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Impact of internal factors on product innovation: Empirical Evidence from Vietnamese textile and garment firms

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Abstract

This article aims to examine the internal factors affecting product innovation in Vietnamese textile and garment enterprises. The study used statistical methods and logit regression models along with data collected from the 2021 Economic Census of the General Statistics Office of Vietnam. The research results show some statistically significant results, as follows: (i) enterprises with state capital account for the lowest proportion in the sample but have the highest product innovation rate, and the proportion of product innovation in textile and garment enterprises increases gradually with enterprise size; (ii) enterprise characteristics (employee size and import-export activities) have a positive influence on product innovation; (iii) characteristics of business owners including gender, level of expertise, and gender diversity among owners all influence product innovation; (iv) applying information technology (using the internet, management software, automation systems, and spending on software) has a positive influence on product innovation; (v) enterprise resources for innovation including capital intensity and research and development activities have a positive influence, while, labor costs have a negative influence on product innovation. Furthermore, the role of capital intensity in product innovation depends on the type of enterprise. Specifically, this influence is strongest for enterprises with 100% foreign capital but is not statistically significant for joint-stock companies that do not have state capital. The research results are the basis for proposing solutions and recommendations to increase the product innovation of textile and garment enterprises in Vietnam.

Keywords: Impact, Internal factors, Logit regression model, Product innovation, Textile and garment, Vietnam.

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1. Introduction

In contemporary markets, customer expectations encompass advanced features, high quality, and reasonable prices, making product innovation a crucial factor for meeting these demands and retaining customers. Furthermore, product innovation enhances business competitiveness, enables the creation of new products tailored to customer needs, and facilitates market expansion. When businesses engage in product innovation, they can enhance product features, reduce costs, or increase product value, thereby improving their competitiveness and attracting customers. Additionally, product innovation allows businesses to generate new value for customers, leading to increased customer satisfaction. Consequently, in today's rapidly developing economy, product innovation holds significant importance for enterprise development [1].

Aligned with this trend, the textile industry in Vietnam has recognized product innovation as a key imperative. The textile and garment industry is a vital economic sector in Vietnam, contributing significantly to the country's GDP. According to the General Statistics Office, as of December 31, 2020, there were 23,738 enterprises operating in the textile and garment industry in Vietnam. The Ministry of Industry and Trade of Vietnam reports an 8.3% increase in industrial production in the textile industry and a 7.6% increase in the garment industry in 2021 compared to 2020. Textile and garment exports are projected to be worth 40.3 billion USD in 2021, a 15.2% increase from the previous year. Foreign direct investment enterprises account for USD 24.3 billion of textile and garment exports, representing a 17.8% increase and constituting 60.3% of the country's total textile and garment export turnover. Despite these achievements, Vietnam's textile and garment enterprises face challenges such as regional and global competition, rising raw material prices, and tariff reforms in foreign trade partnerships. Consequently, many enterprises in the industry have recognized product innovation as a strategy to enhance product quality, improve competitiveness, meet market demand, and ensure sustainable development in the future. However, the internal factors of enterprises play a critical role in successful product innovation. Therefore, studying the influence of internal factors on product innovation in Vietnamese textile and garment enterprises is essential to proposing solutions for improving productivity and product quality, thereby fostering sustainable development in the textile and garment industry and actively contributing to the national economy.

This study aims to test hypotheses regarding the influence of internal factors on product innovation in Vietnamese textile and garment enterprises. The article is structured into five parts. Following the introduction, Section 2 provides an overview of research related to internal factors impacting product innovation in enterprises. Section 3 describes the materials and methods, including data, variables, and the research model. Section 4 presents detailed estimation results from Logit models and tests the research hypotheses. Finally, Section 5 highlights theoretical and managerial contributions, as well as policy implications.

2. Literature Review

2.1. The Linkage between Firm Size and Product Innovation

There has been considerable discussion among both academics and practitioners about the relationship between firm size and product innovation. An increase in linkage was first noted by Schumpeter [2]. Large firms have been more likely to adopt a new technology toward introducing a new product. SMEs are more flexible when it comes to adapting to change and responding quickly, encouraging innovation and creativity [3-5], but they are often less likely to have access to the key resources and capabilities for innovation [6]. The reason for this is that small and medium-sized enterprises (SMEs) possess certain advantages due to their small size, streamlined business model, and proximity to their customer base. These factors enable SMEs to swiftly recognize emerging market opportunities ahead of their competitors. On the other hand, larger companies with economies of scale and substantial resources are better positioned to excel in innovation endeavors that necessitate investments in technology and intangible assets. Henceforth, a debate about the linkage that continues today as a consensus among researchers has to be reached. The empirical evidence on nexus firm size and product innovation at the firm level is inconsistent; it depends on several issues, such as research context and helpful resources that will help product innovation in enterprises.

