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Do Technological Innovation and Export Matter in Product Innovation of Small and Medium Enterprises in Vietnam?

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ABSTRACT: This paper studies the effects of technological innovation and export on product innovation at small and medium Vietnamese enterprises (SMEs). The study uses cross-sectional data from 2,647 enterprises from 10 selected provinces in Vietnam. This study employs Logit regression to examine the relationship between technological innovation, export, and product innovation. This study finds that technological innovation and exports have a positive impact on product innovation. The findings of this study offer some policy discussions and the development of strategies to enhance product innovation among small and medium enterprises.

KEYWORDS: Product innovation, technological innovation, export, SMEs.

JEL codes: F18, O31, O32, O53.

I. INTRODUCTION

The world's big economies soon realized the importance and role of innovation in terms of efficiency and increasing the competitive edge of enterprises in the market (Singh, 2009). Furthermore, innovation helps firms react quickly to market changes or make market offers prior to their competitors (Zahra & Covin, 1995). Therefore, product innovation is important due to rapid changes in technology and global competition in the market eroding the added value of existing products and services (Gunday et al. 2011). Today, technological innovation and potential export markets appearing through Free trade agreements (FTAs) have gradually become the focus of research in the study of factors affecting product innovation. Since technological innovation has long been regarded as a crucial element in establishing and maintaining a country's or firm's competitiveness. It is generally accepted that technological innovation leads to higher innovation. Nonetheless, the literature on the effects of innovation and export reports is contrary to empirical evidence. Currently, there are very few studies on the technological innovation of SMEs and their export, especially the impact on export propensity in Vietnam. In Vietnam, SMEs' technological innovation activities have not been studied and are quite limited while they are decisive factors affecting product innovation of a firm. Most prior studies focus on the impact of R&D intensity, R&D-related capabilities, and technology on export decisions. Moreover, R&D spending has been used as an indirect measure of innovations in various earlier empirical investigations (Hirsch & Bijaoui, 1985; Kumar & Siddharthan, 1994; Basile, 2001) without considering other direct measurements of innovation such as product innovation and process innovation. In addition, to the best of the researcher's knowledge, there has been very scarce research that considers how the modification of technological innovation and SME export affects firms' likelihood to export.

We consider the issue in a transitional economy - Vietnam as the case for several reasons. First, the Vietnamese government is accelerating the implementation of the overall strategy for international integration through 2020, vision to 2030. Therefore, special attention has been being paid to providing incentives to exporting firms and expanding export markets. The promotion of firms' export activities is important for the country's overall export growth and economic development, especially in the context of the economy being adversely affected by the Covid-19 pandemic. In the meantime, research and development are considered as one of the golden keys to firms remaining competitive advantage in foreign markets. Although the R&D expense of Vietnamese companies has significantly improved in recent years, there are still many firms that have not fully recognized the importance of investment for R&D in the survival and success of their businesses. Second, the rich stream of innovation research has focused mainly on developed economies (Booth & Katic, 2013) and emerging economies (Tamini & Valéa, 2021). However, studying the association between technological innovation, export, and SMEs' product innovation in a transition economy such as Vietnam may be an interesting case. The country's economic reform since 1986 has marked the process of opening the economy, eliminating the State monopoly of foreign trade, and allowing privately held companies to participate in international business.

The speed of the transition and liberalization process in Vietnam is also different from that of other transition economies due to distinct institutions and policies applied during the process. Such a transition economy environment significantly impacts innovation policies, export strategies, and the performance of firms as it bears additional uncertainties (Vo & Le, 2017; Vo et al., 2018; Vo et al., 2022a) and can limit firms' absorptive capabilities (Meyer, 2004; Vo et al. 2021; Vo et al., 2022b). Third, although several studies have investigated innovation export activities of firms (c), a few studies examining the simultaneous effects of technological innovation and export on SME product innovation in a transition economy have been known little. Thus, the aim of the study is to enhance the understanding of how affects the product innovation of SMEs in a transition economy.

II. THEORETICAL BACKGROUND AND HYPOTHESIS

According to the Organization for Economic Cooperation and Development (OECD, 2005), there are four types of innovation including product, process, marketing, and organizational innovation. Specifically, product innovation is the introduction of a new product whose properties or uses have been improved significantly, including significant improvements in specifications, components and materials, integrated software, user-friendliness or other functional characteristics.

