Technology innovation and firm performance of non-financial public listed companies: the case of vietnam.

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Abstract: This research investigates the impact of technological innovation on the productivity of non-financial public listed companies in Vietnam. The FGLS regression model is used with data collected from the financial statement of Vietnam from 2011 to 2023 with 4610 observations. The results show that most technological innovation variables have a negative effect on the return on assets and have no impact on the market value. Specifically, technological innovation influences enterprise revenue and profit, including new products, new processes, R&D expenditure, age, size, and employee cost. From the study results, some implications are suggested to improve public-listed companies' performance in Vietnam.

Keywords: Technology innovation, firm performance, public-listed companies.

1 Introdution

Previous research has reported companies, in particular small and medium companies, must implement a technical innovation plan that is incorporated with the overall strategy of the firm to gain and increase their competitiveness [15]. Technological innovation activity has also been shown to boost corporate performance [11]. Product innovation, as example, product innovate is the outcome of a company's performance and efficiency in launching innovative additional features to the market, which can be measured in market share and profit oriented [13]. Additionally, both large and small businesses profit from green technology and feasible development in all aspects. There are numerous ways in which technology innovation can contribute to environmental, economic, and social sustainability, it found that Greater inventiveness can improve urban environment [6]. Although a several of studies suggesting that innovation and technology activities has a beneficial influence on corporate performance, other statistical research has found that these activities may not always have a positive effect, depending on the characteristics of the organization or the collection of firm-level variables and evironmental contingency [9]. One study has reported that Companies that have a successful track record in developing a technology may not be as

successful in developing products based on that technology [22], while other study has indicated that the most essential component of success in business is innovation and that investing in technical innovation is the most prevalent approach for increasing growth [12]. It is due to the technological innovation types and features and companies' firm levels are complex, and there have also been inconsistencies in the statistical and analytical approaches used by academics [22]. Despite the necessity of innovation has achieved widespread acceptance from a mixture of empirical analysis results which have produced a mixed argument based on theory, empirical results, and real businesses experience.

Given that Vietnam is an emerging economy with many flaws, a high level of information asymmetry, and low financial disclosure transparency, the question of whether investing in technological innovation influences the performance of listed companies has caught the interest of both researchers and policymakers. Additionally, the majority of studies in Vietnam are mentioned about the roles of innovation in the performance of the SMEs companies. Most studies are restricted to a particular region or town, with a limited selection of businesses surveyed. As a result, the representativeness of the research is low. The paper investigates the relationship between technological innovation and the performance of non-financial public firms in Vietnam (including revenue, profit). Since then, the paper will make a recommendations to improve the business performance of Vietnam's publicly traded enterprises.

2 Literature review

2.1 Innovation and its role in development

The word "innovation" signifies many various things to various individuals, as is frequently a case with phrases that are popular at certain times. When it comes to the meaning of this word, it is impossible not to mention the definition of Schumpeter who first began to theorize about the characteristics and dynamics of innovation in the early 20th century. According to Schumpeter, innovations are innovative mixture of skills, resources, and so on that are subject to commercialization attempts [20]. It is fundamentally the process where new concept are developed and commercialized and he saw innovation as capitalism's lifeblood. Following an early study of entrepreneurship and innovation, the next definitive work on this subject was in the 1980s by the well-known manager Peter Drucker. In his 1985 book "Innovation and Entrepreneurship", Drucker defines "innovation" as: "Innovation is the specific tool of entrepreneurs, the means by which they exploit change as an opportunity for a different business or a different service." [8]. According to his definition, innovation is more than just new innovations or

technologies; it is also about emerging opportunities provided by new technologies, products, processes, business models, and so on. The following years after that, there are a lots of research sharing the same idea, according to Bessant & Tidd, the transformation of ideas into useful and used widely new products, processes, and services to benefit the organization and its stakeholders is known as innovation [5]. According to OECD's definition, innovation can be divided into four types: product innovation, process innovation, marketing innovation, and organizational innovation [18]. Following [18], the principal international source of rules for identifying and assessing initiatives for innovation.

Therefore, innovation is vital because it leads to the formation of new businesses, which in turn fosters economic growth. It is true if the new firms are fresh start or new companies within existing organizations, the latter of which has recently been referred to as intrepreneurship. While both start-ups and current businesses benefit from these breakthroughs in the form of increased sales and profits, the net effect on the national and international economies is growth. Economic growth is defined as the yearly growth rate of a nation's gross domestic product (GDP), and it is a proxy for the overall well-being of its citizens.

