

## The Role of Innovation in Technology Capacity of Enterprises in the Manufacturing Industries in Viet Nam



Hieu Pham Van<sup>1</sup>, Trang Nguyen Thi<sup>2</sup>

<sup>1,2</sup>Hanoi University of Business and Technology

**ABSTRACT:** This research aims to assess the role of innovation in technology capacity of enterprises in the manufacturing industries in Viet Nam by building index assessing technology capacity of enterprises performed by The General Statistics Office (GSO). The Technology Capability Index (TCI) is composite index based on five component indexes including innovation index (I). The results reveal that TCI of enterprises in the manufacturing industries Viet Nam in the period from 2014 to 2018 on a rather low level averaged 1.427 on a 5 point scale. In the component indexes, contribution of innovation and R&D index are too low level. On that basic, the paper suggests some policy implications on innovation for Vietnam.

**KEYWORDS:** Innovation, technology, competition, manufacturing enterprises.

### 1. INTRODUCTION

New technologies create new supply sources to meet the demands of traditional markets. New production and consumption needs and changing consumer expectations require businesses to change their production, business, design, marketing, and product distribution methods. With the increasing trend of globalization and the emergence of the Industrial Revolution 4.0, innovation creates competitive advantages for the country as a whole and for businesses in particular. In Vietnam, the manufacturing industry plays an important role and is a driving force for the economy.

In recent times, the phrase "innovation" has been mentioned a lot, attracting special attention from the government, businesses, and scientific researchers both domestically and internationally. Innovation brings significant impacts mainly because it creates the ability to implement improvements in productivity, which is the core driver of economic growth.

Vietnam always identifies the goal of developing the manufacturing industry as a spearhead sector that plays a leading role in economic growth. In fact, the manufacturing industry has made significant contributions to Vietnam's economic development through improving GDP, attracting FDI, promoting exports, and creating jobs for workers. Moreover, companies in the manufacturing industry are the subject of rapid technological change and must constantly innovate their products to meet customer demands, maintain and expand their market share. Innovation are one of the factors that make up the technology capacity of enterprises.

This article aims to evaluate the role of innovation in the technological capacity of the manufacturing industry in Vietnam. This role is assessed through the construction of a technology capacity index for the manufacturing industry in Vietnam based on the data from the General Statistics Office's survey of firms' technology capacities, while also investigating the reasons why firms have limited incentives to invest in research and development, which has hindered their ability to innovate. The article is structured as follows: after the introduction, the next section presents the research method, research results and discussions, followed by policy implications and conclusions.

### 2. RESEARCH METHOD AND DATA

In the current context of globalization and increasing competition, businesses cannot survive and develop in the market without implementing innovation and creativity in their operations. Innovation and creativity have become a mandatory requirement for businesses to compete and sustain their development on the market (Ancona & Caldwell, 1987).

Among contemporary scientists, Joseph Schumpeter (1883-1950) is often referred to as the "father" of the field of study of innovation. His research works have made a significant contribution to the development of the concept of innovation and have had a profound impact on subsequent studies of innovation. According to Schumpeter's view, innovation always exists, and economic development should be considered as a process of changing substance due to innovation. It is not enough to study the

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economy through the allocation of resources. He believed that innovation is the "new combination" of existing resources, and economic development is driven by innovation through a dynamic process in which new technologies replace old ones. (Schumpeter, 1934).

Inheriting and developing previous research, in 2005 in the Oslo Manual, the Organisation for Economic Co-operation and Development (OECD) provided a definition of innovation at the enterprise level. This definition is currently widely used: "An innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations" (OECD, 2005).

To evaluate the role of innovation in technological capability, in this study, the author proposes the construction of a simple but comprehensive set of indicators that reflect all the factors that make up a company's technology capacity, including innovation.

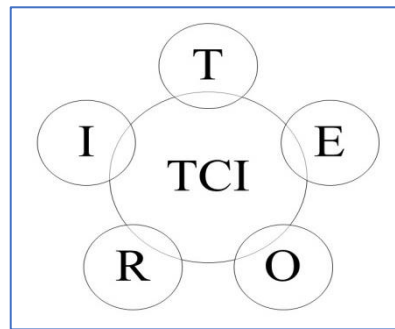


Figure 1. Technology capability index of enterprises and its components

The Technology Capability Index (TCI) is a composite index based on five sub-indices, including: the Technology and Production Equipment Index (T); the Efficiency Index (E); the Organizational and Management Capability Index (O); the Research and Development Capability Index (R); and the Innovation Capability Index (I).