2.2. The Linkage between Export and Product Innovation

Scholars have recognized the significant role of exporting in the global economy. Exporting is a widely adopted strategy for entering international markets [7]. Many scholars support the export promotion theory, which suggests that exports can drive innovation through factors such as scale, competition, spillover, and learning effects [8]. Several recent studies have explored the causal impact of exporting (export status or export intensity) on product innovation. Salomon and Shaver [9] conducted an analysis using firm-level data and found evidence of learning by exporting in terms of product innovation among Spanish manufacturing firms from 1990 to 1997. The study drew information on product innovation from a survey where firms self-reported the number of new or improved products and the number of patent applications. The authors discovered a positive causal effect of both export status and export volume on innovation, taking into account factors such as firm size, R&D expenditure, and advertising intensity. Notably, the increase in product innovation occurred shortly after firms began exporting. Fafchamps, et al. [10] utilized panel data from Moroccan manufacturers and found a positive relationship between product innovativeness and the duration of export experience. They interpreted this finding as an example of learning by exporting, suggesting that Moroccan firms, mainly specializing in consumer goods like garments, textiles, and leather, needed to design products that appealed to foreign consumers. In favor of the argument is Bratti and Felice [11] work, which found that export status positively affected the probability of introducing product innovation. Di Cintio, et al. [12] found that companies engaged in direct exporting have a greater likelihood of introducing product innovation in comparison to firms that do not export or engage in indirect exporting.

Overall, these studies highlight the importance of exporting for driving innovation and demonstrate the positive effects of export activities on product innovation in different contexts.

2.3. The Linkage between the Trait of Manager and Product Innovation

According to the resource-based view (RBV) of the firm, innovation plays a critical role in maintaining a competitive edge over rivals. However, it is crucial to recognize that innovation is not a static state and has a finite lifespan before becoming outdated. Hence, achieving sustained innovativeness is vital for companies in the long term [13].

Top managers hold a pivotal position in driving organizational goals and objectives, particularly through the adoption of inclusive leadership styles. Their educational backgrounds and experiences contribute to product development within the firm. By actively staying abreast of emerging trends through ongoing education and gaining practical market experience, they are better equipped to enhance the firm's processes, products, and market strategies [14].

In addition to comprehending the marketplace and customer needs, senior managers must also possess a solid understanding of financial literacy to make informed decisions, mitigate risks, and achieve the firm's objectives. Research by Corley and Schinoff [15] has demonstrated that senior management's financial literacy enhances their confidence in capitalizing on new investment opportunities and making sound decisions compared to those with limited financial literacy.

Furthermore, recent studies have explored the impact of demographic factors and leadership traits of top managers on different types of innovation. Shah, et al. [16] affirmed that the educational level and experience of top managers and owners positively influence product innovation. Okrah and Irene [17], in their study, found that as managers gain expertise, their inclination towards innovation increases. Interestingly, the logit model indicates that managers' propensity for innovation starts to rise after the fourth year, suggesting a progressive shift in their attitude towards innovation.

2.4. The Linkage between R&D Intensity and Product Innovation

The relationship between R&D and innovation is found in both theoretical and experimental studies. Spending on R&D expenditures and the existing knowledge base provide the enterprise with better opportunities to adopt successful product innovation. Furthermore, R&D activities have the potential to bring significant transformations to a firm's knowledge base and reshape its frame of reference [18]. By revising and updating existing knowledge, firms can engage in double-loop learning, a process that is particularly advantageous for driving product innovation. New technological knowledge allows a company to think about innovating its processes and operating habits, thereby recognizing new opportunities for innovation. Recent research conducted by Carvache-Franco, et al. [19] provides new insights into the relationship between research and development (R&D) intensity and product and process innovation. The study found a positive association between R&D intensity and innovation in both products and processes in Ecuador and Peru. However, no significant relationship was observed in the case of Chile.

2.5. The Linkage between IT Application and Product Innovation

The study by Chen, et al. [20] reveals that the development of technology has an impact on the innovation of businesses. Firms that can adopt new advanced technologies are more likely to have innovative products and improve existing ones. The paper by Wu, et al. [21] suggests that Internet-based collaboration has a positive impact on the product innovation performance of supplying firms. Nonetheless, it is important to note that an excessive dependence on Internet-based collaboration can impede product innovation. In other words, there exists an inverted U-shaped relationship between Internet-based collaboration and the performance of product innovation. Bartelsman, et al. [22] conducted a study that showed how broadband connectivity can boost innovation and productivity in firms across ten European countries. In today's world, businesses can leverage technologies like deep learning and data mining to efficiently search for information and address emerging technical obstacles. Blockchain technology facilitates comprehensive supply chain management and bolsters product trustworthiness. Simulation software, design tools, and product modeling enable businesses to swiftly test novel solutions and enhance existing products. Textile and garment industries can optimize operations through the use of automated machinery, ensuring precise and rapid cutting, sewing, and finishing processes. Additionally, sensors and intelligent monitoring systems allow for real-time tracking of crucial parameters such as temperature, humidity, pressure, and production speed.

3. Materials and Methods

3.1. Data Collection

The sample was selected based on the economic census from the Vietnamese General Statistical Office in 2021. A total of 23,738 Vietnamese garment and textile firms were recruited for this survey until the end of 2020. Data management was obtained using an Excel program and statistical significance was analyzed using Stata software.