An economic theory commonly used to explain the innovation process of enterprises is the Product Life Cycle theory (PLC) being proposed by Vernon (1966). According to Lambkin & Day (1989), this theory is divided into four stages including introduction, growth, maturity and decline. The nature of the international product life cycle is technological innovation and market expansion, which are important for explaining product innovation models. In other words, technology is a pivotal factor for creating and developing new products, while the strategic determination and international trade model is influenced by the size and structure of the market (Morgan & Katsikeas, 1997).

Salomon & Shaver (2005) collected data from 276 Spainish enterprises to research the relationship between exports and innovation's ability. The results show that exporting is positively related to the increase of innovation, the learning capacity of firms being realized through export activities.

Another study by Damijan et al. (2008) studied small and medium-sized enterprises in Slovenia on the relationship between export activities and product innovation, process innovation in enterprises. This research claims that export experience exert a positive impact on the innovation.

Afterwards, Divisekera & Nguyen Van Khanh (2018) researched Australian companies and concluded that input motivation for innovation includes government funding, cooperation, human resources, and technology, while institutional, foreign ownership factors are the main one. At which point, Mai Le Thuy Van et al. (2018) studied the relationship between internal and external influences on innovation activities of 996 Vietnamese companies. The study points out the limitations of Vietnamese SMEs in the process of implementing technological innovation: financial resources, relationships with organizations outside the enterprise, etc.

Recently, Heji et al. (2019) studied the relationship between R&D spending, technological innovation and product innovation has been studied by Heji et al. (2019) with data from 730 companies in the Netherlands. The study showed that there is a positive relationship between R&D (technology innovation) spending and product innovation. Following that, Nguyen Thi Van Anh & Nguyen Khac Hieu (2020) studied the factors affecting innovation in SMEs in Vietnam. The results show that the following variables have an effect on a firm's technological innovation: firm size, international quality certification, export, informal cost, government technical support.

Through the review of the related studies to increase the persuasion and have more basis when analyzing for the relationship between technological innovation, export and product innovation for the topic.

A. Technological innovation

Technological improvement gradually becomes an important role in life with the creation and application of new technological knowledge to make things differently than already implemented; speciality about products and services or processes of company (Barge-Gil & López, 2014). Heji et al. (2019) found that there is a positive relationship between R&D spending, technology, and product innovation. Investment in R&D is by far the most popular indicator being used in technological innovation (Volberda et al. 2013). This is almost universally accepted by researchers as the innovation term is mainly associated with research and development (R&D) associated with the creation of new products (Armbruster et al. 2008). New technological knowledge challenge, strengthen trust and knowledge basis allowing businesses to consider, innovate processes and their operating habits (Forsman, 2009) and motivates businesses to realize new opportunities to innovate products (Foss, Lyngsie & Zahra, 2013). These results strengthen the support for the following hypothesis:

Hypothesis 1 (H_1): Technological innovation has a non-linear effect on product innovation of SMEs in Vietnam.

B. Export

According to Lefebvre et al. (1998), source of data from small manufacturing companies in Canada indicated that efforts in research or product improvement and cooperation with competitors pointing out the differential effect between exporters and non-exporters. According to Van Beveren et al. (2010), most enterprises choose to innovate themselves before exporting. Salomon & Shaver (2005) realize that exports produce positive impacts to the innovation afterwards. Girma et al. (2008) seek positive evidence of exporter status on investment decisions for innovation of Irish firms. Damijan et al. (2008) claim that past exporting experience boosts innovation. Understanding the present export market is the top priority of businesses before entering a new market, thereby improving their products to meet customers needs in this market. Based on the above arguments, the study proposes the second hypothesis:

Hypothesis 2 (H_2): Export has a non-linear effect on product innovation of SMEs in Vietnam.

From the above arguments and based on the results of previous studies, the research model is summarized in Figure 1.

