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Impact of innovation on the performance of manufacturing enterprises in Vietnam

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Abstract

This research aims to assess the impact of innovation on the efficiency of enterprises in Vietnam's manufacturing and processing industry. The findings reveal that engaging in research and development (R&D) activities positively contributes to enterprise efficiency. Similarly, the implementation of process innovation strategies and product expansion strategies improves enterprises' production and business performance. Meanwhile, strategies involving changes to entirely new business domains reduce enterprise efficiency, while strategies aimed at improving product quality do not demonstrate any effect on enterprise efficiency. Innovation-related investments in equipment, machinery, and ICT exert a greater impact on the efficiency of medium enterprises compared to large enterprises. The research also provides some suggestions on the issue of innovation for enterprises in Vietnam.

Keywords: innovation, input, output, R&D, enterprise performance.

JEL classification: O31, D24, L25, L60, P27.

1. Introduction

Innovation plays a crucial role in increasing productivity, promoting growth, and creating income disparities between countries. For businesses, innovation is a key factor in determining success, survival (Jimenez and Sanz-Valle, 2011; Bell, 2005; Cho and Pucik, 2005; Gopalaksihnan and Damanpour, 1997; Damanpour, 1996; Wolfe, 1994), and sustainable competitive advantage (Standing and Kiniti, 2011; Bartel and Garud, 2009; Johannessen, 2008; Mumford and Licuanan, 2004). Companies that fail to innovate are unable to compete effectively in the global market (Yang *et al*., 2018). In contrast, those capable of absorbing external knowledge and integrating it into their existing systems are more likely to innovate and maintain a stronger market position (Yelmi *et al*., 2021). In European countries, technological innovation enables firms to improve productivity, sales volume, profits, and market value (Cho and Pucik, 2005; Lööf and Heshmati, 2002; Lööf *et al*., 2003; Van Leeuwen *et al*., 2006; OECD, 2009). Research and development (R&D) expenditure is considered a key indicator of the efforts of both governments and enterprises in integrating science and technology. R&D expenditures, along with innovation potential and investment in physical capital, have a positive impact on labor productivity in both manufacturing and service industries (Segarra-Blasco, 2010). This effect is also observed in Asian countries (Kwon *et al*., 2003; Tsai and Wang, 2004; Hegde and Shapira, 2007; Yan *et al*., 2009).

In Vietnam, research and development (R&D) has been shown to have a positive impact on business performance (Ngo *et al*., 2021). The government has recognized the importance of innovation in economic growth, improving productivity, and increasing income. As a result, several plans and policies have been implemented to support innovative businesses and enhance competitiveness, ultimately leading to sustainable long-term economic growth. For instance, Decision No. 844/QĐ-TTg, dated May 18, 2016, was issued by the Prime Minister to approve a project that supports the national innovation startup ecosystem until 2025. Additionally, Decree No. 38/2018/NĐ-CP, dated March 11, 2018, was issued by the government to provide details on investment in small and medium-sized innovative startups.

Furthermore, the government has set a target of enabling at least 300 small and medium enterprises across provinces and centrally run cities to develop and implement pilot projects on productivity improvement by 2025. This number is expected to reach 500 by 2030, as stated in Decision No. 36/QĐ-TTg, dated January 11, 2021, which outlines the master plan to enhance productivity through science, technology, and innovation for the period 2021-2030.

Despite the presence of these support policies and goals, many remain broad in scope and lack the detailed guidance necessary to support businesses effectively. It is required to consider and evaluate the impact of innovation on business efficiency, identify which business aspects are most affected by innovation, and set specific goals to support those areas. This task is challenging due to the lack of a universally accepted definition and measurement of innovation, resulting in different criteria and approaches. Therefore, this research aims to examine the impact of innovation on business efficiency in Vietnam and provide empirical evidence to serve as a scientific basis for policymakers in developing effective orientations and policies to support innovative businesses. Additionally, this research will contribute to enriching, supplementing, and diversifying research on this topic in Vietnam.

