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Evolutionary study on collaborative innovation of technology innovation in SMEs and public policy innovation based on complicated network

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ABSTRACT

During the process of exploring the sustainable economic development path, all countries in the world have realized the significant role of technological innovation. In recent years, the dominant position of small and medium-sized enterprises (SMEs) in the technological innovation has been universally recognized, and many countries have launched corresponding supportive policies to promote the improvement of innovation capability in SMEs. This dissertation comparatively analyzes the public policy systems for promoting technological innovation in developed countries and developing countries, and points out the deficiencies of current Chinese policies for technological innovation. Specifically, they are mainly reflected in three perspectives: lack of legal protection, insufficient support in fiscal taxation policies and incompleteness of social service systems. Therefore, according to the problems in the collaborative innovation of technological innovation in SMEs and public policy innovation in China, this dissertation puts forward five suggestions to construct the corresponding supportive policy system so as to provide possibility for the further integration of regional collaborative innovation.

Key words: Complicated network; public policy; technological innovation; collaborative innovation

INTRODUCTION

As one of the most successful countries in macro-control, China has formulated various public policies, which are not only of great significance to Chinese economic development but also of profound guiding function for the development path of technological innovation. However, as China started late on studying the promotion of technological innovation from policy aspect, and lacked relevant successful experience, the whole policy-making process lacks consideration on integrality and relevance. Consequently, the public policies cannot perfectly match with the demands of technological innovation, and the policy support is insufficient, which further leads to the slow growth in Chinese technological innovative capability [1-3]. In this regard, the profound dissection on the relationship problems between public policies and technological innovative capability in China is of important theoretical value and practical significance for formulating relevant policies more scientifically and systematically as well as enhancing the Chinese technological innovative capability and overall competitiveness more comprehensively. This is also the research objective of this dissertation.

1. LITERATURE REVIEW

During the early research process of technological innovation, the factor of public policies was excluded. Schumpeter points out that, the process of technological innovation is actually the recombination of enterprise production factors and construction of new production functions. Under such thinking, Schumpeter specifies five production factors, excluding public policies [4].

Arrow is the first economist to pay attention to the role of public policies in technological innovation. Through studying the overflow effect of technological innovation, Arrow finds that, the competitive economic model independent of public policies cannot achieve the social optimization, whereas the government can promote the

economic growth and social optimization through formulating relevant public policies [5].

The national innovation system proposed by Freeman is regarded as a symbolic research which completely incorporates public policies into technological innovative systems. As Freeman indicates, the free competition under market-oriented economic system cannot effectively promote the technological innovation and technological progress, while only the resource schedule and dynamic allocation of state macroscopic level can drive the technological innovation of an industry most effectively [6].

Studies about the relationship between technological innovation and public policy in China are mainly done in the 21st Century. Theoretically, Wang Dan has analyzed the relationship among public policy, technological innovation and economic growth, and points out that public policy indirectly contributes to economic growth by influencing technological innovation, which can be seen from its effect of external quality improvement and internal double importance.

2. ANALYSIS OF PUBLIC POLICIES FOR THE PROMOTION OF TECHNOLOGICAL INNOVATION AMONG TYPICAL COUNTRIES IN THE WORLD

3.1 Conditions of public policies for the promotion of technological innovation among typical countries in the world

From the current world economic situation, the old industrialized countries, such as USA, Germany, Britain as well as Japan form the first echelon, while the newly industrialized countries such as South Korea as well as Singapore compose the second echelon. Besides, some developing countries like China, India, Brazil, constitute the third echelon. However, despite of the economic level of these countries, all of them have been fully aware of the significance of technological innovation for their economic development and social progress; moreover, each of them has vigorously developed its own technological innovation through various supportive public policies. Specific conditions are listed in Table 1.

Table.1: Conditions of Public Policy for the Promotion of Technological Innovation among Typical Countries in the World

Time Span	Developed Countries		Developing Countries	
	The USA	Japan	Brazil	India
The Stage of World Economic Recovery after the Second World War (Before 1945)	Beginning to put forward some supportive policy for the promotion of technological innovation from the national level	Making various policies for the training of high-end personnel, and introducing incentive policies so as to stimulate them to do more scientific research.	None	None
The Stage of the overall World Economic growth reaching Unprecedented prosperity (1945-1969)	Creating a comprehensive legal system and providing reliable financial support for the development of technological innovation especially for that in small and medium-sized enterprises.	Establishing a sound intellectual property protection system to ensure the continuous benefit of the inventor.	Establishing the Credit Bureau for Scientific Research Projects early in the 1960s to specially provide loans for state-owned and private enterprises, vigorously supporting the technological innovation and process innovation on the enterprise level	Setting up a number of small industrial development banks, supporting the technological development of small and medium-sized enterprises through a variety of measures. In addition, the national financial institutions in India also serve as important sources of funding channels for them.
The Stage of Sustainable Economic Development till Now (since 1969)	Directly supporting the technological innovation of small and medium-sized enterprises through fiscal policy, and at the same time, providing comprehensive social services for them.	Based on their emphasis on intellectual property rights, launching the Intellectual Property Court Facilities Law to strengthen its emphasis and protection on intellectual property rights. Attention to and protection of intellectual property rights has benefited the inventors and small and medium-sized enterprises in Japan, and inspired the working enthusiasm of the research personnel in Japan.	In the 1990s, Brazil adjusted the technological innovation system from the national level to determine the framework of seeing small and medium-sized enterprises as the main technological innovation subjects. Launching the "Technology Innovation Partnership Program", "The New Millennium Institute Plans". On the tax level, Brazil has developed a very preferential policy for technological innovation of domestic small and medium-sized enterprises.	For a long time, India has been relying on independent innovation of science and technology to promote the development of national basic industry, heavy industry and electronic industry.