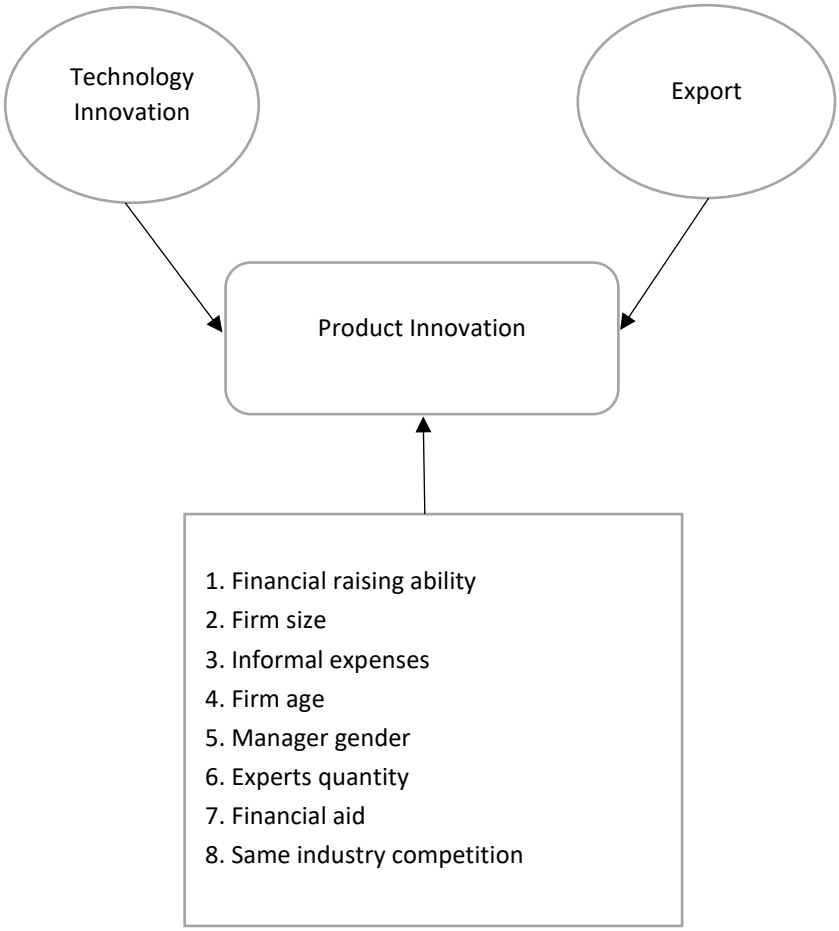

Figure 1: Theoretical model

III. RESEARCH METHODOLOGY

A. Data source

Statistical data on Vietnamese SMEs were collected from 10 provinces selected for the 2015 survey round according to established customs in previous rounds (Hanoi, Ha Tay, Hai Phong, Ho Chi Minh City, Phu Tho, Nghe An, Quang Nam, Khanh Hoa, Lam Dong and Long An). These enterprises have been re-interviewed every two years since 2005, the survey is a collaborative effort of the Central Institute for Economic Management (CIEM), the Institute of Labor and Social Sciences (ILSSA), and other staffs of the Ministry of Labour-Invalids and Social Affairs (MOLISA) and ten representatives of the Department of Labour-Invalids and Social Affairs (DOLISA). Development Economics Research Group (DERG) at the University of Copenhagen and UNU-WIDER. The stratified sampling method is used because of its certain advantages. The surveyed enterprises belong to 18 fields as food processing, metal products manufacturing and wood products production.

B. Definition and measurement of variables in the research model

1) Dependent variable: Product innovation – DMSP Product

Product innovation is a dummy variable that takes the value 1 if the enterprise has recommended a new product line or group and commercializes that product on the market in a year and conversely has been the value 0 (Romijn & Albaladejo, 2002).

2) Independent variables

The independent variables in the study include technological innovation, R&D spending and exports.

Technological innovation and R&D expenditure are used to measure the level of technology innovation of the enterprise. Specifically, the former is a dummy variable, taking the value 1 if the enterprise has introduced at least one new technology/ production process in a year, and the value 0 otherwise. Nguyen Thi Van Anh & Nguyen Khac Hieu, 2020). The second variable measure of technological innovation taking place in the enterprise is the amount of money invested for R&D department/ the total revenue of the business for the year, the unit of which is million VND, the calculation result is (%). This measure has been used by many researchers (Romijn & Albaladejo, 2002; Nguyen Thi Van Anh & Nguyen Khac Hieu, 2020).

$$\text{RND} = \frac{\text{Total R\&D expenditure}}{\text{Total revenue}}$$

The export variable is measured by a dummy variable that takes the value 1 if the firm has conducted exporting and the value 0 otherwise (Nguyen Thi Van Anh & Nguyen Khac Hieu, 2020).