Function formula:

$$TCI_i = \frac{1}{n} \left( \sum_{e=1}^n T_e + \sum_{e=1}^n E_e + \sum_{e=1}^n O_e + \sum_{e=1}^n R_e + \sum_{e=1}^n I_e \right)$$

In this formula:

- i: manufacturing field "i"
- e: enterprise number "e"
- n: number of enterprise in manufacturing field "i"

Meanwhile, the component indices T, E, O, R, and I are built based on sub-indices. According to the author's assessment, the TCI technology capacity index has closely reflected the actual technology capacity of Vietnam's manufacturing enterprises, and is also close to international standards for technology capacity assessment. In Vietnam, technology capacity and level are assessed according to Circular 17/2019/TT-BKHCN with 5 elements and measured through a set of indicators based on 26 criteria with a maximum score of 100. However, the requirement for detailed data with a large number of indicators is a significant limitation when applying this set of indicators. Therefore, the author's proposed TCI technology capacity index will be simplified but still reflect the factors that make up the technology capacity of enterprises, including innovation and creativity.

The data used for calculation and analysis is based on the technology capacity survey data of enterprises conducted by the General Statistics Office and some other technology surveys by other organizations. Due to the limitations of primary data as well as the consistency of survey questions, the study only applies to calculating the technology capacity index for the period from 2014-2018.

### 3. RESEARCH RESULT AND DISCUSSIONS

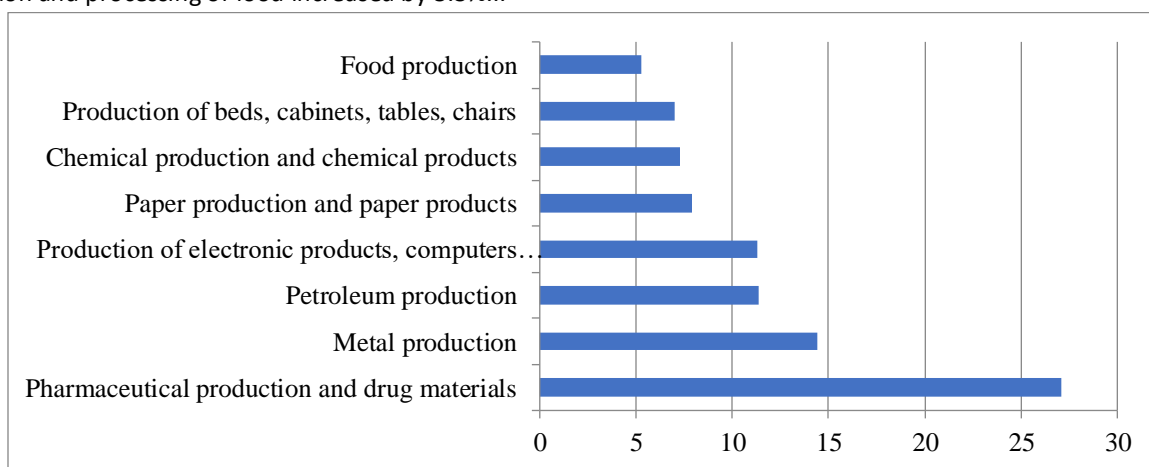
#### 3.1. Overall production results of the manufacturing enterprise

The manufacturing industry has made significant contributions to the economic development of the country. The results that this industry has achieved in recent times have had positive and noteworthy changes. The proportion of the manufacturing industry in GDP increased from 13% in 2010 to 16% in 2018, and since 2015, the growth rate has maintained above 10%/year. In the context of the global economic downturn caused by the COVID-19 pandemic since late 2019, the leading role in growth for the entire Vietnamese industry of manufacturing businesses is even more a bright spot.

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Compared to the general level, the manufacturing enterprises have better production and business results. In 2010, the net revenue of manufacturing enterprises was on average 53.6 billion dong per enterprise, while that of all enterprises was 26.8 billion dong; the corresponding figures in 2018 were 95.2 billion dong and 38.7 billion dong per enterprise (2.5 times lower than the manufacturing enterprises). However, manufacturing enterprises mainly focus on low-tech and labor-intensive industries, which means that they rely on exploiting cheap labor. Labor productivity, value added, and profit margin will only have a breakthrough if innovation and technology, especially technological innovation, are implemented.