2. Overview

2.1. Definition

Currently, the definition and measurement of innovation remain inconsistent. According to German economist and political scientist Joseph Schumpeter, innovation is associated with five manifestations (Vyas, 2009): (i) the creation of new products or the improvement of existing product quality; (ii) the adoption of new industrial processes; (iii) the entry into new markets; (iv) the development of new sources of raw materials or other new inputs; and (v) the establishment of new forms of industrial organization. According to the Organisation for Economic Co-operation and Development (OECD) and Eurostat (2005), innovation is understood as product, process, organizational, and marketing innovation. Battisti *et al*. (2011) consider innovation as the successful exploitation of new ideas. Meanwhile, new ideas are new products/processes or services; exploitation demonstrates the feasibility of the concept; success refers to the market acceptance of the innovation that the enterprise implements. Innovation is a complex and continuous process. Innovation begins with an innovative idea, planning to implement the concept, and allocating resources to implement and deploy the idea. The implementation of an idea involves a combination of tangible and intangible resources, which can be utilized at one or multiple steps in the implementation process. Innovation can be either successful or unsuccessful. Patents may or may not have broad application. Innovative products and services may or may not be accepted by the market.

Regardless of the outcome, each innovation effort allows enterprises to accumulate knowledge and experience, thereby facilitating future innovation initiatives and contributing to improved efficiency, increased productivity, and sustained competitiveness in the market.

Assessing the impact of innovation on business performance is complex and varied, mainly due to the continuous nature of innovation, definitional inconsistencies, and the availability of research data. However, most studies have assessed the impact of innovation using the following approaches: (i) input-based measures, such as investment in R&D, ICT, and technological equipment (OECD, 2009); (ii) intermediate output measures, such as the number of patents (Segarra-Blasco, 2010); and (iii) final output measures, including new products or new processes (Chudnovsky *et al*., 2006; Abazi-Alili *et al*., 2014).

2.2. Input approach of innovation

Krusinskas *et al*. (2015) examined the relationship between investment intensity, R&D innovation, and performance of small manufacturing enterprises in Lithuania from 2005 to 2012. The results showed that before 2010, medium-low technology enterprises led in tangible asset investment. However, from 2010 onwards, high- and medium-high technology industries significantly outperformed other sectors in terms of investment intensity. These enterprises were also superior in terms of productivity, export volume, and return on assets. Kwon *et al*. (2003), Tsai and Wang (2004), Hegde and Shapira (2007), and Yan *et al*. (2009) have shown a positive impact of R&D expenditure on enterprises in Asian countries. However, Ciemleja and Lace (2011) did not find a significant impact of R&D on improving the productivity of enterprises in South American countries. Along with R&D inputs, innovation outputs also have a positive impact on enterprise productivity. Segarra-Blasco (2010) analyzed the determinants of research and development (R&D) implementation and the impact of R&D and innovation on labor productivity of Catalan enterprises. The study revealed that R&D expenditure, innovation output (measured by the number of new products), investment in physical capital, market share, and exports positively influenced labor productivity across both manufacturing and service industries. However, the author did not find a relationship between patents and enterprise productivity.

From the innovation input perspective, Bogliacino and Pianta (2009) studied the relationship between innovation and productivity growth of European industrial enterprises. Their findings indicated that innovation, driven by competitive strategies in technology, as well as cost, quality, and labor skills, plays a positive role in enterprise profitability. Innovation is considered from the perspective of technology (specifically R&D expenditure per employee) and cost (proxied by expenditure on machinery and equipment). The positive impact of R&D on enterprise productivity is also found in the studies of Cuneo and Mairesse (1983), Wakelin (1997), and Tsai and Wang (2004).

