Improving technology achievements transfer and industrialization level by strengthening the innovation capability of enterprises

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Abstract. This article expounds the definition of the innovation capability of enterprises, as well as the innovation development status and existing problems the enterprises encountered in China and especially in the Guangdong - Hong Kong - Macao Greater Bay Area. It comprehensively discusses the significance and corresponding measures of strengthening the enterprise innovation capability and emphasizing the dominant position of enterprises in innovation. It also analyzes detailedly the advantages of the Greater Bay Area in innovative development, international exchanges and cooperation, relying on which the enterprises, as the innovative subject, can better matching the international innovation resources, and further improving the technology achievements transfer and industrialization level.

Keywords: enterprise; innovation; Guangdong-Hong Kong- Macao Greater Bay Area; industrialization

1 Introduction

The Report to the 20th National Congress of the Communist Party of China emphasizes that "We will reinforce the principal role of enterprises in innovation and promote deeper integration of the innovation, industrial, capital, and talent chains." For enterprises, innovation is a crucial driving force and core competitive strength for their sustainable development and the key to maintaining advantages in the fierce global competition. The innovation capability of an enterprise will directly affect its survival and growth, which is always closely connected to their products upgrading and market competitiveness. For the overall development of the country, the enterprises are the primary sources of technological innovation which provide a constant support for innovative development through constant efforts in the R&D of new technologies, new products[1]. Consequently, finding the factors and corresponding approaches to promote enterprise innovation capability is of great significance for realizing sci-tech self-reliance and self-strengthening at higher levels.

K. Zhang et al. (eds.), *Proceedings of the 4th International Conference on Management Science and Software Engineering (ICMSSE 2024)*, Advances in Engineering Research 244,
https://doi.org/10.2991/978-94-6463-552-2_26

2 The Development of Enterprise Innovation Capability

2.1 The Definition of Enterprise Innovation Capability

As early as in the 1980s, scholars from home and aboard began to do researches on the definition and composition of innovation capability which can be generally summarized to the following aspects, i.e. technological innovation, managerial innovation, market innovation, innovation resources, innovation processes and innovation implementation capability[2-6]. Technological innovation is a comprehensive reflection of multiple competencies. It can be categorized by the subject into three levels: enterprise innovation capability, industrial innovation capability and national innovation capability. Since enterprises are the fundamental units of a nation's economy, their innovation capability plays a principal role in the national innovation system which serves as the foundation for both industrial and national innovation capabilities.

2.2 Current Innovation Development Status of the Chinese Enterprises

The innovative awareness on the enterprise side has been greatly aroused with the continuous optimization of the enterprise innovation environment and the constantly improvement of the innovation incentive policies in China. They gradually recognize that scientific and technological innovation is the key for enterprises to obtain competitive advantages and achieve sustainable development. According to the *Statistical Bulletin of National Science and Technology Expenditure (2000 to 2022)*, the R&D investment of enterprises has increased over 44 times from 54.06 billion yuan RMB in 2000 to 2.38786 trillion yuan RMB in 2022. According to the statistics of the *Yearbook of Science and Technology Statistics of China*, the expenditure of enterprises on basic research has also increased significantly. During 2018 to 2022, the expenditure of enterprises on basic research increased from 3.349 billion yuan RMB to 17.492 billion yuan RMB. At the same time, the amount of R&D personnel in enterprises also increased continuously from 3.4248 million in 2018 to 4.9978 million in 2022. By the end of 2023, there were about 427,000 enterprises in China (excluding Hong Kong, Macao and Taiwan) with 4.015 million patents for inventions, within which the valid patents accounted for more than 70%. In 2023, the industrialization rate of invention patents applied by enterprises exceeded 50% for the first time. In addition, the Fortune 500 list also reflects the actual capabilities of Chinese enterprises. 142 Chinese enterprises were on the Top 500 list in 2023, accounting for 28.4% and ranking the first worldwide for five consecutive years.

2.3 Current Innovation Development Status of Enterprises in the Guangdong-Hong Kong-Macao Greater Bay Area

Through these years, the Greater Bay Area has achieved brilliant innovation performances. According to the statistics of *Blue Book of Guangdong-Hong Kong-Macao Greater Bay Area: Report on reform and innovation (2024)*, the R&D investment in 2023 exceeded 460 billion yuan RMB, with an R&D investment intensity of about

3.4%, which is the same as that of the United States in 2022. According to the Top 1,000 enterprises on the global R&D investment list in the *2019 EU Industrial R&D Scoreboard*, there are 32 enterprises in the Greater Bay Area, with an average R&D investment of 847 million euros. 104 enterprises in the San Francisco Bay Area, with an average R&D investment of 1,072 million euros. 30 enterprises in the New York Bay Area, with an average R&D investment of 1.273 billion euros. Besides, 309 of the listed enterprises in the Greater Bay Area are of high intensity, 195 are of medium and high intensity, 27 are of medium and low intensity, and 63 are of low intensity. From the *Evaluation Report on China's Regional Innovation Capability 2023*, which is regarded as an annual examination of innovation capabilities for provinces, Guangdong has been ranking the first for 7 consecutive years. Guangdong has 67,000 industrial enterprises above the designated size, 69,000 high-tech enterprises, as the main driving force of regional innovation capabilities, they have profound achievements in enterprise innovation and innovation performance, which are both ranking the first in the country.