Before the time when Covid-19 pandemic affected many industries and businesses in Vietnam and countries around the world, manufacturing enterprises proactively changed their production methods, improved their growth models, diversified their supply chains for production and consumption, and changed their trading methods to interact more effectively with consumer needs. As a result, some labor-intensive and export-oriented industries in the field of manufacturing and processing had high growth rates in 2020, such as: pharmaceutical production and drug materials increased by 27.1%; metal production increased by 14.4%; petroleum production increased by 11.4%; production of electronic products, computers and optical products increased by 11.3%, and many industries had moderate growth rates such as: paper production and paper products increased by 7.9%; chemical production and chemical products increased by 7.3%; production of beds, cabinets, tables, chairs increased by 7%; production and processing of food increased by 5.3%...



**Figure 2. Growth rates of some manufacturing industries in 2020.**

**Source:** General Statistics Office (GSO)

Digital transformation in businesses is one of the aspects that reflects the activities of innovation in enterprises. The Covid-19 pandemic has forced businesses to shift from traditional forms to digital economy applications and e-commerce due to social distancing requirements. However, despite the demands of the new situation, the proportion of businesses applying digital technology is still quite modest.

### 3.2. Technology Capability Index

In this study, the authors propose using a simple yet comprehensive set of indicators that fully reflect the factors that make up a firm's technological capabilities. The Technology Capacity Index (TCI) is a composite index based on 05 indicators, including: the current technology and production equipment index (T); Efficiency Index (E); the Organizational and Management Capability Index (O); the Research and Development Capability Index (R); and the Innovation Capability Index (I).

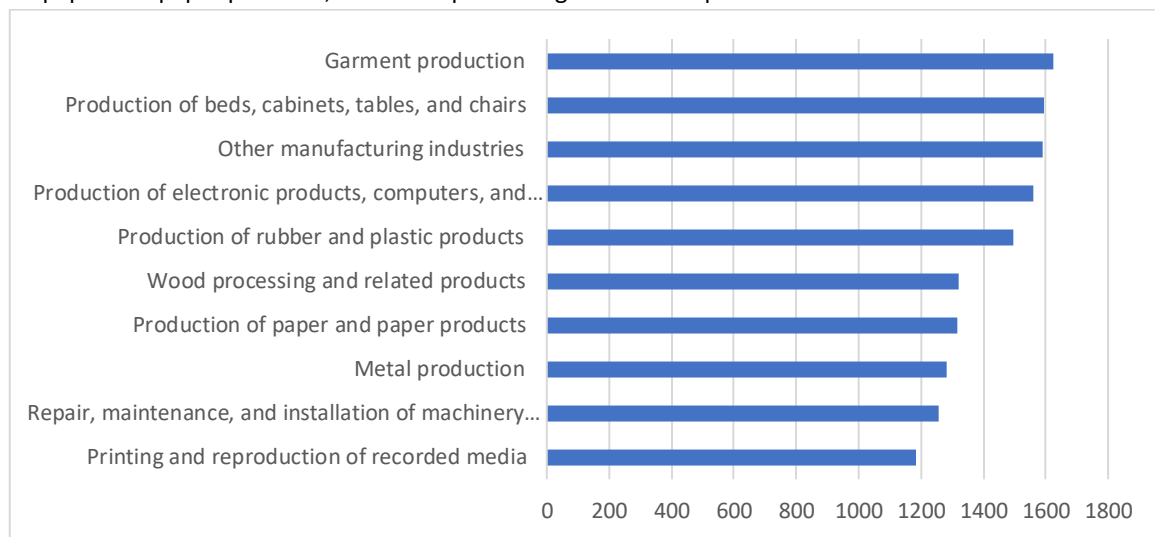
The technology capacity index is calculated based on data from the Annual Economic Census on technology use in production of the surveyed business entities (referred to as the Enterprise Technology Capability Survey).