2.3. Output approach of innovation

Chudnovsky *et al*. (2006) used panel data from the Argentine innovation survey for the period 1992-2001 to examine the impact of innovation inputs on innovation outputs and the impact of innovation outputs on labor productivity. The results of the econometric analysis showed that internal R&D and technology acquisition costs have a positive impact on a firm's ability to introduce new products and processes to market. New products/processes have a positive impact on labor productivity. The study also revealed that firms engaging in innovation activities achieve higher levels of productivity compared to those that do not. The research results also indicated that larger firms are more likely to engage in innovation activities and become innovators. Innovation here is seen as a process, carried out with specific inputs (R&D activities and the acquisition of existing and non-existing technologies) as well as interactions with other firms and organizations.

Atalya *et al*. (2013) examined the relationship between innovation and firm performance using survey data from 113 automotive firms in Turkey - a sector noted for high innovation as of 2011. The results indicated that technological innovation (product and process innovation) had a significant and positive impact on firm performance. In contrast, non-technological innovations (such as organizational and marketing innovations) showed no such effect.

Abazi-Alili *et al*. (2014) utilized data from the Doing Business Enterprise Performance Survey conducted by the World Bank and the European Bank for Reconstruction and Development (EBRD) in 2002, 2005, and 2009 to investigate the relationship between innovation activities, ownership structure, and firm performance. The study’s findings revealed that firm size, R&D intensity, foreign ownership, competition, skilled workers, and export activities have positive and significant effects on a firm’s motivation to innovate. Moreover, innovative foreign-owned firms that possess higher levels of skilled workers and are based in European Union member states exhibit higher productivity, as measured by average revenue per worker. In this context, R&D intensity is replaced by a variable indicating whether to invest in R&D.

Pham and Ho (2017) examined the impact of innovation on enterprise productivity using survey data from approximately 2,500 small and medium enterprises across ten provinces and municipalities in Vietnam between 2007 and 2009. Using the Cobb-Douglas production function with a fixed effects model, the authors found that the impact of innovation on

productivity varied depending on the location of the enterprise. Specifically, enterprises located in smaller cities benefited more from innovation than those in major urban centers, such as Hanoi and Ho Chi Minh City. This disparity was attributed to higher innovation costs and operating expenses in larger cities, despite the lower labor productivity in smaller localities (CIEM, 2010). However, there is no difference between the impact of innovation on the productivity of micro firms (with fewer than ten employees) and larger firms (with more than ten employees). Interestingly, innovation in high-tech industries has no significant impact on productivity compared to low-tech and other industries.

3. Methodology

3.1. Selecting variables in the model

a) Selecting variables to represent innovation

The literature reveals that there are various approaches to innovation, including innovation inputs, outputs, and processes. This study specifically focuses on the input and process of innovation. The input of innovation refers to whether a firm engages in research and development activities (Abazi-Alili *et al*., 2014). The innovation process, on the other hand, involves investing in machinery, equipment, and information and communication technology (ICT) to support the implementation of innovation (OECD, 2009). Firms must have a well-defined innovation plan and strategy to generate innovative products and services (Hertog *et al*., 2011; Carlborg and Kindström, 2014; Černe *et al*., 2016). Martin-Rios *et al*. (2019) further emphasize the critical role of innovation strategy in influencing business competitiveness and growth opportunities. This study considers innovation strategy as a pivotal initial stage of the innovation process, which directly affects innovation implementation methods, resource allocation, and resource combination. Therefore, in addition to spending on machinery, equipment, and ICT, the innovation process is also considered in terms of whether an enterprise pursues an innovation strategy to improve efficiency. The innovation strategy here is considered from various perspectives, including process strategy, product quality strategy, product quantity expansion strategy, production and business expansion strategy, and production and business change strategy.

b) Enterprise performance and some other independent variables

Taking advantage of readily available data, the study utilizes the average revenue per employee indicator, measured as revenue per employee (Abazi-Alili, 2014), to represent business performance.