3.2. The Model

The objective of this research model is to identify the factors that influence product innovation in the textile and garment industries in Vietnam. Product innovation behavior is represented as a binary variable, where a value of 1 indicates that a business has innovated or improved its product during the year, and a value of 0 represents all other cases. According to Long [23], the appropriate model for analyzing this type of dependent variable is the logistic model class. To determine whether to use the Logit or Probit models, we employ test criteria based on Akaike Information Criteria (AIC) and Bayesian Information Criteria (BIC). The results of the Logit model are deemed more suitable and are utilized in this study.

Figure 1illustrates the research model.

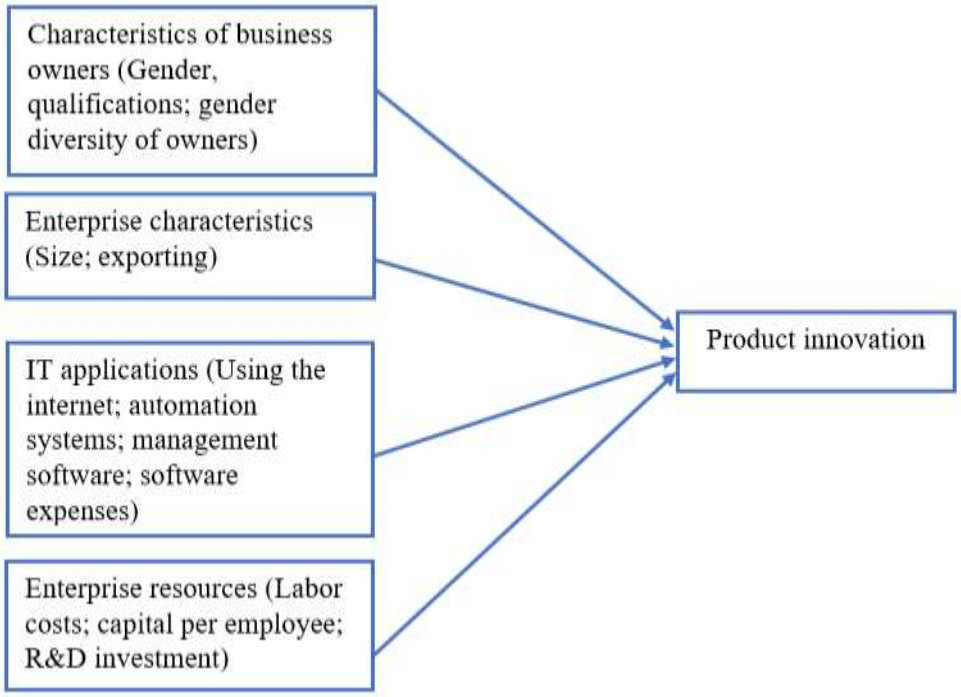

Figure 1.
Research model.

Dependent variable Y, taking either 0 or 1, in product innovation research.

Y = 1, if the company introduces a new product to the market or improves an existing product, and Y = 0 otherwise.

The Logit model is based on the logistic distribution function, which is an S-shaped curve between 0 and 1, used to convert a linear combination of predictor variables into a value for the probability of an event occurring.

$$p = P(Y = 1|X) = \frac{e^{\beta_0+\beta_1X_1+\cdots+\beta_kX_k}}{1 + e^{\beta_0+\beta_1X_1+\cdots+\beta_kX_k}} = \frac{e^{X\beta}}{1 + e^{X\beta}}$$

In which, $\beta_0$is the intercept coefficient;β_0; $\beta_1; \beta_{2;} \ldots;$ β_k are the coefficients (parameters) corresponding to the independent variables (predictor variables) $X_1, X_2, \ldots, X_k$. Return the linear function as follows:

$$1 - p = 1 - \frac{e^{X\beta}}{1 + e^{X\beta}} \Leftrightarrow 1 - p = P(Y = 0|X) = \frac{1}{1 + e^{X\beta}}$$

Calculate the ratio $\frac{p}{1-p} = e^{X\beta}$called the OR-odds ratio.

Taking the natural logarithm of the odds (OR), we get a linear model in terms of X and β:

$$\ln\left(\frac{p}{1-p}\right) = X\beta$$

The parameters β are estimated by the method of maximum likelihood. To consider the effect of X on p, calculating partial derivatives of both sides with respect to X, we have:

$$\frac{\partial p}{\partial X} = p(1-p)\beta$$

3.3. Empirical Model

The empirical model was written for each observed variable as follows

$$\ln\left(\frac{p_i}{1-p_i}\right) = \beta_0 + \beta_1 Size_i + \beta_2 Exim_i + \beta_3 Cost\_Labor_i + \beta_4 Capital_i + \beta_5 R\&D_i + \beta_6 Net_i + \beta_7 Auto_i + \beta_8 Soft_i + \beta_9 Cost\_Soft_i + \beta_{10} Gen_i + \beta_{11} Fem_i + \beta_{12} Qua_i$$

Where $p_i = P(Innovation_i = 1|X_i)$is the probability of introducing a new product to the market or improving an existing product.

The independent variables are explained in Table 1.

In the empirical research model, unlike previous studies, we include new explanatory variables representing the application of information technology in the production and business activities of enterprises. In the context of digital transformation in developing countries, this study expects the application of information technology (using the internet, management software, and automation systems) to promote product innovation.