3.2 Enlightenment of international experience on Chinese policies for technological innovation

In terms of public policy for the supporting of technological innovation, there are similarities and differences among the old industrial countries, newly industrialized countries and developing countries. The summary done by this paper is shown in table 2.

Table.2: Comparison of Supportive Public Policy for Technological Innovation among various Countries in the World

Series No.	Similarities	Differences
1	All construct policy cornerstone for the development of technological innovation from the aspect of legislation.	In developed countries, with the mature market operation, it's easy to establish a sound mechanism for technological innovation, while it's necessary for the developing countries to implement market reform.
2	All establish the service system with high-quality service and fast construction for technological innovation with the government as the main body.	Technological innovation policy in the USA is implemented mainly from the aspect of legislation.
3	All set up the supporting fiscal, tax, credit and financial policy system.	Britain focuses more on the direct support of fiscal policy, and emphasizes on the transformation of technological innovation achievements.
4	All establish the sustainable long-term technological development programs from the national level.	Germany's social service system is more perfect, which provides comprehensive advisory services for technology innovation.
5	All focus on the effectiveness, consistency and enforceability of the supporting policies.	Japan pays more attention to the training of scientific personnel and protection of intellectual property rights.

Public policy measures for technological innovation among various countries in the world have profoundly enlightened China on how to make supporting policies for technological innovation:

First of all, China should be clear of the dominant role of small and medium-sized enterprises in technological innovation. Small and medium-sized enterprises especially scientific and technological SMEs, are not only important force of technological innovation, but also an important part of a nation's innovation system. This has been confirmed not only in developed countries but also in developing countries. Compared with other countries, China has a large number of small and medium-sized enterprises, but they are relatively weak in competitiveness. Therefore, China has to strengthen its policy support for SMEs in order to improve their technological innovation capacity.

Secondly, China's policy support for technological innovation should be carried out from multiple perspectives and in a multi-level and coordinated way. Throughout the world, the policy support for the technological innovation is implemented from various aspects of legislation, finance, tax, social service etc. In terms of the reality of China, the environment for technological innovation is not perfect, and economic strength of the small and medium-sized enterprises is weak. Therefore, it is necessary to improve the technological innovation system by force of law, to ensure funding of technological innovation through financial support, to stimulate technological innovation enthusiasm of small and medium-sized enterprises through fiscal taxation policies, and to provide convenience for every step in the technological innovation through social service.

Finally, China should not only learn from the advanced international experience, but also develop its own road of technological innovation. From the successful experiences of Japan, India and other countries, it can be known that they have learned from advanced experiences from the developed countries such as American, and developed their own roads of technological innovation based on their practical situations. As the country with the fastest economic growth in recent years, China boasts a large domestic market demand, and the economic pattern is changing from a labor-intensive one into a technology-intensive one. How to choose the path of technological innovation in China should fully rely on its actual circumstances and current economic development situation. Besides, the path should reflect China's own characteristics.

2.3 Status analysis of the public policies to promote technology innovation in China

Through a sweeping view of the supportive policies for technology innovation in recent China, it can be seen that the policy has played a more and more important role in these aspects like preventing innovation risks, encouraging enterprise innovation enthusiasm, and accelerating inter-enterprise cooperation. Nevertheless, when it comes to the promotion of technology innovation in small and medium-sized enterprises (SMEs), there are still the following problems in the public policy system.

Firstly, Chinese public policies to promote technology innovation are short of legal guarantee. In China, the legislation for independent innovation for SMEs is scattered in clauses and weak in adaptability. Worse still, quite a lot of laws and regulations are repeated and contradictory with each other. What's more, there isn't any corresponding legislation aiming at risk investment as well as science and technology input. In addition, the quality of law

enforcement team and the enterprise legal awareness are in urgent need of improvement.

Secondly, Chinese fiscal and taxation policies are not strong enough in supporting technology innovation. Chinese fiscal appropriation for technical research and development is in a strikingly lower proportion in the whole fiscal expenditure compared with that of developed countries. What's more, in the limited scientific research input, there are less than 40% of the funds invested into SMEs. From the point of taxation policies, preferential treatment to the technology innovation of SMEs is mainly from local governments. However, preferential margin differs greatly from place to place because of the regional imbalance of economic development.

Thirdly, the Chinese social service systems for technological innovation are not perfect yet. In recent years, China also starts to build enterprise incubators of various categories. However, it can still not satisfy the demands of numerous SMEs quantitatively. In addition, the service level of diverse science and technology institutions is low and their service capacity is insufficient. As a result, the enterprises, universities and research institutes cannot be effectively combined, the intellectual property cannot achieve effective protection, and the real demands of enterprises cannot be satisfied in technological innovation.

CONCLUSION

As technological innovation is the important force to promote economic development and social progress, this study aims to formulate reasonable public policies to promote Chinese technological innovation, especially the technological innovation in SMEs. Through comparison with advanced international experience and analysis of Chinese current status of technological innovation, this dissertation offers the following policy proposals:

Firstly, perfect the legislation system for promoting technological innovation and construct institutional environment for the technological innovation in SMEs.

Secondly, strengthen supportive force of fiscal taxation policies so as to guarantee the abundant capital of SMEs for technological innovation.

Thirdly, improve working remuneration of scientific research personnel, reinforce intellectual property protection, and comprehensively enhance the basic innovation capability of SMEs.

Fourthly, construct industry-study-research cooperation network, and accelerate industrialization speed of technological innovation results so as to really form the output of technological innovation.

Fifthly, advance the marketization process of technological innovation, and formulate reasonable and regional marketing policies so as to boost the economic development with technological innovation.

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