2.2 Technological innovation

2.2.1 Analyzing technological innovation base on product and process innovation

Typically, technology advances are associated with product and process innovation[7]. Product innovation is the capacity to create new products to consistently bring innovative products to the market and supplement value to its products by combining technology in order to please customers or the market. Process innovation, on the other hand, reduces production costs through the development of new technologies to substantially boost productivity and the development of process innovation that connect between input and output [7].

2.2.2 Analyzing technological innovation Base on Research and Development (R&D)

The innovation process often begins with research and development activities including market research, analysis of demand, formulating a new concept, testing them through evaluation, and designing a new product [3].

R&D investment may improve the allocation of resources for innovative activities, enhance production circumstances, and boost technological progress output. Using technological improvement accomplishments such as scientific and patents papers, It is achievable to mission of creating new goods, decreasing resource use, and

lowering emissions of the forms of trash, thus attaining and expanding economic development [13].

2.3 The institutional background of Vietnam and the factors that determine the success of these companies

2.3.1 Innovation history of Vietnam

As the adoption of Doi Moi strategy, Viet Nam's innovation policy structure has changed considerably. Since then, Vietnam has steadily shifted from a centrally organized to a socialist-oriented market economy. The science and technology system was reformed and the state management of science and technology was modernized between 1996 and 2010. However, from 2011, the Vietnamese economy has experienced slower growth and slight improvement in growth quality and labor productivity. Science and technology development and innovation were identified as top goals in the Socio-economic development Strategy plan 2011–2020.

During 35 years of industrialization, modernization and international integration (1986-2021), Vietnam's innovation strategy has seen dramatic changes, including scope changes, ease of entrance and operation in S&T, and types of aid [23]. As a result, science and technology in Vietnam have achieved significant progress in all areas, providing a real improvement to the economic growth of society, improving people's quality of life, and consolidating national defense and security.

2.3.2 Overview about public listed company in Vietnam

After 18 years of development and expansion, the Vietnam stock market now has 731 companies listed due to international investor interest and the liberalization of state-owned industries [17]. Nonetheless, in comparison to other countries, the Vietnam stock exchange still has some limitations, such as a borderline with a small size, transparency minimal, and, most significantly, an inadequate shareholder protection system [17]; [14].

2.3.3 The contribution of public-listed companies to Vietnam economy

After 25 years of operation, Vietnam's stock market today contains around 1,900 public businesses, with 404 listed on the Ho Chi Minh Stock Exchange (HOSE) and the Stock Exchange. The Hanoi Stock Exchange (HNX) has 343 listed companies, while the Upcom Stock Exchange has 895 enrolled for trade. Moreover, the size of our country's stock market is expanding, and it is becoming a key medium- and long-term capital mobilization route for the economy [16].

According to the Ministry of Finance, investors' quality is steadily improving. Foreign and institutional investors' active engagement in Vietnam's stock market has helped to improve the level of corporate governance in conformity with worldwide principles for

listed businesses. The stock market is seen as a "launching pad" for many enterprises to grow drastically in size and quality, eventually becoming industry leaders [10]. The stock market plays an active part in the equitization of state-owned firms, allowing state-owned enterprises to be more open and transparent, therefore helping to the execution of the policy of restructuring state-owned enterprises [10].

2.3.4   Firm performance: concept and measurement

In this research, author considers ROA as a accounting-based criterion and Tobin's Q like a market-based criterion of company management and how it's being changed by technological innovation. Tobin's Q may be determined by the ratio of the company's market capitalization divided by its total assets. Companies has a Q ratio larger than 1.0 is able to produce more value by successfully utilizing accessible resources, whereas others has a Q ratio less than 1.0 are linked to inefficient use of the available resources. Tobin's Q has come to be recognized as an essential indicator of corporate success since it demonstrates the value provided for investors. A higher Tobin's Q value indicates better economic success [1]. In that way, the author can evaluate the companies from both inside and outside impacts to help firms build a wise strategy.
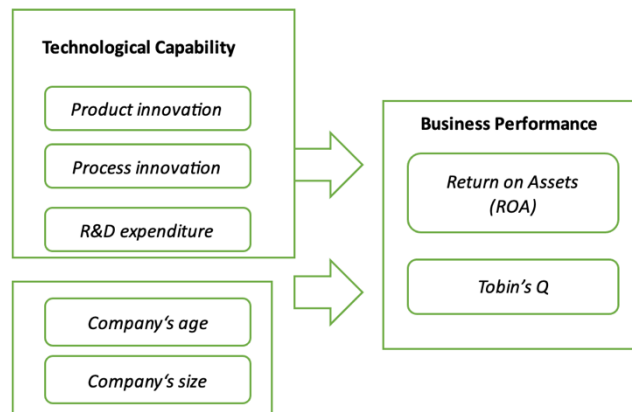
Figure 1
Research Model
Source: Developed by author