Table 1.
Explain the variables in the empirical research model.

Variable symbol	Name	Explanation
Explanatory variable		
Innovation	Product innovation	A binary variable, taking the value of 1 if in the year the firm has product innovation or improvement, equal to 0 otherwise
Dependent variable		
Capital	Capital intensity	The natural logarithm of total capital at the end of 2020 divided by the total number of employees at the end of the year
Exim	Firms with import and export activities	A dummy variable, set to 1 if an exporter; equal to 0 otherwise
Cost_labor	Average pay for labor	The natural logarithm of the total labor costs in the year (Total amount payable to employees incurred in the year; Total amount paid to employees from the bonus and welfare fund; Contribution to union dues, social insurance, health insurance, unemployment insurance) divided by the total number of employees at the end of the year
Gen	Gender of the firm manager	A dummy variable, set to 1 if a manager is male, equal to 0 otherwise
Fem	Gender diversity of owners	A dummy variable is set to 1 if one of the firm owners is female and 0 otherwise
SIZE	Firm size	Natural logarithm labor at the end of 2020
R&D	Investment research and development	A dummy variable, set to 1 if firms invest in R&D activities, and 0 otherwise
Net	Uses of the internet for business	A dummy variable, set to 1 if firms use the internet, and 0 otherwise
Auto	Uses of automation in business	A dummy variable, set to 1 if firms use automation = 0 otherwise
Soft	Uses of application software for business	A dummy variable = 1 if firms use software = 0 otherwise
Qua	Educational level	A dummy variable = 1 if manager/Owners were trained = 2 if manager/Owners were trained during 3 months below = 3 if having a primary training level = 4 if having an intermediate training level = 5 if having a college certificate = 6 if having a bachelor's degree = 7 if having a postgraduate degree = 8 if having a doctorate = 9 otherwise

4. Results and Discussion

4.1. Current Situation Product Innovation of Textile and Garment Enterprises

4.1.1. Product Innovation by Ownership

The proportion of enterprises that have innovative products by ownership could be represented as below:

Table 2.
Product Innovation by ownership.

Ownership	No innovation		Innovation	
	Quantity	Percentage %	Quantity	Percentage %
One-member limited liability company with 100% central state capital	10	58.82	7	41.18
One-member LLC with 100% local State capital	2	50	2	50
Joint stock companies, limited liability companies with state capital > 50%	38	43.18	50	56.82
Cooperative	187	77.92	53	22.08
Private enterprise	383	91.41	36	8.59
Private limited company, a limited company with state capital <= 50%	13,988	85.14	2,441	14.86
Joint stock companies do not have state capital	1,946	68.33	902	31.67
Joint stock company with state capital <= 50%	53	43.09	70	56.91
Enterprises with 100% foreign capital	2,354	70.29	995	29.71
State-owned enterprises enter into joint ventures with foreign countries	9	81.82	2	18.18
Other enterprises enter into joint ventures with foreign countries	153	83.15	31	16.85
Total	19,123	80.65	4,589	19.35

As can be seen from Table 2, the type of limited company and joint stock company (state-owned enterprises) accounted for a big percentage compared to other companies, with 70% of single share-holder limited companies having product innovation, over 60% of joint stock companies, and state-owned limited companies (half of the state or above) having product innovation, whereas the proportion of other state-owned limited companies is quite low (under 20%).

4.1.2. Product Innovation by Firm Size

Table 3 presents product innovation by firm size.

Table 3.
Product innovation by firm size.

Capital	No innovation		Innovation	
	Quantity	Percentage %	Quantity	Percentage %
Micro bussiness	11,867	89.19	1,438	10.81
Smal bussiness	4,840	76.58	1,480	23.42
Medium business	1,454	68.36	673	31.64
Large bussiness	962	48.44	1,024	51.56
Total	19,123	80.56	4,615	19.44

In general, the percentage of Vietnamese textile and garment enterprises that have product innovation is approximately 19,44% in which the number gradually increases by firm size. The percentage of microbusiness (with the smallest proportion) is the lowest, the figure represents about 10.81%.

4.1.3. Product Innovation by Firm Activities

Table 4.
Product innovation by firm activities.

Activities	Status	No innovation		Innovation	
		Quantity	Percentage %	Quantity	Percentage %
R&D	0	18,982	83.06	3,871	16.94
	1	141	15.93	744	84.07
	Total	19,123	80.56	4,615	19.44
Exim	0	14,173	87.39	2,045	12.61
	1	4,950	65.82	2,570	34.18
	Total	19,123	80.56	4,615	19.44
Net	0	5,514	92.89	422	7.11
	1	13,609	76.45	4,193	23.55
	Total	19,123	80.56	4,615	19.44
Auto	0	18,299	84.55	3,345	15.45
	1	824	39.35	1,270	60.65
	Total	19,123	80.56	4,615	19.44
Cost_soft	0	3,708	74.1	1,296	25.9
	1	2,931	60.97	1,876	39.03
	Total	6,639	67.67	3,172	32.33
Soft	0	2,635	78.52	721	21.48
	1	4,004	62.03	2,451	37.97
	Total	6,639	67.67	3,172	32.33

It can be seen from Table 4 that firms that invest in R&D activities account for the highest product innovation proportion, the percentage shows up to 84,07%, coming from second position firms that use automation for business.