According to the Cobb-Douglas production function, total capital or total assets is an indispensable factor with a direct impact on business production, particularly for scaling businesses in Vietnam. Therefore, the average total assets per employee is an essential independent variable. Additionally, the professional qualifications of the enterprise owner and the experience of the enterprise (represented by the age of the enterprise) can also impact enterprise performance. This research hypothesizes that higher professional qualifications of the enterprise owner will result in greater business efficiency, and greater enterprise age will also contribute to enhancing efficiency through accumulated experience. To test this hypothesis, this research includes two additional independent variables in the model: the enterprise owner's level of expertise and the age of the enterprise.

3.2. Regression method

The multivariate regression model employed in this research is the ordinary least squares (OLS) regression method. Although this is a relatively simple and convenient method for assessing the impact of innovation on business performance, the results obtained are reliable if the model ensures that there is no multicollinearity. Furthermore, the data in this study are neither time-series nor panel data; therefore, the use of the OLS method, with assurance of no multicollinearity, is appropriate.

Under the input approach, which considers innovation as an input of the enterprise, enterprise performance is modeled by the following function:

$$ln(Y/L)_i = \beta_0 + \beta_1 ln(K/L)_i + \beta_2 ln(EM/L)_i + \beta_3 R\_D_i + \beta_4 Qt_i + \beta_5 Sp1_i + \beta_6 Sp2_i + \beta_7 Hd1_i + \beta_8 Hd2_i + \beta_9 Tdcm_i + Age_i + \varepsilon_i$$

where:

ln: natural logarithm; i: enterprise i;

Y/L: revenue per employee;

K/L: average assets per employee;

EM/L: expenditure on machinery, equipment, and ICT per employee;

R_D: dummy variable that takes the value of 1 if the enterprise implements R_D and 0 if it does not;

Qt: dummy variable that takes the value of 1 if the enterprise pursues a process innovation strategy to improve production efficiency and 0 if it does not;

Sp1: dummy variable that takes the value of 1 if the enterprise pursues a product quality improvement strategy and 0 if it does not;

Sp2: dummy variable that takes the value of 1 if the enterprise pursues a strategy of expanding its product range, for example, new products, and 0 if it does not;

Hd1: dummy variable that takes the value of 1 if the enterprise pursues a strategy of expanding its operations into a new production-business field and 0 if it does not;

Hd2: dummy variable that takes the value of 1 if the enterprise pursues a strategy of changing its operations to another production and business field, and 0 if it does not;

Tdcm: the enterprise owner's level of expertise, Tdcm equals 1 if the enterprise owner has a degree below university level, 2 if they have a university level, and 3 if they have a degree above university level;

Age: age of the enterprise.

Literature suggests that the differential impacts of innovation on firm performance vary based on scale (Chudnovsk *et al.*, 2006; Pham and Ho, 2017) and export orientation (Abazi-Alili, 2014). Therefore, this research will also consider the impact of innovation across firm sizes (large vs. small) and trade orientation (exporting vs. non-exporting) for comparative analysis.

3.3. Research data

This research utilized data from the 2016 and 2018 enterprise surveys conducted by the Vietnam General Statistics Office, as well as the 2018 Technology Survey conducted by Vietnam's Ministry of Science and Technology. Combining two data sets, including the 2018 enterprise survey and the 2018 technology survey, we obtain data with complete information on assets, labor, revenue, age of enterprises, and variables representing innovation mentioned in the above model. However, data on business owners' characteristics was exclusively available from the 2016 enterprise survey. As the surveyed enterprises did not entirely overlap across the data sets, enterprise identification numbers (ID), which include information on operating location (province, district, commune), and tax codes were used to match observations across data sets. The consistency of the enterprise ID across different datasets made it feasible to combine the three datasets. After combining the three data sets, outlier variable values exceeding the typical range of the overall sample were removed. Finally, the research sample obtained includes 3,775 enterprises in the manufacturing industry. The focus on enterprises in the manufacturing industry is due to the scope of the technology survey, which targets this sector exclusively. The number of observations used for regression here far exceeds the minimum sample size threshold of 130 observations, thereby reducing the occurrence of multicollinearity and enhancing the accuracy of the estimated coefficients.