3) Control variables

Financial raising capacity is measured by the number of short-term and long-term loans the enterprise receives from outside organizations. If enterprises have been accessed to financial resources from credit institutions which will exert a positive effect on their innovation activities (Avlonitis, 2007).

Firm size is measured by the natural logarithm of the total number of official or full-time employees in the company. Some studies claim that larger companies have better finance, marketing, stronger research ability, and deeper product/process development experience which facilitate the transformation of innovative ideas into new products and processes (Azadegan, Patel, & Parida, 2013).

Informal cost (also known as lubrication cost) is measured by a dummy variable that takes the value 1 if the firm has to pay informal costs and the value 0 otherwise. This cost makes a barrier for businesses to innovate, improve product quality as well as renovate (Nguyen Thi Van Anh & Nguyen Khac Hieu, 2020).

Business age will be evaluated by calculating the number of years from established to the year the survey was conducted. The longer firms have operated, the more experience they will accumulate in market exploration, afterwards they can access better resources to take risks in innovation activities. (Wang et al. 2008).

Manager gender in the research is a dummy variable, taking the value 1 if the senior manager is male and the value 0 if the senior manager is female. According to Ndoro (2012) shows that if the owners are male which will help their business innovate more effectively thanks to the dynamism of men in searching, exploiting and planning long-term business strategies.

Experts quantity is measured by the number of specialists in the company in comparison to the total employees. Romijn & Albaladejo (2002) pointed out that the workforce's education level can contribute to the creative capacity of the enterprise, especially the presence of university-educated professionals.

Financial support in the study is a dummy variable, taking the value 1 if the business has received financial support from the government and taking the value 0 otherwise. According to Divisekera & Nguyen Van Khanh (2018), government funding seems to be by far the most effective form of support to stimulate innovation.

Same industry competition in the study is a dummy variable, taking the value 1 if the firm faces competition from firms operating in the same industry and the value 0 otherwise. Strong competition puts downward pressure on costs, leading to greater innovation activities (Soames et al. 2011).

C. Estimation method

Since the dependent variable is measured in two states including product innovation and none using Logit regression model for data analysis. In this study, Logit regression method is used to determine the factors that affect product innovation in Vietnamese SMEs. Logit regression equation of the theme can be presented as follows:

$$\ln\frac{\widehat{P_1}}{1-\widehat{P_1}} = \beta_0 + \beta_1 DMCN + \beta_2 RND + \beta_3 XK + \beta_4 HDTC + \beta_5 QM + \beta_6 CP + \beta_7 TGHD + \beta_8 GT + \beta_9 SLCG + \beta_{10} HTTC + \beta_{11} CT + \varepsilon$$

In which:

$\widehat{P_1}$: estimate the probability of the enterprise will implement product innovation

$1-\widehat{P_1}$: estimate the probability of the enterprise will not implement product innovation

β_0, β_1, …, β_{11}: estimated coefficients
ε: error

Table 1. Description of variables in the study

Variable names	***How to measure***	***Expectations***
Product Innovation **(DMSP)**	Dummy variable: Take the value 1 if the business introduces a new product line, group of products, commercializes that product in the market for a year and takes the value 0 otherwise (Romijn and Albaladejo, 2002)	
Technological Innovation **(DMCN)**	Dummy variable: takes the value 1 if the firm apply at least one new technology/ new production process in a year and get 0 otherwise (Nguyen Thi Van Anh and Nguyen Khac Hieu, 2020)	(+)
R&D expenditure **(RND)**	Ratio of money spent on R&D department with the total revenue of the enterprise in the year (Romijn and Albaladejo, 2002; Nguyen Thi Van Anh and Nguyen Khac Hieu, 2020)	(+)
Export **(Export)**	Dummy variable: take the value 1 if the enterprise performs the activity export and receive 0 otherwise (Nguyen Thi Van Anh and Nguyen Khac Hieu, 2020)	(+)
Financial raising capacity **(HDTC)**	The quantity of short-term and long-term loans received by enterprises from outside organizations (Avlonitis, 2007)	(+)
Size **(QM)**	Natural logarithm of total number of official or full-time employees in the company (Azadegan et al. 2013)	(+)
Informal Cost **(CP)**	Dummy variable: takes value 1 if the firm has to pay informal expenses and get 0 otherwise (Nguyen Thi Van Anh and Nguyen Khac Hieu, 2020)	(-)
Business Age **(TGHD)**	Number of years from establishment of the business to the year of the survey (Wang et al. 2008)	(+)
Manager Gender **(GT)**	Dummy variable: take the value 1 if the manager grants high is Male and get 0 if the senior manager is Female (Ndoro, 2012)	(+)
Experts Quantity **(SLCG)**	Ratio of number of experts in the company to the total number of employees (Romijn and Albaladejo, 2002)	(+)
Financial support **(HTTC)**	Dummy variable: takes the value 1 if the business has received financial support from the government and get 0 otherwise (Divisekera and Nguyen Van Khanh, 2018)	(+)
Same Industry Competition **(CT)**	Dummy variable: take the value 1 if the firm faces competition from other firms operating in the same industry and get 0 otherwise (Soames et al. 2011)	(+)