4.2. Empirical Model Estimation

4.2.1. The Result of the Sample

This is the result of Logit regression model estimation by using the maximum likelihood method, fixing for Heteroscedasticity, removing several observations that are missing data, 9542.

Table 5.
Logit regression model estimation.

Innovation	Coef.	Std. err.	P>z	Mean	Margin	dy/dx
Size	0.192	0.040	0.000	3.999		
Exim	0.173	0.062	0.005	0.076	0.332	0.031
Cost_labor	-0.079	0.034	0.019	0.539		
Capital	0.095	0.019	0.000	8.469		
R&D	2.225	0.120	0.000	6.001	0.782	0.458
Net	0.564	0.127	0.000	0.945	0.321	0.091
Auto	1.125	0.064	0.000	0.177	0.536	0.231
Soft	0.355	0.056	0.000	0.663	0.341	0.062
Cost_soft	0.294	0.051	0.000	0.495	0.347	0.052
Gen	0.332	0.077	0.000	0.708	0.335	0.057
Fem	0.378	0.070	0.000	0.382	0.367	0.068
Qua						
2	0.873	0.296	0.003	0.008	0.371	0.145
3	0.305	0.214	0.154	0.028	0.251	0.045
4	0.582	0.168	0.001	0.064	0.306	0.092
5	0.470	0.169	0.006	0.059	0.283	0.072
6	0.726	0.139	0.000	0.605	0.338	0.118
7	0.721	0.188	0.000	0.039	0.337	0.117
8	1.110	0.272	0.000	0.008	0.428	0.192
9	0.440	0.152	0.004	0.143	0.277	0.067
_cons	-3.823	0.263	0.000			

Several findings could be discussed in the table:

1. By firm size: The effect of labor size (size denote) is positive at a 1% significant level. According to Acs and Audretsch [24], large companies tend to have an advantage in innovation in capital-intensive industries, where there is a focus on mass production and differentiated goods. On the other hand, small businesses have an advantage in innovation in labor-intensive industries that require high skilled labor. Exporters (*Exim*) have more of a chance of product innovation than non-exporters; the figure shows 3%. Our findings favor Aghion, et al. [25] and Hue [26],who found that exporting impacts positive innovation.
2. Resources for product innovation: It can be seen from Table 5, that firms that use application software positively affect the probability of product innovation at a 1% significant level. Specifically, under the assumption that other variables remain constant, if enterprises did use automation systems, the probability of innovation would be 53.6%, compared to 23.1% of other companies. Several previous studies are in favor of the finding, such as Cassiman and Veugelers [27];Duguet and MacGarvie [28] and He and Wintoki [29]**.**
3. By application of information technology, the estimated results of the Logit model show that, with a significance level of 1%, businesses that utilize information technology (such as internet, automation systems, software utilization in management, and investment in software) have a positive impact on the probability of product innovation. Specifically, when other factors are held constant at their average levels, if a company uses automation systems, the probability of product innovation will be 53.6%, which is 23.1% higher than companies that do not use automation systems in their business operations. Similar conclusions have been drawn in various contexts. According to Bartelsman, et al. [22], workers who have access to high-speed internet positively influence firm-level product innovation in ten European countries. Additionally, Bresnahan, et al. [30] and Brynjolfsson and Hitt [31] conclude that the application of the Internet and information technology has a positive impact on product innovation in US businesses.
4. By the characteristics of business owners: The gender of the business owner and their level of education significantly influence product innovation in the textile and garment industry. In the context of this study, businesses with male owners have a 5.7% higher probability of product innovation compared to those with female owners. Gender diversity among business owners also has a positive impact on product innovation in Vietnamese textile and garment enterprises. This finding aligns with the conclusions of Ruiu and Breschi [32].

The educational level of managers affects the innovation of businesses. Specifically, business owners with a university degree have a product innovation probability of 33.8%, which is higher than that of those without formal training at 11.8%. Similar conclusions have been drawn in several studies conducted in different countries, indicating that businesses owned by individuals with higher levels of education have a greater potential for innovative and creative advancements [33].

4.2.2. Research Results Estimation by Ownership

It can be seen from Table 2 that Textile and garment enterprises are mainly in the form of private limited liability companies, state-owned limited companies <= 50%, accounting for 69.21%, followed by 100% foreign-owned enterprises accounting for 14.11%, and third are joint stock companies without state capital, accounting for 12%.

The estimation of the Logit regression model by three common types in Table 6 allows us to examine the impact of exploratory variables on the probability of product innovation by a group of enterprises.

Table 6.
Research results estimation by popular enterprises.