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3 Methodology

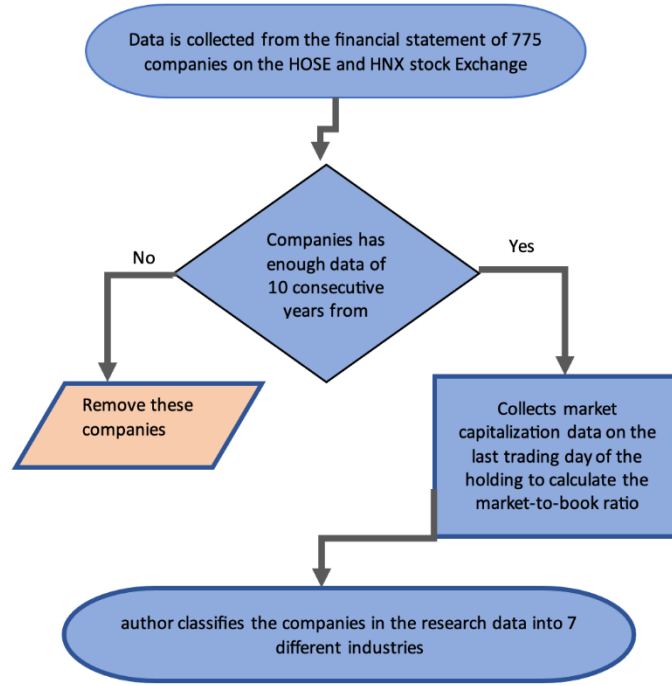The data of this research was collected and processed by the author as follow:

Figure 2
Research Data Process
Source: Developed by author

3.1 The research method

3.1.1 Research Models and Variables

Model 1:

$$\text{ROA}_{i,t} = \beta_0 + \beta_1 \text{PDI}_{i,t} + \beta_2 \text{PCI}_{i,t} + \beta_3 \text{RD}_{i,t} + \beta_4 \text{AGE}_{i,t} + \beta_5 \text{SIZE}_{i,t} + \beta_6 \text{GOS}_{i,t} + \beta_7 \text{EC}_{i,t} + \varepsilon_{i,t} \ (1).$$

Model 2:

$$\text{TobinQ}_{i,t} = \beta_0 + \beta_1 \text{PDI}_{i,t} + \beta_2 \text{PCI}_{i,t} + \beta_3 \text{RD}_{i,t} + \beta_4 \text{AGE}_{i,t} + \beta_5 \text{SIZE}_{i,t} + \beta_6 \text{GOS}_{i,t} + \beta_7 \text{EC}_{i,t} + \varepsilon_{i,t} \ (2)$$

In which:

Variable	Acronym	Formular
Return on Assets	ROA	$\dfrac{\text{Net profit after taxes}}{\text{Total assets}}$
Tobin Q	TobinQ	$\dfrac{\text{MVE} + \text{PS} + \text{DEBT}}{\text{TA}}$
Product innovation	PDI	Dummy=1 if the company invests in developing new items or new manufacturing technologies, or in improving existing products, 0 otherwise.
Process innovation	PCI	Dummy=1 if the company's production or service delivery flexibility has improved, increased production capacity or reduced labor cost, energy cost and 0 otherwise.
R&D expense	R&D	$\dfrac{\text{Cost of goods sold}}{\text{Net Revenue}}$
Size of company	SIZE	Ln(Total assets)
Age of company	AGE	$\text{Year}_{n+1} - \text{year established}$
Government policy	GOS	Dummy=1 if the company receives state support in the form of grants, loans, subsidies, tax refund, and programs for the innovation process from the government, 0 otherwise.
Employees cost	EC	$\dfrac{\text{Payables to employees}}{\text{Number employees of company}}$

Table 1

Variable calculation

Source: Developed by author

3.1.2 Research method

The study uses balance panel data to examine the impact of technological innovation on firm performance. The combination of cross-sectional data and time series data are the panel data, so observed variables have higher variability, provide more information and have higher reliability. The study uses the least squares estimation method (OLS); fixed-effects model (FE); random effects model (RE); feasible general least squares estimation method (GLS).