These datasets are all conducted by leading statistical organizations in Vietnam and follow scientific sampling methods. The surveys employ the Systematic Random Sampling method, ensuring that the selected sample size is larger than the minimum required, thereby ensuring representativeness across industries and regions. Therefore, these data sets are suitable for scientific research and allow for generalization to enterprises nationwide.

4. Result

4.1. Preliminary statistical results

a) Innovation strategy and R&D

Firstly, this research will examine preliminary statistics on the innovation situation of enterprises and compare them among small, medium, and large enterprises, as well as between enterprises with and without foreign trade activities.

TABLE 1: **The percentage of enterprises that pursue innovation strategies and engage in R&D activities**

	Process innovation (Qt)	**Improve product quality (Sp1)**	**Expanding product range (Sp2)**	**Expanding operations into a new production-business field (Hd1)**	**Change of activity to another production and business sector (Hd2)**	**R_D**
Total	69.02	73.03	40.73	11.73	2.48	6.43
Small enterprises	64.87	71.98	37.35	12.48	3.31	3.65
Medium enterprises	71.67	75.38	41.99	10.79	1.52	7.42
Large enterprises	74.85	73.66	45.95	10.91	1.53	10.74
Enterprises without foreign trade activities	67.16	74.07	37.71	12.29	3.28	3.91
Enterprises with foreign trade activities	70.65	72.13	43.36	11.25	1.78	8.63

Source: Author's calculation.

Table 1 illustrates that most enterprises prioritize product quality improvement as their innovation strategy, with 73.03 percent of enterprises choosing this approach. Next is process innovation, with 69.02 percent of enterprises adopting this strategy. Expanding product types and operations ranks third, while the strategy of changing to a different field of operation is the least popular, selected by only 2.48 percent of enterprises. When examining each type of strategy, it is clear that large enterprises report the highest adoption rate of process innovation, with 74.85 percent of enterprises, followed by medium enterprises (71.67 percent), and small enterprises (64.87 percent). Additionally, enterprises engaged in foreign trade activities are more likely to adopt process innovation strategies than those without foreign trade activities. The reason is that process innovation often requires a clear strategy, idea, and financial resources, such as investing in imported machinery and technology to improve production processes. In this respect, large enterprises have an advantage over medium enterprises, while small enterprises have the least advantage. Furthermore, exposure to intense global competition compels enterprises engaged in foreign trade activities to continually innovate their technology and machinery to remain competitive.

Secondly, in terms of product quality innovation, it is interesting to note that medium enterprises lead the pursuit of this strategy (75.38 percent), followed by large (73.66 percent) and small enterprises (71.98 percent). It is also worth noting that enterprises without foreign trade activities are more likely to pursue this strategy than those involved in foreign trade. This pursuance may stem from foreign trade enterprises in Vietnam often operating under processing contracts with strict quality requirements dictated by foreign partners. Meeting these standards can be challenging, which could explain why the rate of product quality innovation is lower in enterprises with foreign trade activities.

The third strategy, product line extension, is more popular among large enterprises, followed by medium, and then small enterprises. Interestingly, enterprises with foreign trade activities are more likely to pursue this strategy compared to those without foreign trade activities.

The fourth strategy, business expansion, is most commonly chosen by small enterprises, followed by large enterprises, and finally, medium enterprises. Similarly, enterprises without foreign trade activities are more likely to choose this strategy than those with foreign trade activities.

Finally, the fifth strategy mentioned is changing business activities into a new field. This strategy is challenging and high-risk, which explains why the proportion of enterprises choosing this strategy is very low (only 2.48 percent). When looking at the breakdown by enterprise size, it is notable that small enterprises have the highest rate of choosing this strategy (3.31 percent), while large and medium enterprises share virtually equal rates (1.53 percent and 1.52 percent, respectively).