According to the calculated results of the Technology Capacity Index for Vietnamese Manufacturing Enterprises in the period from 2014-2018, the level was relatively modest with an average of 1.427 out of 5 points. Among the index groups, the largest contribution came from the current technology and production equipment index. Conversely, the research and development capacity and innovation index for Vietnamese manufacturing enterprises were at a very low level. This result reflects that enterprises are quite satisfied with the compatibility of the technology and production equipment they are using. This could be one of the reasons why enterprises have less incentive to enhance their research and development capacity, leading to very limited innovation capability for these enterprises.

Notably, during the 2014-2018 period, although research and development capacity showed some promising signs, the capacity for innovation decreased significantly. Looking at the second-level industries, the top five industries in which businesses had the highest level of technological proficiency were: garment production, production of beds, cabinets, tables, and chairs; other

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manufacturing industries; production of electronic products, computers, and optical products; and production of rubber and plastic products. Conversely, the five groups of industries with the lowest level of technological proficiency were: metal production; printing and reproduction of recorded media; repair, maintenance, and installation of machinery and equipment; production of paper and paper products; and wood processing and related products.



**Figure 3. Technology capacity index of some typical industries**

Source: Author

During the period of 2014-2018, the repairing, maintenance, and installation of machinery and equipment industry was the one with the best improvement in technology capacity index. Next are the industries of other processing and manufacturing industries, electrical equipment manufacturing, and textile. On the other hand, the pharmaceutical and pharmaceutical materials production industry, various types of copying and recording, paper and paper products manufacturing, and other non-metallic mineral products manufacturing industries are the ones with declining technology capacity index.

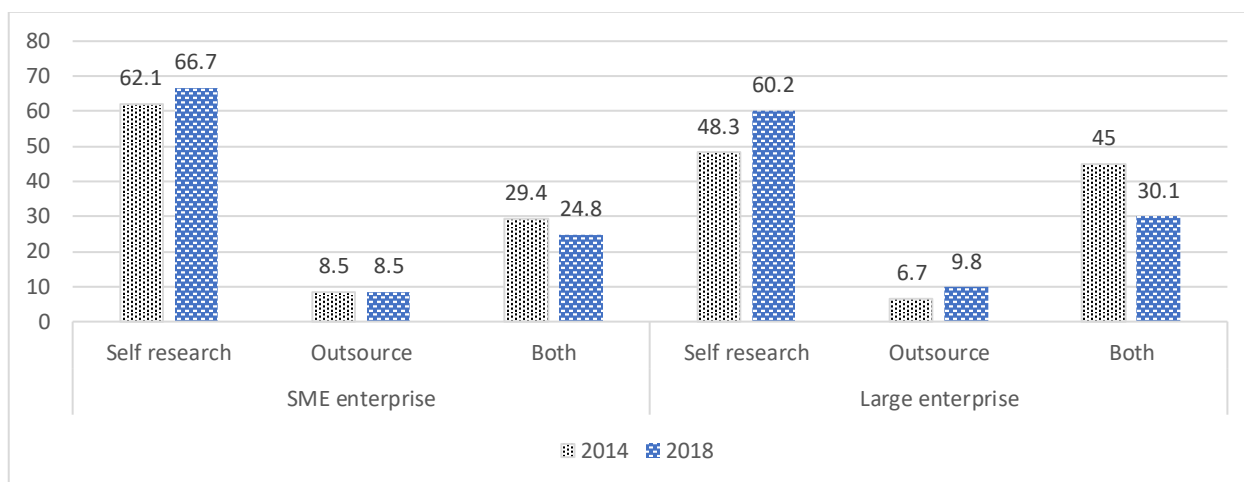
### 3.3. The role of innovation in technology capacity.

The survey results show that the proportion of manufacturing enterprises in Vietnam conducting research and development (R&D) activities is relatively low and tends to decrease. Specifically, in 2014, 5.4% of manufacturing enterprises had R&D activities, which decreased to 4.5% in 2018. Meanwhile, the proportion of R&D activities in large enterprises was at 11.8%. This fact shows that Vietnam's manufacturing industry has not paid enough attention to investing in production technology and has not considered it a strength to create competitive capabilities for businesses. However, it must also be said that the current institutional environment has not really created the impetus for enterprises to invest in technology and R&D activities.