Source: Author's compilation

IV. RESULTS AND DISCUSSION

A. Research results

Table 2 shows mean, standard deviation, minimum value, maximum value, variance inflation factor, and also indicates that the VIF index of the independent variables in the model is all less than 10. Thereby, the current models do not exist multicollinearity when considering these variables in the research model.

Inspections of the model: Pearson Chi - square test, marginal impact level. In terms of Chi-square test, the test results are p>0,05, so this model is suitable. The marginal effect test shows that the independent and control variables are statistically significant after estimating regression which actually have an impact on the dependent variable.

Table 2. Statistical description and test for multicollinearity between variables in the model (N= 2647)

Variable name	*VIF*	*Mean*	*Standard Deviation*	*Minimum value*	*Maximum value*
DMSP		0,238	0,426	0	1
DMCN	1,10	0,049	0,215	0	1
RND	1,03	0,002	0,012	0	0,179
XK	1,33	0,070	0,255	0	1
HDTC	1,34	0,404	0,968	0	24
QM	4,98	1,702	1,187	0	6,551
CP	2,30	0,431	0,495	0	1
TGHD	2,81	16,506	10,129	2	61
GT	2,23	0,590	0,491	0	1
SLCG	1,44	2,776	6,745	0	75
HTTC	1,13	0,053	0,224	0	1
CT	4,96	0,876	0,329	0	1

Source: Processing results from Stata.

Table 3. Regression result

Variable name	*Estimated coefficient*	*Marginal effect (dy/dx)*
Hằng số	-1,120 (0,174)	
DMCN	0,508** (0,199)	0,102**
RND	0,518 (3,807)	0,093
XK	0,437** (0,193)	0,086**
HDTC	0,250*** (0,054)	0,045***
QM	-0,133** (0,053)	-0,024**
CP	-0,151 (0,108)	-0,027
TGHD	0,009** (0,005)	0,002**
GT	0,056 (0,095)	0,010
SLCG	0,017** (0,007)	0,003**
HTTC	0,265 (0,197)	0,050
CT	-0,206 (0,137)	-0,038

Note: (***): Significance level 1%; (**): 5% Significance level; (*): Significance level 10%; std: standard error

Source: Processing result from Stata.

B. Discussion

1) Technological innovation

According to Table 4.3, it can be seen that technological innovation in **DMCN** (β=0,508; p=0,011) has statistical significance at the significance level of 5%. Technological innovation exerts a positive impact on product evolution in Vietnamese SMEs. The coefficient of marginal effect shows that if enterprises implement technological innovation leading to the probability of product innovation in these enterprises increases by 10,2%. Henceforth, if enterprises can or have the capacity to apply new technology/process to the product creation process which will promote the motivation to create new products. This is consistent with the results of previous studies (Barge-Gil and López, 2014; Heji et al. 2019).

2) R&D expenditure

Although the RND variable is not statistically significant in this study, the practical impact of R&D investment on technological and product innovation cannot be denied. The process of R&D spending takes a long time to see results, on the other hand there was

limited R&D data measuring only one year which is a relatively short time to perceive R&D efficiency of recently developed research. However, we still witness the positive side of the former to the latter through the DMCN variable, which shows that businesses can apply new technologies/processes to production which proves that R&D projects from previous years have successfully transformed knowledge, especially the effectiveness of product innovation. This means that hypothesis 1 is supported.