Regarding innovation in terms of research and development (R&D) activities, large enterprises exhibit the highest rate of R&D activities (10.74 percent), followed by medium enterprises (7.42 percent), and finally, small enterprises (3.65 percent). Meanwhile, enterprises engaged in foreign trade activities demonstrate a significantly higher rate of R&D participation compared to those without foreign trade activities (8.63 percent versus 3.91 percent).

b) Revenue, assets, expenditure on machinery and equipment per employee

TABLE 2: **Value of revenue, total assets, average machinery and equipment per employee**

Unit: million VND/person.

	Total	**Enterprises without foreign trade activities**	**Enterprises with foreign trade activities**	**Small enterprises**	**Medium enterprises**	**Large enterprises**
Revenue per employee (Y/L)	1,409.465	1,207.197	1,585.688	1,466.535	1,449.452	1,290.629
Average assets per employee (K/L)	1,526.298	1,844.668	1,248.922	1,933.997	1,236.672	968.1927
Expenditure on machinery, equipment, and ICT per employee (EM/L)	224.5716	188.5493	255.9556	236.3201	229.4653	201.7957
Ratio of machinery, equipment, and ICT expenditure to total assets	14.7%	10.2%	20.5%	12.2%	18.6%	20.8%

Source: Author's calculation.

Table 2 presents noteworthy findings regarding R&D intensity, represented by expenditure on machinery, equipment, ICT per employee (EM/L), average total assets per employee (K/L), and revenue per employee (Y/L). For all three criteria, small enterprises consistently record the highest values, while large enterprises exhibit the lowest. Interestingly, enterprises with foreign trade display higher average revenue and expenditure on machinery, equipment, and ICT per employee than those without foreign trade. However, enterprises without foreign trade demonstrate higher average total assets per employee than those with foreign trade.

Here, the author introduces an additional criterion, the ratio of expenditure on machinery, equipment, and ICT, to gain insight into enterprises (although this criterion is not considered and evaluated in the model). By firm size, this ratio displays a decreasing trend with increasing size; specifically, large enterprises report the highest ratio (20.8 percent), followed by medium enterprises (18.6 percent), and small enterprises (12.2 percent). Enterprises engaged in foreign trade have a ratio approximately twice that of those without foreign trade (20.5 percent compared to 10.2 percent).

These findings suggest that large enterprises have lower absolute values for average assets or the value of equipment, machinery, and ICT per labor unit due to their ability to leverage production efficiencies at scale. In reality, large enterprises continue to allocate a significant portion of their financial resources to machinery, equipment, and ICT to enhance production efficiency. It should also be noted that average revenue is not an accurate measure of business efficiency, as high revenue may be accompanied by high production costs, which can affect the overall efficiency of the business.

4.2. Correlation coefficient of variables in the model

Firstly, this research examines the partial correlations of the variables in the regression model to determine the initial relationship between the independent variables and the dependent variable.

TABLE 3: **Correlation coefficient of variables**

	ln(Y/L)	ln(K/L)	ln(EM/L)	Qt	Sp1	Sp2	Hd1	Hd2	R_D	Tdcm	Age
ln(Y/L)	1.000										
ln(K/L)	0.658	1.000									
	[0.000]										
ln(EM/L)	0.301	0.442	1.000								
	[0.000]	[0.000]									
Qt	0.034	-0.002	-0.014	1.000							
	[0.038	[0.907]	[0.377]								
Sp1	0.038	0.023	0.020	0.216	1.000						
	[0.021]	[0.152]	[0.222]	[0.000]							
Sp2	0.071	0.043	0.013	0.110	0.176	1.000					
	[0.000]	[0.008]	[0.439]	[0.000]	[0.000]						
Hd1	0.041	0.053	0.045	-0.027	0.000	0.128	1.000				
	[0.012]	[0.001]	[0.006]	[0.098]	[0.998]	[0.000]					
Hd2	-0.008	0.049	0.019	-0.051	-0.071	0.006	0.174	1.000			
	[0.604]	[0.003]	[0.246]	[0.002]	[0.000]	[0.716]	[0.000				
R_D	0.069	0.036	0.024	0.057	0.067	0.089	0.031	0.014	1.000		
	[0.000]	[0.027]	[0.145]	[0.000]	[0.000]	[0.000]	[0.054]	[0.406]			
Tdcm	0.100	0.040	-0.007	0.013	-0.033	0.030	-0.018	-0.013	0.090	1.000	
	[0.000]	[0.014]	[0.678]	[0.429]	[0.040]	[0.063]	[0.272]	[0.433]	[0.000]		
Age	0.038	0.070	0.031	-0.015	-0.021	-0.004	0.018	0.019	-0.011	-0.029	1.000
	[0.021]	[0.000]	[0.054]	[0.349]	[0.197]	[0.806]	[0.276]	[0.233]	[0.489]	[0.076]	

