

# Factors affecting the Product Innovation of Industrial Enterprises in Thai Nguyen province: An empirical investigation

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**Abstract:** *Product innovation is one of the crucial strategies for companies to maintain a competitive advantage, especially in the global market. Using survey data of 266 industrial enterprises in Thai Nguyen province, the study has shown six factors that have a strong and direct positive impact on the product innovation activities of enterprises, including (1) Competition and market information, (2) Institutions, policies and legal system, (3) Infrastructure, (4) Enterprise characteristics, (5) Entrepreneur and human resource quality, and (6) Financial capacity. The paper also shows that, for improving product innovation, enterprises need to promote a culture of product innovation, build an R&D fund, strengthen cooperation and association to increase human resource quality, actively approach government policies and supports, and enhance product efficiency innovation management.*

**Keywords -** *Product Innovation, Industrial Enterprises, Thai Nguyen province, Competitive Strategy, Research and Development*

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## I. INTRODUCTION

Innovation brings many benefits to countries. According to the report of the Manual (2005), innovation has a positive impact on improving the competitiveness of businesses and enhancing the living standards of nations. Each country chooses different economic development paths since it has unidentical advantages in terms of resources, population, finance, and technical levels [16]. In the past, economic development was often based on natural resources; however, in the later stage, economic growth was based on investment capital; Now, the new trend of economic development will be based on innovation (Porter, 2008) [8]. There are many reasons for this shift, but it is widely accepted that natural resources are limited; hence, development based on this advantage will not be sustainable. To deal with this problem, countries have chosen to increase innovation activity. It has proven that countries pursuing the strategy of increasing innovation and applying advanced science to production and business activities will improve economic efficiency.

The Vietnamese government has recognized the importance of innovation for the country's economic development. They have been proactive in economic integration, taking advantage of domestic and foreign capital sources, spillover knowledge flows, absorbing knowledge, and creating new products of knowledge. Thai Nguyen is one of the important regions of Northern Vietnam, both economically and politically. In Thai Nguyen province, there were 794 enterprises operating in the processing and manufacturing industry, with production and business capital of 357,582.5 billion VND, and created jobs for 156,325 people (GSO, 2020) [15]. Processing and manufacturing enterprises have affirmed their important contribution to Thai Nguyen province's socio-economic development. This enhancement has helped economic growth, income increase, hunger eradication, and poverty reduction for people in the region and neighboring areas. Currently, domestic and international market competition is very fierce, requiring firms to increase innovation activities. Neely and Hii (1998) believe that only innovation can help businesses improve labor productivity, improve product and service quality, reduce product costs, therefore increasingly high requirements of customers, when human needs are changing day by day [17].

However, the innovation speed of industrial enterprises in Thai Nguyen province is still slow due to the low awareness of the role and importance of innovation activities, lack of focus on research and development (R&D), capacity in innovation is still under potential. On the other hand, Thai Nguyen Province has not yet built an effective innovation system, and has not yet introduced mechanisms and policies to stimulate innovation activities in industrial enterprises. Therefore, the number of industrial enterprises in Thai Nguyen province pursuing innovation activities is still small. Therefore, this study is necessary to find out the crucial factors to promote innovation activities of industrial enterprises in Thai Nguyen province.

## **II. LITERATURE REVIEW**

According to the Manual (2005, p.48), product innovation is the introduction of a new or significantly improved product with respect to its properties or intended use [16]. This includes significant improvements in specifications, components and materials, integrated software, user-friendliness or other functional characteristics. Innovation can create a product that is completely different from the old product, or just a small improvement in design, style, and usability (Amara et al., 2009) [1]. Thái Hà (2009) has defined that innovation of products/services is the result of implementing a new way to solve customer problems, bringing benefits to customers and suppliers [19]. Similarly, this definition is supported by Chang et al. (2011) [3]. Nord and Tucker (1987) argue that product innovation is a product related to new technology [18]. To clarify this issue, Hồ Ngọc Luật (2019) distinguishes between significantly improved products and completely new products [5]. An improved product is an old product that has added new features, or is simply a cost reduction by changing raw materials, components. A new product is a product that has a difference in technical characteristics or product features compared to previous products produced by the enterprise.