4 Results and Discussions

4.1 Descriptive Statistical Analysis

Descriptive statistics are an important step that needs to be taken to analyze research data. Descriptive statistics help describe the basic characteristics of the data in detail. Table 4.1 provides the results describing the variables used in the research model, the descriptive characteristics include: Number of observations, mean value, standard deviation, maximum value, minimum value of variables.

Variable	Obs	Mean	Std.Dev.	Min	Max
ROA	4610	.0631792	.0786784	-.6455064	.7836998
TobinQ	4610	.545117	.6419687	0	8.733678
PDI	4610	.6399132	.4800774	0	1
PCI	4610	.6800434	.46651	0	1
RD	4610	.8132609	.2845973	-8.384849	12.27424
AGE	4610	27.44534	17.38669	0	146
SIZE	4610	11.79551	.6722815	10.13225	14.11896
GOS	4610	.0848156	.2786373	0	1
EC	4610	61.7937	166.6636	.0282461	3077.741

Table 2

Descriptive statistics of the variables in the study

Source: Aurthor collects from Stata 15.1

First, descriptive statistics show that the Return on Assets index of companies in Vietnam has an average value of 0.0631792, that is, the efficiency of using assets of Vietnamese companies in about 6.3%. However, Vietnamese companies only have a very large

difference in the use of company assets with the smallest value being -0.6455064 and the largest value being 0.7836998 indicating their financial competitiveness. The main differences between companies.

Next, for the market value variable (TobinQ), descriptive statistics demonstrate that the minimum and maximum values of Tobin's Q of firm's market value are 0 and 8.733678, respectively, when compared to the individual variances between firms. The average value is 0.545117 (less than 1), revealing that most firms' market value is less than the enterprise's replacement cost, and the enterprise's investment volume has shrunk, indicating that the enterprise is still some distance from the point of equilibrium where Tobin's Q equals 1.

For the investment and development cost (RD) variable, the statistical results show that the R&D cost for Vietnamese enterprises is 0.8132609, the minimum and maximum value of R&D of Vietnamese companies is -8.384849 and 12.27424. This shows that the level of investment in science and technology of domestic enterprises varies greatly and depends on the policies of each company.

The remaining control variables include: company size (SIZE), company age (AGE), and labor cost (EC). The results of descriptive statistics show that the company size of the enterprise has an average value of 11,79551, the age of the company up to the present time reaches the highest value of 145, this shows that there is companies sustainable development over the past 100 years. For labor cost (EC), this value reaches at least 0.0282416 and the highest is 3077.741.

4.2   Correlation Analysis

The author performs correlation analysis using the Pearson correlation matrix to get an initial view of the correlation between the variables used in the research model, especially the correlation between the dependent variable and the independent variables. The correlation coefficients between the variables in the model are detailed in Table 4.2.

Variables	ROA	TobinQ	PDI	PCI	RD	AGE	SIZE	GOS	EC
ROA	1.0000								
TobinQ	0.5338*** (0.0000)	1.0000							
PDI	-0.0129 (0.3827)	0.0559*** (0.0001)	1.0000						
PCI	-0.0162 (0.2701)	0.0326*** (0.0269)	-0.0088 (0.5483)	1.0000					
RD	-0.2988*** (0.0000)	-0.1921*** (0.0000)	-0.0088 (0.5483)	-0.0109 (0.4596)	1.0000				
AGE	0.0581*** (0.0001)	0.1444*** (0.0000)	0.0655*** (0.0000)	[Insert Caption]** (0.0000)	-0.0235 (0.1104)	1.0000			
SIZE	-0.0349** (0.0177)	0.0220 (0.1360)	0.0456*** (0.0019)	0.00251* (0.0881)	-0.0127 (0.3886)	0.1554*** (0.0000)	1.0000		
GOS	0.0126 (0.3914)	-0.0166 (0.2600)	-0.0052 (0.7241)	-0.0082 (0.5790)	-0.0038 (0.7958)	-0.0340** (0.0208)	-0.0790*** (0.0000)	1.0000	
EC	0.0420*** (0.0044)	-0.0285* (0.0530)	0.0058 (0.6946)	0.0053 (0.7193)	-0.0065 (0.6571)	0.0699*** (0.0000)	0.1599*** (0.0000)	-0.0353** (0.0164)	1.0000