Note: p-values in square brackets.

Source: author's calculation.

The correlation coefficient results table shows that most innovation-related variables exhibit a statistically significant positive correlation with enterprise performance (expressed as average revenue per employee), except for variable Hd2 (whether the enterprise pursues a strategy of changing its business activities to other production and business fields or not). Thus, it can be expected that innovation through R&D and investment in machinery, equipment, ICT, as well as pursuing a strategy of process innovation, improving product quality, expanding products, and expanding the field of operation, will have a positive impact on improving enterprise performance. In addition, the remaining variables—average total assets per employee, professional qualifications of enterprise owners, and enterprise age - also display a statistically significant positive impact on the average revenue of the enterprise. In a separate relationship, professional qualifications and the age of the enterprise both contribute to improving and enhancing business performance.

The correlation coefficient results table also shows that the correlation between the independent variables is relatively low (the correlation coefficients are all less than 0.5), and most of them are not statistically significant. This low correlation suggests a low risk of multicollinearity, thereby supporting the robustness and validity of the regression model.

4.3. Regression results

After performing the multicollinearity test and ensuring that multicollinearity is not present, the regression results are as follows:

TABLE 4: **Regression results**

	Total	**Small enterprises**	**Medium enterprises**	**Large enterprises**	**Enterprises without foreign trade activities**	**Enterprises with foreign trade activities**
ln(K/L)	0.685***	0.680***	0.772***	0.736***	0.749***	0.619***
ln(EM/L)	0.0098	0.0262	0.0347*	0.0223**	0.0217**	-0.00825
Qt	0.0715*	0.083	-0.0403	-0.0287	0.016	0.112
Sp1	0.0166	-0.0157	0.036	0.061	0.0359	0.00304
Sp2	0.0851**	0.0676	-0.00791	0.0676	0.0409	0.102
Hd1	0.033	0.0903	-0.00387	-0.0431	-0.0478	0.144
Hd2	-0.328**	-0.340*	-0.194	-0.0937	-0.161	-0.342*
R_D	0.172**	0.258	0.024	-0.0197	0.0578	0.192
Tdcm	0.149***	0.0386	0.0547	0.0193	0.00286	0.0492
Age	0.00007	0.00002	-0.00960*	0.00075**	0.00081*	0.00009
_cons	1.572***	1.564***	1.523***	1.778***	1.665***	1.969***
No of obs	3,775	2,015	591	1,169	2,021	1,754
R^2	0.44494	0.33982	0.62672	0.74436	0.66644	0.30582

Note: ***, **, * correspond to the significance levels of 1%, 5% and 10%, respectively.
Source: Author's calculations.

There is a statistically significant difference between enterprises that conduct R&D activities and those that do not. The positive regression coefficient of the R_D variable suggests that enterprises that conduct R&D are more efficient. However, the R&D intensity, measured by expenditure on machinery, equipment, and ICT per employee (EM/L), does not have an impact on enterprise performance. In terms of the innovation process, pursuing the strategy of process innovation (Qt) and expanding the number of products (Sp2) demonstrate a statistically significant positive impact on enterprise performance. This result indicates that enterprises that prioritize process improvements and product expansion will achieve better performance than those that do not. However, pursuing the strategy of expanding production and business activities (Hd1) and improving product quality (Sp1) do not have an impact on enterprise performance. Pursuing the strategy of changing production and business activities to a different field (Hd2) has a negative impact, reducing enterprise performance. The enterprise owner's level of expertise (Tdcm) has a positive and statistically significant impact on enterprise performance, as shown by the regression coefficient of the variable tdcm. However, the study did not find a significant impact of business age (Age) on enterprise performance.