There are a lot of factors that affect the product innovation of enterprises. Arranz et al. (2019) emphasize that companies should consider innovation as an important corporate strategy, not to reduce costs or improve production efficiency, but to achieve an advantage in competition [2]. In addition, the author has pointed out that the driving force of innovation activities can come from external environmental pressure (passive innovation) or the initiative and voluntariness of enterprises. Using data from 5461 Spanish enterprises, Arranz et al. (2019) study the factors that encourage and hinder innovation in companies. The authors have emphasized that market information and especially the uncertainty about the demand for goods and services strongly affect enterprises' innovation activities [2].

Arranz et al. (2019) highlight the role of state management in innovation and argue that it is one of the crucial levers for businesses, especially in building ecosystems [2]. This statement is also supported by Yang et al. (2019) when they show that public finance policy and government regulation related to environmental issues have a strong influence on innovation in the field of the environment in China's energy sector [12]. Meanwhile, Romijn and Albaladejo (2002) emphasize the importance of institutional support for innovation and policy [9].

Sivak, Caplanova and Hudson (2011) use data from the World Bank Enterprise Survey (WBES) project, conducted in 2009, to analyze innovation in emerging European and Asian countries [10]. Their research concludes that infrastructure (including transportation, information technology, and financial infrastructure) is critical to innovation, with potential impacts on knowledge transfer as well as entrepreneurship. Of course, governments play an essential role in providing infrastructure, not only transport infrastructure but also other matters by influencing the competitive environment and governance.

Firm characteristics such as size, age, or ownership strongly impact innovation activities (Zhu, Wittmann and Peng, 2012) [14]. Size is considered to be one of the main internal factors for innovation (Cohen, 2010; Huergo and Jaumandreu, 2004); Zemplerová and Hromádková, 2012) [20][6][13]. Age is another essential determinant of innovation (Huergo and Jaumandreu, 2004; Tripsas and Gavetti, 2000) [6][11].

Romijn and Albaladejo (2002) find that the innovation capacity of companies is measured mainly on the product innovation capacity [9]. Internal factors include training level and experience of the manager, staff skills, spending on R&D and training activities.

Arranz et al. (2019), Romijn and Albaladejo (2002) emphasize the influence of staff qualifications and skills on innovation activities [2][9]. In which on-the-job training is vital for all enterprises in innovation (Hussen and Çodgezzen, 2019; Dostie, 2018) [7][4].

Romijn and Albaladejo (2002) suggest that the level of spending on R&D and training strongly influences innovation [9]. This is also supported by Arranz et al. (2019) when they emphasize the importance of innovation costs and corporate financial viability for innovation activities [2].

**III. METHODOLOGY**

**1. Research Methods**

To study the factors affecting the product innovation of industrial enterprises in Thai Nguyen province, the paper uses correlational methods with regression according to Enter method. This is widely accepted as a modern, suitable method to identify and evaluate the impacting factors.

Using the Slovin sample calculation formula, the author calculated the number of samples needed to ensure representativeness. Accordingly, the author investigated 266 industrial enterprises in Thai Nguyen province. The author uses questionnaires to collect data. The survey form consists of five parts: (1) Information about the person being investigated; (2) Information about the investigated enterprise; (3) The innovation status of industrial enterprises in Thai Nguyen province; (4) Factors affecting innovation; (5) Policy suggestions.

The author uses a 5-scale Likert scale to collect the responses' evaluations as following table:

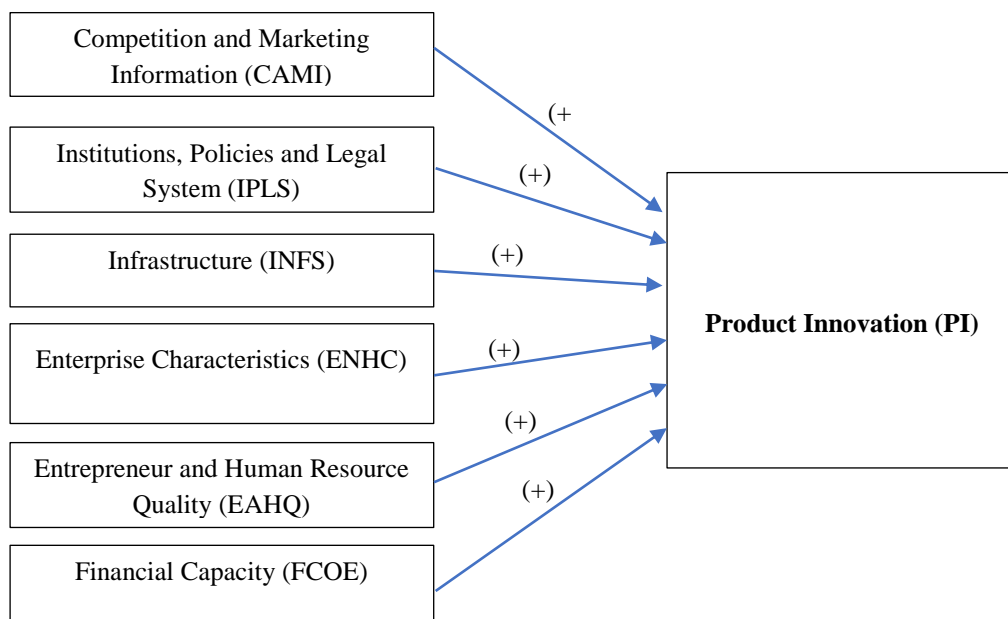
**Table 1. Likert 5-Scale**

Point	Range	Interpretation
5	4.20 - 5.0	Excellent / Very high
4	3.40 - 4.19	Good / High
3	2.60 - 3.39	Average
2	1.80 - 2.59	Poor / Low
1	1.0 - 1.79	Weak / Very Low

After conducting a pilot survey, relevance and accuracy testing, the questionnaire is delivered to leaders of selected industrial enterprises. Therefore, the author collects questionnaires, removes invalid votes, and encrypts data to input, analyze results, and writing reports.

**2. Research hypothesis**

The research hypothesis of the model is as follows:



**Figure 1. Research framework**

*Hypothesis 1:* Competition and market information promote product innovation activities of industrial enterprises in Thai Nguyen province.

*Hypothesis 2:* Institutions, policies and legal system affect the product innovation activities of industrial enterprises in Thai Nguyen province.

*Hypothesis 3:* Infrastructure promotes product innovation activities of industrial enterprises in Thai Nguyen province.

*Hypothesis 4:* Enterprise characteristics affect the product innovation activities of industrial enterprises in Thai Nguyen province.

*Hypothesis 5:* Entrepreneur and human resource quality affect product innovation activities of industrial enterprises in Thai Nguyen province.

*Hypothesis 6:* Financial capacity affects the product innovation activities of industrial enterprises in Thai Nguyen province.

#### IV. FINDINGS AND DISCUSSIONS

Six independent variables are used in the regression analysis, including (1) Competition and market information, (2) Institutions, policies and legal system, (3) Infrastructure, (4) Enterprise characteristics, (5) Entrepreneur and human resource quality, and (6) Financial capacity. The dependent variable is the product innovation. The Enter procedure is implemented for this regression.

**Table 2. Model summary**

R	R-Square	Adjusted R-Square	Std. Error of the Estimate	Durbin-Watson
0.874	0.764	0.759	0.36378	2.258

The adjusted R-Square coefficient reflects the impact of the independent variables on the dependent variable. Accordingly, 75.9% of the change in product innovation is due to the six proposed factors in the research model. Besides, the Durbin-Watson coefficient of 2.258 proves that the model has no autocorrelation phenomenon.

**Table 3. ANOVA of the Model**

	Sum of Squares	DF	Mean Square	F	Sig.
Regression	111.125	6	18.521	139.951	0.000
Residual	34.276	259	0.132		
Total	145.400	265			

Fisher's test result is 139.951, with a 99% confidence level means the model has statistical significance.