2.4 Existing Problems the Chinese Enterprises Encountered

However, there are problems existed in the process of innovation carried out by enterprises, caused by the late start and weak foundation of enterprise innovation in China. First, enterprises do not have motives strong enough to carry out basic researches, and they do not have enough close and in-depth cooperation with universities and research institutions. The investment level in basic research still has much to be enhanced compared with that of the innovation-driven countries such as the United States and Japan. Second, the cooperation between enterprises and other innovation organizations is not deep enough. Although there are enterprises cooperating with universities and research institutes, the industry-university-research institute collaboration has not yet proceeded to the phase of in-depth integration. Third, the enterprise innovation environment and intellectual property protection system, especially the intellectual property protection practices and market competition environment in China is yet to be improved.

3 Advantages of Innovative Development in the Greater Bay Area and Approaches to Improve Technology Achievements Transfer and Industrialization

3.1 Advantages of Innovative Development in the Guangdong-Hong Kong-Macao Greater Bay Area

The Guangdong-Hong Kong-Macao Greater Bay Area is one of the most open and economically vibrant regions in China, where the enterprise innovative activities give crucial support to promote regional economic development and technological innovation.

The main sources of R&D investment in the Greater Bay Area are the government and the enterprises. The R&D investment on the government side is mainly input for basic research, public welfare research and common key technology research with a series of policies formulated, such as implementing preferential tax policies to support

scientific and technological innovation and subsidy policies for enterprise research and development investment, encouraging enterprises to increase investment in research and development, supporting enterprises to build R&D institutions (including key laboratories) and to undertake major national and provincial sci-tech projects and key core technology researches. The R&D investment input by the enterprises generally focuses on the applied research and the market transformation of technological achievements. A great number of high-tech and start-up enterprises are gathering in the Great Bay Area, forming a powerful network and industrial clusters which greatly facilitates the industrial upgrading. They also exploit the advantages of the Greater Bay Area to the fullest, including the favorable policies, innovative entrepreneur spirit, comparatively complete industrial chains, and strong intellectual support home and abroad.

The Greater Bay Area, at the forefront of national development, also has unique advantages in its geographical location and economic environment. It has a large number of high-quality research institutions, well-known universities with strong innovation bases and numerous high-tech enterprises. It is an important region in China to develop a world-class city cluster to integrate and promote global cooperation and development, efficient and convenient transportation system, strong strength in economy and vivid sprite of entrepreneurship, which provide the most favorable conditions for international scientific and technological exchanges and cooperation.

3.2 Approaches to Improve Technology Achievements Transfer and Industrialization

There is a large number of excellent strong and innovative enterprises in the Greater Bay Area. At present, there are 57,000 national high-tech enterprises and more than 30,000 small and medium-sized technology-based enterprises, ranking the first in China. They are the main force that truly translates scientific research achievements into innovative products, as well as the dominant innovation subjects that put scientific research results into actual productivity. It is essential to make full use of the strong strength and innovation capability of the enterprises in the Guangdong-Hong Kong-Macao Greater Bay Area to effectively improve the technology achievements transfer and the productivity transformation level, and turn the Guangdong-Hong Kong-Macao Greater Bay Area into an international scientific and technological innovation center with global influence. The main approaches are: from the government side, first is to strengthen its policy guidance by optimizing policy measures in response to regional development situations and the actual needs of enterprises; second is to deepen the cooperation mechanism, i.e. to improve the existing international sci-tech cooperation models, and enhance the top-level design to provide institutional guarantees for international collaboration; third is to improve the funding mechanism to support innovation entities in further leverage bilateral and sci-tech cooperation, especially the civil cooperation. For the enterprises, first is to study the relevant policies and make full use of the preferential items such as tax incentives, such as additional deductions for R&D expenses, to increase R&D investment, thereby promoting technological innovation and industrial upgrading; second is to strengthen industry-university-research institute collaboration to jointly build R&D centers and laboratories, benefiting from resource

sharing and collaborative innovation, such as the establishment of Guangdong-Hong Kong-Macao Joint Laboratories; third is to actively carry out the transformation of sci-tech achievements to boost the productive forces.

4 Conclusions

The enterprises are the main participants in economic activities such as the transfer and transformation of sci-tech achievements into productive forces, the new force to promote innovative breakthroughs and achieve high-quality development. The Greater Bay Area gathers the sci-tech innovation strengths of mainland China, Hong Kong, and Macao, leveraging their respective advantages and fostering a mutually beneficial and complementary relationship. This dynamic has created a pronounced industrial clustering effect, which in turn provides significant support for innovation as well as international collaboration in the field of science and technology. The enterprises in the Guangdong-Hong Kong-Macao Greater Bay Area have a relatively strong innovation capacity and economic strength, providing a more favorable condition for high-quality development of the region. The enhancement of the technological innovation capability is vital for enterprises to win competitive advantages which can be promoted by the joint force of both the government and the enterprises. The government should mainly improve the top-level design, formulate and implement more favorable policies to guide the development of the enterprises. The enterprises should strengthen the connection with the government, industry, universities and research institutes, make full use of the supporting policies and intellectual resources in order to solve the bottle-necking problems in the industrial innovation and practices.

In the current phase of the profound development of the new technological revolution and industrial transformation, the realization of sci-tech self-reliance and self-strengthening at higher levels is based on the essential prerequisite of enhancing the innovation capability of enterprises. As the core subject within the national innovation system, the enterprise innovation capability is not only vital for their own survival and development but also for the economic security and technological advancement of China. Therefore, improving the innovation capability of enterprises and strengthening the dominant position of enterprise in innovation, are of great significance to the realization of a nation of high-level sci-tech power.

Acknowledgment

This research is sponsored by Guangzhou Social Science Fund (Grant No.2024GZYB64), Exploration of approaches to promote international science and technology cooperation by reinforcing the principal role of enterprises in innovation and developing a new system for technology transfer and transformation.

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