

Construction of regional innovation capability indicator system

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Abstract: At present, China's economy is shifting towards a stage of high-quality development. In the report of the 20th National Congress of the Communist Party of China, it is particularly emphasized that "innovation is the primary driving force, and we must adhere to the innovative development strategy". Seizing the advantages brought by the development of the digital economy is of great significance for enhancing the independent innovation ability of various regions in China and building an innovative country. In this context, building comprehensive regional innovation capability indicators is crucial for national development.

Keywords: Innovation Capability; Input-Output

1. Research background and literature review

Driven by innovation, China's major technological innovation achievements continue to emerge, achieving significant breakthroughs in high-tech fields such as manned spaceflight, quantum communication, and big data platforms. Although China has repeatedly achieved results at this stage, compared to other developed countries such as Europe, America, and Japan, China still lacks the core technology required for semiconductor technology and other confidential instruments. Adhere to the development and innovation strategy, guided by national strategic needs, enhance China's independent innovation capability, resolutely win the battle for key core technologies, and shorten the gap between China and technologically advanced countries. In the new stage of development, China's economy is gradually entering a new normal, with advantages such as population, resources, and marketization that have gained dividends gradually disappearing. The driving force for regional economic development is gradually shifting from factor investment to innovation. It can be said that innovation has become a strategic support and driving force for the high-quality development of China's economy at this stage. With the continuous development of regional economy, the environment faced by the market is becoming increasingly complex, and competition is also intensifying. Regional innovation ability marks the decisive factor for regional comprehensive competitiveness and international competitive advantage. Driven by innovation strategies, important scientific and technological innovation achievements have been continuously emerging in China in recent years.

Joseph Schumpeter^[1] first proposed the term "innovation" by combining technology with economy. He first proposed the definition of innovation in his book "Economic Development Theory" published in 1912. He believed that innovation is a new combination of production methods, establishing a new production function. Innovation is strictly different from technological invention, as it introduces technological innovation into economic organizations and forms new economic capabilities. Following Schumpeter's innovation theory, British researcher Friedman^[2] first proposed the national innovation system in his 1987 book "Technology Policy and Economic Performance: The Experience of Japan's National Innovation System", defining it as a system composed of institutions such as the public and private sectors, which constantly interact and influence each other within the system, influencing the development of new technologies. On this basis, American scholar Suarez^[3] proposed the concept of national innovation capability and evaluated it using the number of patents, pointing out that national innovation capability is influenced by factors such as law, education level, and intellectual property rights. In 1992, British scholar Cook^[4] published "Regional Innovation System: The Competition Rules of New Europe", which first proposed the concept of regional innovation system. It was defined as an organizational system within a region where innovation entities such as educational and research institutions and productive enterprises are interconnected and cooperate, and each division of labor. Since then, domestic and foreign scholars have conducted research on innovation capabilities from multiple perspectives, including countries, regions, and enterprises.

2. Construction of index system

Given existing research, scholars usually choose the number of patents or the output value of new products as indicators to measure regional innovation capacity, but these measurement standards quantify the output results. When measuring regional innovation capability

based on the number of patents, due to the lag in the time required for patent acceptance, it is not possible to accurately measure the innovation capability of the current year., Previous research has been unable to comprehensively measure regional innovation capability. Based on the measurement of regional innovation capability by the China Academy of Science and Technology Development Strategy (China Regional Innovation Capability Evaluation Report 2022), this article constructs evaluation indicators for regional innovation capability from the perspectives of innovation input and innovation output as secondary indicators.

According to the innovation subject, it can be divided into innovation in knowledge by universities, innovation in research and experimental development by researchers in different regions, and innovation in products and technologies by enterprises. The investment process of innovation requires the investment of many production factors such as labor, technology, and information. Based on the availability and importance of data, this article selects the investment of human resources and capital to construct this process.

First level indicators	Second level indicators	Weight	Third level indicators	Measurement method	Unit	Weight	
Regional innovation capability indicators	Innovation investment	0.524	Enterprise innovation manpower investment	R&D(person year)/permanent resident population	%	0.058	
			Enterprise innovation capital investment	R&D expenditure	Ten thousand yuan	0.079	
			R&D creates manpower investment	Full time equivalent/resident population of research and experimental development (R&D) personnel in various regions	%	0.180	
			R&D innovation capital investment	Internal expenditure of research and experimental development (R&D) funds in various regions	Ten thousand yuan	0.070	
			Knowledge innovation manpower investment	Full time equivalent/permanent resident population of R&D personnel in universities	%	0.071	
				Knowledge innovation capital investment	Internal expenditure of R&D funds for higher education institutions in various regions	Ten thousand yuan	0.065
	innovation output	0.476		Enterprise product output	New product sales revenue of industrial enterprises above designated size	Ten thousand yuan	0.087
					Sales revenue of new products in high-tech industries	Ten thousand yuan	0.138
				R&D output	Number of domestic patent applications authorized	term	0.090
				Knowledge output	Publish scientific papers		0.037
			Enterprise technology output	Technology Market Turnover	Billion	0.123	

3. Evaluate Results

By analyzing the regional innovation capabilities of various provinces (cities) in China, it can be seen that from 2013 to 2021, the regional innovation capabilities of provinces (cities) in China have shown an increasing trend year by year. Especially in regions such as Guangdong, Jiangsu, Zhejiang, and Beijing, the growth momentum of regional innovation capacity is very strong. Divide regional innovation capabilities into three tiers: the first tier consists of Guangdong, Jiangsu, Zhejiang, Beijing, Shandong, and Shanghai, the second tier consists of Hubei, Sichuan, Hunan, Anhui, Fujian, Shaanxi, Henan, Gansu, Jilin, Chongqing, Liaoning, Hebei, Gansu, and Tianjin, and the third tier consists of the remaining provinces. Analyzing the composition of the three major echelons, it can be seen that the first echelon is entirely composed of the eastern region, the second echelon mostly comes from the eastern and western regions, and the third echelon is mainly composed of the western region. In 2021, the average value of the regional innovation capability index in the eastern region was 0.33, the average value of the regional innovation capability index in the western region was 0.08, and the average value of the regional innovation capability index in the central region was 0.159. It can be seen that China's regional innovation capability presents a development pattern from high to

low from east to center to west, and the development of innovation capability between regions is not balanced and sufficient, and this trend is gradually increasing.

4. Conclusion

This article constructs a more comprehensive indicator system. For the central and western regions of China, accelerating the improvement of digital economic infrastructure construction, accelerating the process of digital development, and reducing the “digital divide” between regions with better development have become the main task. For most regions of China, traditional industries need to accelerate their integration with digitization and implement industrial upgrading and transformation. Especially for the secondary industry, which accounts for a large proportion of China’s GDP, it is the main battlefield for industrial digitization. It promotes the deep integration of industry and digitization, empowers the industrial chain with digital technology, and can better improve production efficiency, reduce energy consumption, reduce costs, and promote industrial innovation efficiency.

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