Variable	Overall	Limited, state-owned company	Non – state-owned joint stock company	Foreign invested enterprise
Size	0.192***	0.215***	-0.034	0.295***
Exim	0.173***	0.407***	0.136	-0.293*
Cost_labor	-0.079**	-0.081*	0.172	-0.162*
Capital	0.095***	0.082***	-0.019	0.223***
R&D	2.225***	2.274***	1.944***	2.127***
Net	0.564***	0.382**	0.873***	0.611**
Auto	1.125***	1.472***	1.064***	0.830***
Soft	0.355***	0.257***	0.604***	0.310***
Cost_soft	0.294***	0.207***	0.128	0.630***
Gen	0.332***	0.313***	0.478***	0.316*
Fem	0.378***	0.295***	0.316**	0.085
Qua				
2	0.873***	0.866**	(Empty)	(Empty)
3	0.305	0.436*	0.429	-0.022
4	0.582***	0.989***	-0.722	-1.096
5	0.470***	0.663***	-0.638	-0.801
6	0.726***	1.013***	0.241	-0.900
7	0.721***	0.764*	0.053	-0.596
8	1.110***	0.789	(Empty)	-0.874
9	0.440***	0.782***	-0.103	-0.953
_cons	-3.823***	-3.836***	-3.998***	-2.633**
N	9,542	5,172	1,493	2,346
R^2 (%)	15.99	14.52	18.81	15.65

Note: (***) ; (**) ; (*) at P_value 1%; 5%; 10%.

Ownership does not have a significant level of ability for product innovation. A week of evidence at a 10% significant level showed that importing and exporting negatively affect the probability of product innovation for Foreign-Invested Enterprises. Total labor cost, capital intensity, and used software don't have a significant influence on product innovation in non-state-owned joint stock companies, while the effect of these exploratory variables is significant in limited liability companies, state-owned companies limited, and foreign investments enterprises. In addition, capital intensity also positively influencesthe product innovation of Foreign Invested Enterprise with higher coefficient weight compared to limited liability companies, and state-owned companies limited. Finally education level of managers and owners doesn't have a significant impact on the product innovation of non-state-owned joint-stock companies.

5. Conclusions and Implications

The study utilized data from the 2021 Economic Census of Vietnam conducted by the General Statistics Office to examine the factors influencing product innovation in the textile and garment industry in Vietnam. Some statistically significant findings are as follows:

1. Textile and garment businesses engaged in research and development (R&D) accounted for less than 4% of the sample, but over 80% of such businesses conducted innovative product development. In contrast, businesses without R&D activities constituted a significant proportion (over 96%), with less than 16% of them engaged in innovative product development.
2. The application of information and communication technology (ICT), including internet usage, management software utilization, and automation systems in production and business operations, as well as investment in software, had a positive influence on product innovation in the textile and garment industry in Vietnam. This is a novel finding not previously addressed in studies on innovation at the enterprise level in Vietnam and worldwide. This discovery highlights the significant role of ICT adoption in fostering innovative product development, particularly in the current digital transformation context.
3. Research and development activities within the textile and garment industries in Vietnam had a positive impact on product innovation. Conversely, labor costs had a negative effect on product innovation. The intensity of capital investment had varying effects on product innovation in the textile and garment industry, depending on the economic form. Specifically, capital intensity positively influenced product innovation in businesses with 100% foreign capital, and its impact was higher than the overall sample. However, there was no evidence to suggest that capital intensity influenced product innovation in joint-stock companies without state ownership.
4. Business owner characteristics such as age, gender, female ownership, and educational attainment all had an impact on product innovation across the entire sample but were not significant for businesses with 100% foreign capital.

Based on research results from logit regression models, we proposed several policy implementations, as below:

Firstly, improving the business efficiency of Vietnamese textile and garment enterprises.

The textile and garment industry faces various challenges in implementing the circular economy model for sustainable development. Import dependency on raw materials (cotton, fiber, fabric, etc.) is a major issue. Lack of spatial planning in textile dyeing hinders the development of large industrial parks with centralized wastewater treatment. Outdated perceptions and disinterest in licensing weaving and dyeing projects are prevalent in many localities. Rising costs pose a significant challenge, especially for small and medium enterprises lacking determination and resources.

Vietnam's textile and garment industry primarily serves high-class export markets with stringent product safety and hygiene standards. To overcome sustainability challenges, firms need to promote circular business, reduce net emissions, and use recycled products.According to the Vietnam Textile and Apparel Association (VITAS), raising awareness and assessing opportunities are key to accelerating the effective use of the circular economy. Meeting requirements for recycling rates, product life cycles, and clean materials is essential.

Secondly, governments and policymakers need to encourage businesses to cooperate and exchange knowledge with other businesses and international partners; trade finance, and technical support for market research, product development, and quality control.

The government can streamline import and export procedures to reduce business time and costs for businesses, simplify customs clearance procedures, reduce the number of documents required, and improve the efficiency of logistics infrastructure.

- Organized intensive training and consulting courses and training programs, are very helpful for Vietnamese textile and garment enterprises to increase their knowledge and skills to apply information technology and technological advancements to their business operations.
- Governments consider providing financial support to businesses to invest in information technology and technological advancement; creating an environment that encourages innovation by creating favorable conditions for start-ups; promoting innovation; and creating policies to encourage innovation.

