Wah, 2017; Kraus et al., 2020; Singh et al., 2020a, 2020b). Enterprises would not need to invest in advanced technologies to ensure green growth targets, such as reducing emissions and producing environmentally sustainable goods. Simple actions including respecting environmental standards, optimizing industrial operations to reduce fuel and electricity use, and encouraging the use of ecologically friendly equipment and services have all contributed to this goal's achievement.

It is possible to conclude that H_6 was supported, implying that green product innovation impact favorably affects the financial performance of manufacturing businesses when the impact of $\beta = 0.585$ and P values $= 0.000 < 0.005$. The research results are in alignment with Vietnam's reality and other countries around the world. This study differed from studies of Aguilera-Caracuel and Ortiz-de-Mandojana (2013) and Le (2020) which found inconsistent results that did not support green innovation positively improving firm financial performance. Furthermore, the findings of Palmer et al. (1995), Kiernan (2007), Liu et al. (2011) and Duque-Grisales et al. (2020) support the above viewpoint, confirming that the cost of complying with environmental regulations and being socially responsible will result in higher product costs, a competitive disadvantage in the market, and lower profits. Consequently, the article's conclusions are novel and distinct from those of earlier empirical investigations, particularly those in the context of manufacturing firms in Vietnam. The findings of the study support the notion that green innovation will boost production efficiency, increase a company's competitive edge and value, and have a favorable impact on its financial performance (Asadi et al., 2020; Lin et al., 2019; Porter & Van Der Linde, 1995; Tang et al., 2017). As a result, when businesses embrace green innovation, they will strengthen their brands, increase customer and partner trust in environmentally friendly products or processes, and stimulate consumption. Green products, on the other hand, can benefit from higher prices than businesses that do not use green innovation, as well as grow sustainably and boost earnings.

6 Conclusion and policy implications

Environmental considerations are widely acknowledged as a primary consideration in the pursuit of effective sustainability. Manufacturing companies have been held accountable for both carbon pollution and the emission of harmful pollutants during operations. Profitability of businesses is greatly influenced by their use of green innovation and commitment to environmental sustainability. Due to adherence to environmental laws is regarded as a predictor of future business profitability on the capital market. By reducing carbon emissions into the climate, conserving energy, and improving business productivity, the application of green innovation can also have a positive impact on the environment of enterprises. The objectives of the article were aiming to discover the impact of external environmental factors and green product innovation, as well as the relationship of green product innovation on the environmental and financial performance of SMEs in manufacturing sectors positioned throughout Vietnam's major industrial parks. Environmental factors including customer pressure, government pressure, government support, and market change have had a significant impact on the green product innovation of SMEs, according to the findings

of examining the measurement modeling and structural modeling of PLS-SEM. Further, there was a strong correlation between green product innovation and environmental and financial performance. According to the findings of the research, the paper's contribution has become an important factor in encouraging Vietnamese organizations to participate actively in green innovation, improve their firm development and overall achievement, and play a role in mitigating and developing a greener future in Vietnam.

Hence, based on the survey results from manufacturing businesses in industrial zones in Vietnam, the research recommends and suggests policies as follows:

(1) Manufacturing companies, especially SMEs, should carefully consider capital management, market factors, and long-term development strategies when implementing green innovation. At the same time, they should adamantly propose to the government support requirements when carrying out environmentally friendly innovations in accordance with Party and State policy to ensure that manufacturing companies receive timely support.
(2) In terms of external environmental variables, the government also assists firms in adopting green innovation and green growth through incentive policies such as financial incentives, financial resources, etc. technical resources, pilot projects, training programs, etc. Since most Vietnamese businesses are small and medium-sized and have limited resources, innovation requires a significant financial investment. As a result, the government should work with businesses to develop a fair economic environment by establishing mechanisms, policies, and opportunities for them to access resources by providing Programs, Funds, mobilization of resources from large enterprises and corporations abroad, etc. to help businesses attract more investment, implement innovation, and create a sustainable green economy.
(3) In order to forecast, test, and program for more effective output, manufacturing companies should digitize their production lines by outfitting them with machinery, sensors, and automation control software. and output effectiveness of the product, as well as elevating the organization's value chain and management value chain throughout the product's life cycle. The Government should simultaneously implement a number of policies to timely synchronize, and disburse swiftly with more flexible input criteria, so manufacturing enterprises could easily access preferential loans, reproduce, invest in technology and equipment in line with the green standards and export criteria of foreign countries, and quickly integrate into the global market.
(4) The government should speedily start releasing policies to support capital as well as encourage and attract strategic investors with sufficient financial, technological, and managerial capacity worth participating in the purchase of shares, contributing capital to the enterprise, supporting the communication connection of products of domestic enterprises with foreign countries, or concluding the legal requirements in order for manufacturing enterprises to achieve green innovation efficiency. From there, it becomes obvious that the government plays a crucial role in supporting industrial companies as they innovate in a greener way.

6.1 Limitations and future directions

This research, like other studies, had a few practical limits. To begin, the survey only analyzed the influence of environmental factors on green product innovation in Vietnam's manufacturing sector, but there are other factors that can affect green product innovation.