However, for businesses that have realized the importance of technology for long-term survival and development, they have come up with many solutions to overcome resource constraints (capital, human resources) through solutions such as collaborating in research or outsourcing R&D activities beyond the current capacity of the business. In 2018, 66.7% of businesses with R&D activities conducted their own research, 8.5% outsourced, and 24.8% combined both methods.

The high and increasing proportion of self-research from 62.1% in 2014 to 66.7% in 2018, the nearly constant proportion of outsourcing at 8.5%, and the decreasing trend in the combination of the two forms from 29.4% to 24.8% demonstrate the great efforts of businesses in promoting their research and development activities. This reflects the underdevelopment of professional companies in R&D, both in terms of quantity and quality, as well as the lack of effectiveness in the "Institute-University-Business" cooperation mechanism that the government has long been promoting. Additionally, another reason affecting businesses' outsourcing is the lack of financial resources. Indeed, for large enterprises with abundant resources, over 51% outsourced or combined the two forms in 2014, and although this proportion decreased, it still remained high at 40% in 2018 compared to small and medium-sized enterprises.

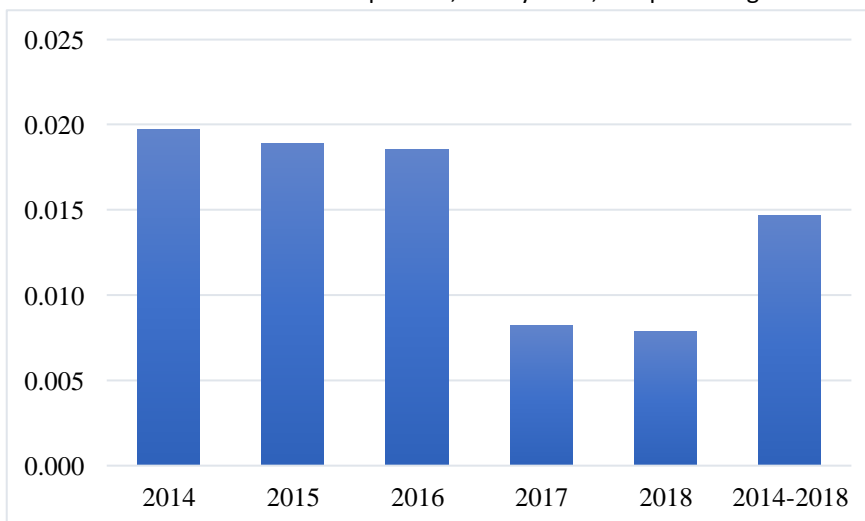
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**Figure 4. R&D activities of Vietnamese enterprises by scale**

Source: Author

According to the survey results, the majority of businesses conducted applied research with an increasing trend, with corresponding rates of 67.5% and 71.3% in 2014 and 2018, respectively. Going deeper into the specific goals of R&D activities, most businesses expect R&D results to be new to the market or new to the company, while the percentage of businesses aspiring to make a mark on the global market is very low. Vietnamese businesses set modest goals in R&D activities, mainly aiming to improve and upgrade the production organization model and products of the business. The evidence is that the percentage of businesses aiming to create new products for themselves increased from 45.3% to 50.4%, while the percentage aiming to create new products for the market decreased from 49.5% to 48%, and the goal of targeting the global market decreased sharply from 5.2% to 1.5%. This is contrary to the increasing trend of large businesses' desire to target the global market. In 2014, only 2.4% of large businesses wanted to create world-class inventions and patents, but by 2018, this percentage had increased to 3.8%.