At the enterprise scale, the results show that among the variables representing innovation, only expenditure on equipment, machinery, and ICT (EM/L) has a statistically significant impact, and this impact is only significant for medium and large enterprises. The regression coefficient for the variable EM/L is larger for medium enterprises (0.0347) compared to large enterprises (0.0223). Only for small enterprises, an additional statistically significant negative impact is observed from pursuing a strategy of changing production and business activities to a new field (Hd2). This result suggests that while small enterprises may have more flexibility in adapting to new business fields, such changes come with risks, including potential initial losses and challenges in identifying a viable development trajectory. Insufficient resources to sustain such changes could lead to bankruptcy, which is why the observed negative impact on small enterprises is understandable.

On the other hand, equipping assets per employee (K/L) demonstrates a positive and the most significant impact on enterprises regardless of firm size (overall form, or whether they trade with foreign countries). When considering the type of business by size, the level of expertise of the business owner (Tdcm) does not seem to affect business efficiency. However, the age of the business does have a statistically significant impact. Interestingly, for medium enterprises, the longer the business operates, the lower its efficiency, while the opposite trend is observed in large enterprises.

When considering enterprises based on their foreign trade activities, the results show that only expenditure on machinery, equipment, and ICT has a positive and significant impact on enterprises with foreign trade activities; this impact is absent in enterprises without foreign trade activities. Surprisingly, the professional level of the business owner had no impact on the efficiency of the enterprise in either type of enterprise. Additionally, the age of the enterprise was found to have a positive impact on enterprises with foreign trade activities, but did not affect those without such activities. Similar to small enterprises, research shows that when enterprises without foreign trade activities adopt a strategy of shifting their production and business fields to other areas, their efficiency decreases. This finding implies the ineffectiveness in changing the production and business fields of these enterprises.

5. Conclusion

Enterprises that engage in R&D activities, pursue process innovation strategies, and expand their product offerings are likely to be more efficient than those that do not. However, changing the field of operation can hurt efficiency. Across all types of enterprises, the influence of innovation on enterprise efficiency appears through increased expenditure on machinery, equipment, and ICT, with notable differential impacts observed between large and medium enterprises. Given the intense competition, rapid technological advancements, and ongoing digital transformation, prioritizing innovation is imperative for all types of enterprises. While promoting R&D implementation is necessary, it requires careful consideration due to financial constraints among most businesses, necessitating prudent directional choices. Spending on innovation in machinery, technology, equipment, and ICT should also be promoted for only medium and large enterprises, as well as those involved in foreign trade. Spending on machinery technology requires financial resources; however, most manufacturing enterprises are outsourcing. Without innovation in technology, machinery, equipment, and ICT for production, these enterprises are unlikely to remain competitive in the current context.

Promoting process innovation and product expansion is crucial for enterprises. Process innovation involves improving production efficiency and increasing automation, thereby reducing dependence on manual labor. On the other hand, product expansion aims to attract a diverse range of customers and adapt to changing consumer needs. However, it is essential to note that changing product quality may not have a significant impact on business efficiency, as most industrial processing and manufacturing enterprises rely on external partners for product quality. Additionally, the current low income and slow growth rate of income and productivity in the domestic market constrain the demand for high-quality products. However, as income increases in the future, it will be necessary to consider the quality of the products supplied.

When considering a change in business fields or activities, enterprises must proceed with caution due to the high level of associated risk. Pursuing a strategy of entering a new field requires a clear strategic direction. It should only be undertaken by enterprises whose owners possess strong expertise, in-depth industry knowledge, and a solid understanding of market trends. This suggestion is crucial given the study's finding that owner expertise has a significant positive impact on business performance.

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