Future research should analyze and take into account other factors, such as technological or organizational factors, to explore as well as evaluate the influence of these factors on green innovation, as well as the relationship of each factor to other green practices involved in the green process innovation or green management, in order to gain a comprehensive understanding. Next, this study was limited to the manufacturing sector, even though there are many businesses in other industry sectors. As a result, future research is needed to evaluate numerous different industries to obtain overall estimations of green innovation. Furthermore, only the convenience sampling approach was used to collect data in this study, which appears to be a type of non-probability sampling method, whereas other sampling methods have several advantages. Fourth, because the results may differ in different countries, industrial sectors, or green practices, future work may implement the proposed model in different situations. Finally, while many studies have found different findings, this study did not look at the influence of environmental performance on financial performance. As a result, future research should focus on the relationships between those factors, particularly the mediating role of environmental performance in implementing innovation, to better understand how environmental performance can help businesses develop sustainably and achieve financial goals.

Appendix A: measurement items

Items	Indicator variable
I. Environmental factors	
1. Customer pressure (AKH)	
AKH1	Customers require enterprises to improve environmental activities
AKH2	Customers focus on environmental protection
AKH3	Customers require environmentally friendly products from businesses
AKH4	Customers are willing to pay more for green products
AKH5	Customers request detailed information on environmental protection of businesses
AKH6	Customers will stop supporting if businesses do not produce green products
AKH7	Customers prefer businesses with strong environmental responsibility
AKH8	Customers pressure companies to comply with societal requirements
AKH9	Customers place pressure on businesses to adhere to environmental regulations
AKH10	Customers often pay attention to the environmental protection behavior of businesses
AKH11	Customers request to organize periodic reviews in the implementation of environmental policies of businesses
2. Government pressure	
ACP1	The government establishes environmental laws to limit industrial practices that have an adverse impact on the natural environment
ACP2	Industry associations require businesses to comply with environmental regulations
ACP3	Businesses will be fined if they violate environmental regulations
ACP4	Government sets standards for wastewater

Items	Indicator variable
ACP5	Government sets emission standards
ACP6	Government sets solid waste standards
ACP7	The government sets the standard for production technology
ACP8	Businesses encounter pressure from government environmental legislation
ACP9	Businesses encounter pressure from local government monitoring of environmental activities
ACP10	Businesses feel pressure from environmental groups (supported by the Government)
ACP11	Government requires businesses to sign commitments on environmental protection
3. Government support	
HCP1	Businesses are financially supported by the Government for the application of green innovation
HCP2	Businesses receive technical support from the Government when applying green innovation
HCP3	The government supports businesses to train green skills for employees
HCP4	The government regularly organizes seminars on environmental regulations for businesses
HCP5	The Government guides the process of implementing environmental protection for businesses
HCP6	Government policy reform creates favorable conditions for green innovation activities of businesses
HCP7	The Government promulgates an environmental strategy to create conditions for businesses to implement green innovation
HCP8	The government forecasts the trend of environmental problems for businesses to implement green innovation
HCP9	Many initiatives have been launched by the Government to increase the attractiveness of green innovation for businesses
HCP10	Government incentives on tax rates for businesses that protect the environment well
4. Market change	
DTT1	Predicting consumer preferences is very challenging
DTT2	Predicting competitor behavior is challenging
DTT3	Progress in the quality of green products develops rapidly
DTT4	Customers' preferences for products change frequently
DTT5	The sales volume of enterprises cannot be predicted in advance
DTT6	Progress on green products by competitors is unpredictable
DTT7	The advancement of green manufacturing technology by competitors is unpredictable
DTT8	Customers' expectations about the level of environmental protection of enterprises are unpredictable
II. Green innovation	
DSP1	Businesses prioritize the use of less polluting materials
DSP2	Businesses prioritize the use of materials that consume fewer resources and energy
DSP3	Businesses use the least amount of raw materials to create products
DSP4	Businesses will consider the product's recycling before proceeding with production

Items	Indicator variable
DSP5	Businesses will consider the reuse of products before proceeding with production
DSP6	Businesses will consider the decomposition of products before proceeding with production
DSP7	Businesses are often the first to bring green products to the market
DSP8	Businesses improve environmentally friendly packaging for products
DSP9	Businesses use recyclable/reusable packaging
III Environmental performance	
SMT1	Green innovation reduces emissions
SMT2	Green innovation reduces waste water
SMT3	Green innovation reduces solid waste
SMT4	Green innovation reduces consumption of hazardous/toxic materials
SMT5	Green innovation reduces the frequency of enterprises causing environmental pollution
SMT6	Green innovation lowers costs
SMT7	Green innovation reduces product production time
SMT8	Green innovation creates sustainable value of enterprises
SMT9	Green innovation strengthens relationships with business partners/customers
SMT10	Green innovation reduces pollution control costs
SMT11	Green innovation helps businesses comply with environmental regulations
SMT12	Customers support businesses whose goods are produced in compliance with environmental standards
SMT13	Partners accept to cooperate with enterprises when products are manufactured in accordance with environmental standards
SMT14	Employees increase loyalty when businesses operate in accordance with environmental standards
SMT15	Employees increase productivity when businesses operate in accordance with environmental standards
SMT16	Businesses can expand business opportunities
IV Financial performance	
HQC1	Businesses reduce the cost of buying input materials
HQC2	Businesses reduce costs for energy consumption
HQC3	Businesses reduce waste treatment costs
HQC4	Businesses increase profits significantly
HQC5	Businesses reduce fines for environmental issues
HQC6	Businesses increase market share in the market
HQC7	The price of the product increases
HQC8	Businesses increase profit on assets
HQC9	Businesses grow return on equity
HQC10	Businesses increase sales revenue

Items	Indicator variable
HQC11	The financial value of the business is increased

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