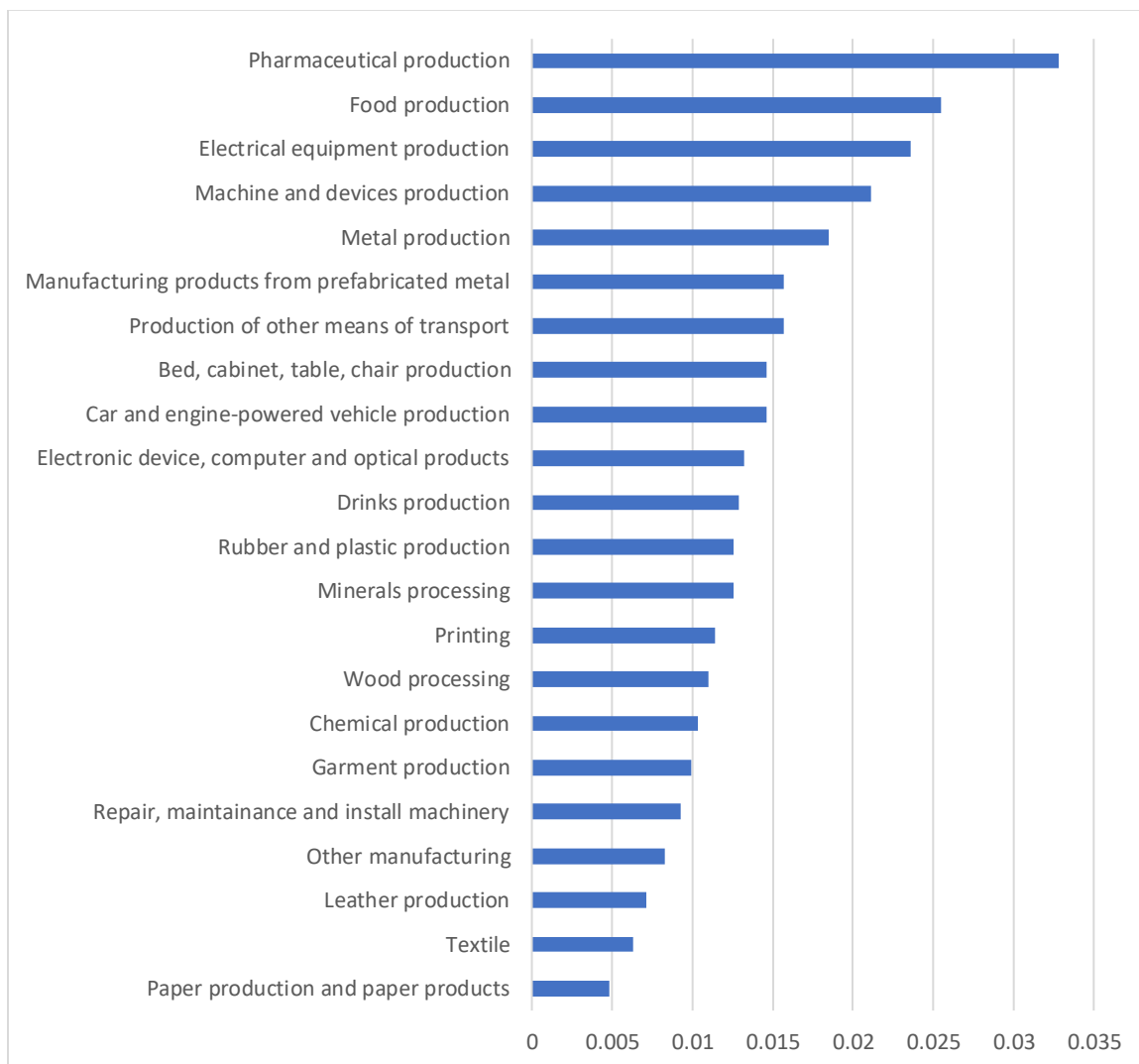
**Figure 5. Innovation Capacity Index of Manufacturing Enterprises during 2014-2018 Period**

Source: Author

The low research and development (R&D) capacity resulted in a correspondingly low innovation index for the manufacturing industry in Vietnam. On average from 2014 to 2018, the innovation index of these enterprises was only 0.015 out of a total of 1 point. In fact, in 2017 and 2018, the index was even lower, at less than 0.01.

One of the main reasons for this is the goal of research and development activities of the businesses. Most companies carry out R&D activities with the main purpose of creating innovations for their internal use, and the goal of technology innovation is primarily for the company itself, followed by innovation for the market, while very few companies aim for global technological innovation. The focus on research to achieve completely new features of the product is very limited, mainly aimed at improving the quality of the product.

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**Figure 6. Innovation capacity index of manufacturing enterprises by business sector.**  
**Source:** Author

At the industry level, the pharmaceutical and medicinal product manufacturing sector has the highest innovation and creativity capacity index, followed by the food production sector, and thirdly the electrical equipment manufacturing sector. On the other hand, labor-intensive industries such as leather production and related products, and garment production are the sectors with the lowest innovation and creativity capacity index, alongside industries that heavily depend on imported machinery and equipment such as textile manufacturing, repair, maintenance, and installation of machinery and equipment, which also have a very low innovation and creativity capacity index.