Thirdly, Increase R&D investment and set up an investment and development fund. R&D activities have not received the attention of many listed textile enterprises in recent years. However, recently, textile and garment enterprises have also paid more attention to this activity, which is particularly valued by major manufacturers around the world. Investing in this field will help the group of textile and garment enterprises listed on the stock market to exploit economies of scale outside, which means that the whole industry will benefit from the results of R&D activities. In addition to spending a part of the budget to continue researching to support the acquisition and operation of imported technologies in the process of finding new and advanced technologies to meet production needs, enterprises listed for textiles should focus more on budget and R&D activities such as improvement, upgrading, and creation of new technologies because this is the necessary direction for enterprises to reach sustainable technologies.In addition, listed textile enterprises need to continue to focus on investing, producing environmentally friendly products, and investing to make a deeper difference in product functions, sustainable fashion garments, and health. An emerging field and niche market since the post-COVID-19 pandemic that textile enterprises have listed.Quickly reform state-owned R&D organizations to strengthen their capacity, including personnel, to be able to absorb new knowledge and technological advances. On the other hand, always update, analyze, and process information about large companies, especially those with leading R&D capabilities in the world, as well as strategic research on technology transfer, and scope of activities. of these companies. At the same time, it is necessary to learn from the experiences of advanced countries in attracting foreign companies with technological potential.

The fourth point emphasizes the importance of enhancing professional qualifications for senior executives. Training and upgrading digital skills that align with changes in the business for all employees and management levels. To ensure the development and widespread adoption of a digital mindset among employees, businesses need competent leaders who can inspire and instill creativity in their employees. These leaders should have an open mind and be willing to delegate authority to their employees. Additionally, they should foster a sense of community and set ambitious goals.

Some limitations and directions for future research: In the Logit model, the authors have not fully explored the control variables related to the financial resources of the business. Additionally, the study has not identified variables that play a moderating or mediating role. These limitations suggest potential avenues for further development in future research.

References

[1] M. Goedhuys and R. Veugelers, "Innovation strategies, process and product innovations and growth: Firm-level evidence from Brazil," *Structural Change and Economic Dynamics*, vol. 23, no. 4, pp. 516-529, 2012. https://doi.org/10.1016/j.strueco.2011.01.004

[2] J. A. Schumpeter, *Capitalism, socialism and democracy*. New York: Harper & Row, 1942.

[3] J. Bower and C. Christensen, "Disruptive technologies: Catching the wave," *Harvard Business Review*, vol. 73, no. 1, pp. 43-53, 1995.

[4] C. S. Koberg, D. R. Detienne, and K. A. Heppard, "An empirical test of environmental, organizational, and process factors affecting incremental and radical innovation," *The Journal of High Technology Management Research*, vol. 14, no. 1, pp. 21-45, 2003. https://doi.org/10.1016/s1047-8310(03)00003-8

[5] M. J. Nieto and L. Santamaría, "Technological collaboration: Bridging the innovation gap between small and large firms," *Journal of Small Business Management*, vol. 48, no. 1, pp. 44-69, 2010. https://doi.org/10.1111/j.1540-627x.2009.00286.x

[6] N. Hewitt-Dundas, "Resource and capability constraints to innovation in small and large plants," *Small Business Economics*, vol. 26, pp. 257-277, 2006. https://doi.org/10.1007/s11187-005-2140-3

[7] G. Azar and F. Ciabuschi, "Organizational innovation, technological innovation, and export performance: The effects of innovation radicalness and extensiveness," *International Business Review*, vol. 26, no. 2, pp. 324-336, 2017. https://doi.org/10.1016/j.ibusrev.2016.09.002

[8] K. Seenaiah and B. N. Rath, "Determinants of innovation in selected manufacturing firms in India: Role of R&D and exports," *Science, Technology and Society,* vol. 23, no. 1, pp. 65-84, 2018. https://doi.org/10.1177/0971721817744445

[9] R. M. Salomon and J. M. Shaver, "Learning by exporting: New insights from examining firm innovation," *Journal of Economics & Management Strategy,* vol. 14, no. 2, pp. 431-460, 2005. https://doi.org/10.1111/j.1530-9134.2005.00047.x

[10] M. Fafchamps, S. El Hamine, and A. Zeufack, "Learning to export: Evidence from Moroccan manufacturing," *Journal of African Economies,* vol. 17, no. 2, pp. 305-355, 2008. https://doi.org/10.1596/1813-9450-2827

[11] M. Bratti and G. Felice, "Are exporters more likely to introduce product innovations?," *The World Economy,* vol. 35, no. 11, pp. 1559-1598, 2012. https://doi.org/10.1111/j.1467-9701.2012.01453.x

[12] M. Di Cintio, S. Ghosh, and E. Grassi, "Direct or indirect exports: What matters for firms' innovation activities?," *Applied Economics Letters,* vol. 27, no. 2, pp. 93-103, 2020.

[13] G. Briest, E. Lukas, S. H. Mölls, and T. Willershausen, "Innovation speed under uncertainty and competition," *Managerial and Decision Economics,* vol. 41, no. 8, pp. 1517-1527, 2020.