**Table 4. Empirical results**

Variable	Standardized Coefficients	t	Sig.	Collinearity Statistics	
				Tolerance	VIF
(Constant)	2.206	8.905	0.000		
FCOE	0.163	2.762	0.006	0.648	1.543
IPLS	0.179	2.952	0.003	0.616	1.622
CAMI	0.247	3.528	0.000	0.465	2.150
INFS	0.388	6.807	0.000	0.698	1.433
EAHQ	0.485	6.642	0.000	0.427	2.344
ENHC	0.066	3.367	0.001	0.698	1.433

The VIF index is less than ten means no multicollinearity. Regression analysis results show that six proposed factors positively influence the product innovation of enterprises. Accordingly, Entrepreneur and Human Resource Quality is the strongest impact on product innovation with a Beta coefficient of 0.485. The following factors are Infrastructure (0.388), Competition and Marketing Information (0.247), Institutions,

Policies and Legal System (0.179), Financial Capacity (0.163) and Enterprise Characteristics (0.066). This result is entirely consistent with the reality occurring in industrial enterprises in Thai Nguyen province. The role of the entrepreneurs and the quality of human resources are the most important drives to promote product innovation in enterprises. An experienced and proactive entrepreneur in innovation, together with qualified team members, will promote innovation in the companies. Infrastructure, especially the development of information technology, is an essential factor in promoting product innovation. Besides, competitive pressure and market information directly affect product innovation. Through continuous innovation and creativity, enterprises can maintain their competitive advantage in the market. Especially, Vietnam's economy integrates more deeply into the international market, the pressure on businesses will increase. Besides, government policies and support as well as financial capacity will enhance innovation in businesses.

## V. CONCLUSION

Today, customers' needs are changing rapidly; hence, the company should constantly innovate products to satisfy customers' expectations. There are several solutions that enterprises should implement to enhance product innovation.

Firstly, the companies need to promote a culture of product innovation. The learnings of individuals or groups are ultimately reflected in the original values, conceptions or beliefs. The person who has prestige and power can influence other group members. When these people convince the group to act on their beliefs, and if the action yields results, it gradually changes the perception. It firstly transfers into shared values or beliefs and finally into shared acceptance. These new values are integrated into organizations and gradually turn into obvious recognitions based on beliefs, standards and behavior. Therefore, enhancing the product innovation culture originates from the business owner. When they create an organization with a creative culture and atmosphere, they have done some steps on their product innovation. When they actively promote an organization's product innovation culture, they become aware of product innovation and involve other organization members in this event.

Second, the enterprise needs to build an R&D fund to establish, maintain and develop a new product research team. Product innovation is a long-term process that requires a strong financial source. The R&D fund helps businesses cover expenses for high-quality human resources, invest in equipment, and improve the quality of their existing product innovation activities. In addition, it is necessary to develop and implement an R&D and product innovation plan based on the development goals of the enterprise. Based on the business strategy and long-term goals, the enterprise must coordinate with relevant departments (e.g., production, marketing or finance department) to implement R&D plans and long-term product innovation plans. They should focus on critical production activities that they have comparative advantages.

Third, the firm should strengthen cooperation and association with other organizations and businesses in order to train high-quality human resources to meet the company's research and innovation activities. On the other hand, enterprises also need to promote cooperation with domestic and foreign scientific and technological institutes. This action takes advantage of research in universities and institutes as a premise for product innovation in enterprises.

Fourth, the enterprises should actively approach government policies on encouraging innovation activities in order to enlist the support of state agencies. Vietnam has many supporting policies for innovation, including a preferential credit policy, high-quality human resource training programs, a preferential tax rate, or market support. They are an important premise to promote product innovation.

Fifth, it is necessary to improve the efficiency of product innovation management. Product innovation management is one of the specific types that are difficult to manage effectively. However, effective product innovation management will bring about sustainable product development for businesses. There are some key points that businesses need to pay attention: (i) Balance between goals related to business activities between internal and external agents; (ii) focus on high-level human resource management, training activities and incentives for R&D staff; (iii) Strict management for information and technology transfer. Good product innovation management will help the innovation process be continuous, economical, and efficient, create many improvements, develop products, and better meet customers' needs.

Product innovation plays a crucial role in business development. This is an effective tool and solution to improve production and business efficiency, therefore increasing profits, especially helping businesses improve their competitiveness. Each enterprise, depending on its size, business fields and market needs, determines its objectives, R&D tasks and product innovation.

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