#### 4. POLICY SUGGESTION

Building a comprehensive institutional framework and policy to promote innovation and creativity is necessary. As a developing country, Vietnam's operating environment, including government policies, has created both opportunities and challenges for business innovation.

##### Improving the institutional framework for innovation

To develop an economy based on innovation, it requires planning and implementing many appropriate policies related to various industries, subjects, and resources, including institutional factors. Institutional factors play an important role, affecting the innovation capacity of subjects, where businesses are the center.

In recent years, Vietnam has made efforts to promote investment in science and technology and innovation. The government has expanded tax incentives for companies engaged in R&D and those investing in advanced technology equipment. Building a comprehensive regulatory framework and policies to promote innovation is necessary. As a developing country, Vietnam's operating environment, including government-related policies, has created incentives for businesses to innovate.

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### Enhance access to financial support

The results of research and practical experience in recent years have shown that R&D activities are truly costly and not always effective. Therefore, besides the vision and development strategy of the enterprise, capital is the top factor ensuring the research and development activities of the enterprise. And this is even more difficult for enterprises with limited financial capacity. Meanwhile, accessing budget support from the government is very limited due to complicated disbursement procedures, and the small scale of support reduces the motivation for enterprises to access it.

Regarding the budget for R&D activities, the majority of it is self-financed by businesses, accounting for about 86%, and around 11% of businesses have to borrow credit to invest in R&D, and only about 3% of businesses can access the government's budget support.

During discussions with some businesses in 2019, the majority of them stated that the biggest obstacle to technological innovation was the difficulty in accessing funding. Business owners really want to innovate to improve production efficiency and increase competitiveness. However, due to low profit margins, they do not have the resources to carry out technological innovation, and borrowing from banks is not feasible as they do not have sufficient collateral. Although there are many policies to support technological innovation for businesses, localities often do not have the resources or the regulations are too difficult for businesses to receive support. Moreover, some businesses even reported that even if they have the financial resources to allocate funds for technological innovation and R&D, the current financial regulations limit their ability to use these funds for the intended purpose.

Research on innovation tends to focus on large companies with abundant resources, so how can small and medium-sized enterprises with limited resources implement innovative initiatives? Therefore, the government's policy should enhance the ability of small and medium-sized enterprises to access financial support for innovation activities in general, and especially for small and medium-sized enterprises.

### Strengthening collaborative relationships in implementing innovation

Vietnamese businesses rarely cooperate with external businesses or research institutions in the process of technological innovation, but rather conduct research and development within their own companies. The proportion of self-research has increased significantly from 62.1% in 2014 to 66.7% in 2018, indicating the great efforts of businesses to promote their research and development activities. This reflects the ineffectiveness of the "Institute-University-Enterprise" cooperation that the government has long promoted. In addition, another reason that affects the outsourcing of businesses is the lack of financial resources. Indeed, with large businesses having more abundant resources, more than 51% of them outsourced or combined both forms in 2014, although this proportion decreased, it still remained much higher at 40% in 2018 than that of small and medium-sized enterprises. Therefore, strengthening cooperation in implementing innovative and creative changes is necessary to fully exploit the advantages of the entities in this relationship.

## 5. CONCLUSION

In summary, research and development activities still take place on a relatively limited scale among Vietnamese manufacturing enterprises during the 2014-2018 period. The majority of the causes lie in the lack of resources and the lack of practical support from the government to promote R&D activities of enterprises. On another aspect, the goal of R&D activities of small and medium-sized manufacturing enterprises is still quite limited in scope to improve productivity, lacking activities with a vision to expand internationally (regionally and globally). Looking at the broader scope nationwide, in recent years Vietnam has achieved notable results in innovation efforts. According to the Global Innovation Index (GII) 2022 report released in September 2022, Vietnam ranks 42nd out of 132 economies, in the Top 50 and second in the group of 36 low-middle-income economies. This result shows many positive signals but also implies major challenges that Vietnam needs to overcome to become an innovative country, especially as the gap between us and the most innovative countries in the region is still very large. Although there are still limitations, this research provides some important information about the role of innovation, research, and development in the technology index of manufacturing enterprises based on survey data.

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