(***);(**);(*) indicate respectively significant level of 1%;5%;10%

Table 3

Correlation matrix

Source: Aurthor collects from Stata 15.1

The results of the correlation analysis show that Vietnamese companies have the correlation coefficient between firm performance (ROA) and product innovation (PDI) variables and process innovation (PCI) of -0.0129 and -0.0162, respectively. As for the correlation between company age (AGE) and ROA, the analysis results showed a positive correlation between these two variables. However, the analysis results also show a negative correlation between company size (SIZE) and the level of profitability of the company, it has shown a negative correlation between these two variables. When it comes to the relationship between Tobin Q and product innovation and process innovation, there is a positive correlation between them. This coefficient shows that the greater the innovation in products and processes of the enterprise, the more it can increase the value of Tobin Q. From an economic view, it can be seen that when the enterprise has innovation, the The company's position in the market has increased significantly. The analysis results also show a positive correlation between the age of the company and the tobinQ index.

Conclusion

Companies have lately had to prove a movement reaction to external developments in the fourth industrial revolution, limited infrastructure prosperity, and long-term sustainability, or, more recently, the Covid-19. Companies must establish strategies to ensure a lasting competitive advantage via creative internalization, as well as strengthen their corporate skills and long-term growth in all aspects: social, environmental, and

economic. In this phase, the role of firms as innovators, as well as their desire to produce, distribute, and engage in innovation activities, has been stressed in the field of technical innovation. Nevertheless, technical innovation strategies, organizational competitiveness, and enhanced internal capacities of businesses may serve as the foundation for a nation's overall competitiveness and sustainable growth. The author's study focused on the impacts of innovative activity on company results in terms of how valuable a firm is in comparison to its total assets, which is the internal health, and Tobin's Q, which is the market worth of companies.

Firstly, Vietnamese companies have technological innovation activities but have not really increased the operational efficiency of enterprises. When a company implements technological innovation, it also means supply, manufacturing organization, quality control, product marketing, distribution, and human resource management operations at all stages, finance and investment. It means the company must also perform to ensure production and business activities. However, the process of technological innovation in organizations is always fraught with obstacles, particularly when it comes to technologies that have been heavily invested in but are now obsolete due to a lack of cash, expertise, and human resource capabilities do not adapt to the new situation businesses can currently reap the benefits of innovation and technological advancement from practice in the 4.0 era as well as from countries around the world, but when faced with production difficulties and technology are issues that have not been prioritized for investment by Vietnamese enterprises. Enterprises' lack of initiative in accessing new technologies and failing to prioritize technological investment in production not only affects production and business efficiency, but also has a detrimental influence on the environment in the area where the firm is located.

Second, R&D expenditure had no obvious impact on present firm performance. This is due to the activity's high investment costs and lengthy implementation time. As a result, R&D activities are undervalued in developing countries. Large and medium-sized organizations are more likely than small businesses to conduct both research and innovation. Only microenterprises have a disadvantage in conducting both research and innovation. Furthermore, when an enterprise's financial resources are still limited, investing a considerable amount of money in R&D expenses would result in financial deficits, resulting in worse operating efficiency and making it difficult to attract potential investors.

Third, the age factor of the company (AGE) has a positive influence on the performance of the company. This means that the more senior the company, the longer it exists in the market, the more it can increase its competitive position in the market, making investments more secure and attracting more customers. more external capital for the business, thereby increasing revenue and profit.

Finally, no association was established between government assistance policy and the study results. It can be explained that, in Vietnam today, practically all capital for investment in technical innovation comes from firm self-capital. Despite the fact that

there are government programs and money for this purpose, businesses rarely have access to capital from the state budget to carry out technology upgrade operations.

However, when studying the impact of technological innovation on enterprise performance, the author's study still has some limitations:

First, the effect of technological innovation on firm's performance through non-financial features such as reputation or dedication have not yet been studied. The author only uses analytical approach utilized in the study was regression.

Second, the number of studies on the impact of technical innovation on firm performance in Vietnam is still limited, with most focused on SMEs; thus, the authors' research findings have little comparison with other studies conducted in Vietnam under similar conditions

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