3) Exports

The result of the variable **"Exports"** (β=0,437; p=0,023) is statistically significant at the 5% level of significance. The coefficient of marginal effect shows that if enterprises carry out export activities, their probability of product innovation increases by 9,3%. This result shows that if they can or have the capacity to carry out export activities in the business process, which will promote the motivation to create new products. This is consistent with the outcomes of previous studies (Damijan et al. 2008). Product life cycles are getting shorter and shorter, innovation is the only opportunity for businesses to stand firmly in the market. That is the reason why businesses must innovate fundamentally and continuously to best adapt in the market. This means that hypothesis 2 of the study is accepted.

4) Financial raising capacity (HDTC)

The ability to mobilize finance is the variable that has a positive impact on the product innovation activities of enterprises **"HDTC"** (β=0,250; p=0.000) at the level significance of 1%. For the most and part of the financial resources of SMEs enterprises stemming from banks, if businesses have access to financial resources from these credit institutions that is a positive influence on their innovation activities. (Avlonitis, 2007).

5) Firm size (QM)

Firm size has a negative impact on product innovation, variable QM (β=-0,133; p=0,012) has significance level at 5%. The research results are contrary to the original hypothesis but suitable to explain for new companies or startups whose managers lack of experience. The more large scale they have, the more difficult they control the business leading to innovate hardly. While, small-scale enterprises are better able to adapt to environmental changes than large-scale ones.

6) Informal Expenses (CP)

The variable CP (β=-0,151; p=0,162) has no statistical significance, which means that informal costs do not affect the product innovation of firms in this study. Henceforth, this cost does not create a competitive advantage.

7) Firm age (TGHD)

The research outcomes show that firm age has a positive impact on product innovation, the variable TGHD (β=0,009; p=0,042) with a significance level is 5%. In fact, the larger the number of years of the enterprises's operation, the easier for them to innovate the product that is consistent with many previous research results. Enterprises with more operating time will accumulate more experience in market exploration and access to better resources to take risks in innovation activities (Wang et al. 2008; Nguyen Quoc Duy, 2015).

8) Manager's gender (GT)

The variable GT (β=0,056; p=0,557), which means that the manager's gender does not affect the product innovation of the enterprise in this study as according to current trend of gender equality, both men and women are equal, treated equally by society, so there will be no alien.

9) Number of Experts (SLCG)

The study performances show that the number of experts of the enterprise is a variable that has a positive impact on product innovation, the variable SLCG (β=0,017; p=0,015), the significance level of 5%. This result is consistent with the previously mentioned research that indicates that the education level of the workforce can contribute to the creative capacity of the enterprise, especially the presence of qualified professionals owning university degrees (Romijn & Albaladejo, 2002).

10) Financial Aid (HTTC)

The variable HTTC (β=0,265; p=0,178), which means that financial support from the government does not affect the product innovation of enterprises in this study because the enterprise has not determined the development orientation. Without a clear direction for development and innovation, it is difficult to measure the scale of innovation and meet procedures for receiving support's need.

11) Same industry competition (CT)

The variable CT (β=-0,265; p=0,134) has no statistical significance, which means that the same industry competition does not exert an effect on the product innovation of enterprises, because if high competition leads to excessive free competition, which is not conducive to improving the competitive edge of the industry and enterprises.

V. CONCLUSION AND IMPLICATIONS

According to product life cycle theory and previous empirical evidence, the article measures the effects of technological innovation and exports on product evolution. Through a sample set of 2647 Vietnamese SMEs in the 2015 survey. The research results show that technological innovation and export have a positive relationship with product innovation in enterprises.

The obtained research results imply that technological innovation is an effective way for enterprises to implement product innovation. Most Vietnamese companies are small and medium-sized, so the level of access to technology is somewhat flexible and thanks to the active support from the government (through the HDTC variable) which helps them to access the technology effectively, leading to a positive impact on innovation activities. Furthermore, well-trained and qualified human resources (through the variable SLCG) is considered as the driving force in technological innovation.

In addition, the results also indicate the recent development of export activities thanks to Free Trade Agreements with many benefits. The former is the improvement of business performance, and the latter is product innovation activities has been promoted. Therefore, the authorities should give priority to accessing incentives as well as understanding barriers to effectively "cross the border".

Although some limitations do exist, there are many opportunities for further research development in Vietnam, specifically the time limitation of the data. The data included in the study is in the form of one-year data, so only a few important time factors affecting the innovation process, as well as the long-term influence of other factors, may have been omitted. In addition, the author will try to expand the survey sample size, specifically, the quantity of businesses has increased which provides a better general and accurate view of product innovation in Vietnam, being considered as the oriented development for the future studies.

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