[14] B. Roxas, "Effects of entrepreneurial knowledge on entrepreneurial intentions: A longitudinal study of selected South-east Asian business students," *Journal of Education and Work,* vol. 27, no. 4, pp. 432-453, 2014. https://doi.org/10.1080/13639080.2012.760191

[15] K. G. Corley and B. S. Schinoff, "Who, me? An inductive study of novice experts in the context of how editors come to understand theoretical contribution," *Academy of Management Perspectives,* vol. 31, no. 1, pp. 4-27, 2017.

[16] S. Z. A. Shah, M. Anwar, and C. M. Hussain, "Top managers' attributes, innovation, and the participation in China–Pakistan Economic Corridor: A study of energy sector small and medium-sized enterprises," *Managerial and Decision Economics,* vol. 42, no. 2, pp. 385-406, 2021. https://doi.org/10.1002/mde.3242

[17] J. Okrah and B. Irene, "The effect of top managers' years of experience on innovation," *International Journal of Innovation Studies,* vol. 7, no. 3, pp. 208-217, 2023. https://doi.org/10.1016/j.ijis.2023.03.004

[18] C. V. Heij, H. W. Volberda, F. A. Van den Bosch, and R. M. Hollen, "How to leverage the impact of R&D on product innovation? The moderating effect of management innovation," *R&D Management,* vol. 50, no. 2, pp. 277-294, 2020. https://doi.org/10.1111/radm.12396

[19] O. Carvache-Franco, G. Gutiérrez-Candela, P. Guim-Bustos, M. Carvache-Franco, and W. Carvache-Franco, "Effect of R&D intensity on the innovative performance of manufacturing companies. Evidence from Ecuador, Peru and Chile," *International Journal of Innovation Science,* vol. 12, no. 5, pp. 509-523, 2020.

[20] Y. Chen, Y. Wang, S. Nevo, J. Benitez-Amado, and G. Kou, "IT capabilities and product innovation performance: The roles of corporate entrepreneurship and competitive intensity," *Information & Management,* vol. 52, no. 6, pp. 643-657, 2015. https://doi.org/10.1016/j.im.2015.05.003

[21] J. Wu, Z. Wu, and S. Si, "The influences of Internet-based collaboration and intimate interactions in buyer–supplier relationship on product innovation," *Journal of Business Research,* vol. 69, no. 9, pp. 3780-3787, 2016. https://doi.org/10.15444/gmc2014.10.05.01

[22] E. J. Bartelsman, M. Falk, E. Hagsten, and M. Polder, "Productivity, technological innovations and broadband connectivity: Firm-level evidence for ten European countries," *Eurasian Business Review,* vol. 9, no. 1, pp. 25-48, 2019. https://doi.org/10.1007/s40821-018-0113-0

[23] J. S. Long, *Regression models for categorical and limited dependent variables, Advanced quantitative techniques in the social sciences Number 7*. Thousand Oaks, CA: Sage Publications, 1997.

[24] Z. J. Acs and D. B. Audretsch, "Innovation, market structure, and firm size," *The Review of Economics and Statistics,* vol. 69, no. 4, pp. 567-574, 1987.

[25] P. Aghion, A. Bergeaud, M. Lequien, and M. Melitz, *The impact of exports on innovation: Theory and evidence*. Cambridge, MA: National Bureau of Economic Research, 2017.

[26] T. T. Hue, "The determinants of innovation in Vietnamese manufacturing firms: an empirical analysis using a technology–organization–environment framework," *Eurasian Business Review,* vol. 9, pp. 247–267, 2019. https://doi.org/10.1007/s40821-019-00125-w

[27] B. Cassiman and R. Veugelers, "In search of complementarity in innovation strategy: Internal R&D and external knowledge acquisition," *Management Science,* vol. 52, no. 1, pp. 68-82, 2006.

[28] E. Duguet and M. MacGarvie, "How well do patent citations measure flows of technology? Evidence from French innovation surveys," *Economics of Innovation and New Technology,* vol. 14, no. 5, pp. 375-393, 2005. https://doi.org/10.2139/ssrn.452000

[29] Z. He and M. B. Wintoki, "The cost of innovation: R&D and high cash holdings in U.S. firms," *Journal of Corporate Finance,* vol. 280-303, pp. 280-303, 2016. https://doi.org/10.1016/j.jcorpfin.2016.10.006

[30] T. F. Bresnahan, E. Brynjolfsson, and L. M. Hitt, "Information technology, workplace organization, and the demand for skilled labor: Firm-level evidence," *The Quarterly Journal of Economics,* vol. 117, no. 1, pp. 339-376, 2002.

[31] E. Brynjolfsson and L. M. Hitt, "Computing productivity: Firm-level evidence," *Review of Economics and Statistics,* vol. 85, no. 4, pp. 793-808, 2003.

[32] G. Ruiu and M. Breschi, "The effect of aging on the innovative behavior of entrepreneurs," *Journal of the Knowledge Economy,* vol. 10, no. 4, pp. 1784-1807, 2019. https://doi.org/10.1007/s13132-019-00612-5

[33] C. Zhang, H. Li, X. Gou, J. Feng, and X. Gao, "CEO educational attainment, green innovation, and enterprise performance: Evidence from China's heavy-polluting enterprises," *Frontiers in Environmental Science,* vol. 10, p. 1042400, 2022. https://doi.org/10.3389/fenvs.2022.1042400