

Construction of Evaluation Index System of Regional Green Innovation Policy Source Ability under the New Development Pattern of "Double-cycle"

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ABSTRACT

Enhancing the ability of green innovation policy source is the core requirement of high-quality development of the regional economy under the "double-cycle" development pattern, and it is the inevitable choice to cope with the changes of the global market environment and overcome difficulties. Accelerate the guidance of green innovation technology, promote scientific and technological innovation and industrial structure upgrading, and give play to the leading role of regional industrial clusters and urban clusters. It is the core value concept to enhance the ability of green innovation. Based on analyzing the connotation of green innovation policy-making ability, this paper analyzes the practical path of improving green innovation policy-making ability from the perspective of input and output and constructs a theoretical evaluation model of regional green innovation policy-making ability. Following the principles of science, rationality, system, comprehensiveness, and easy operation, Finally, a systematic, comprehensive, scientific, and applicable evaluation index system of regional green innovation policy source capability was established by selecting 12 secondary indicators and 40 tertiary indicators from four aspects: basic capability of green innovation policy source, convergence capability of green innovation resources, transformation capability of green innovation achievements and leading capability of green innovation value. This paper provides the evaluation basis for the promotion of regional green innovation policy-making ability through the way of "promoting construction thorough evaluation".

Keywords: Dual circulation, Green innovation origin ability, Evaluation index system

1. INTRODUCTION

At present, affected by the COVID-19 epidemic, the global market economy continues to slump. Under this situation, stabilizing growth, expanding domestic demand, adjusting structure, insisting on innovation, and leading development have become important strategic bases for the country to meet challenges. In April 2020, General Secretary Xi first proposed "building a new development pattern of mutual promotion of domestic and international double cycles", China is forced to implement the "active" development strategy of both offensive and defensive ^[1]. To promote the stable and high-quality development of the country's open economy. This is a strategic measure to conform to the trend, and it is also an inevitable choice for rejuvenating the country and strengthening the country. In 2021, China will usher in the "14th Five-Year Plan", and a new round of scientific and technological revolution and industrial transformation will advance rapidly. China's development environment is still complex and

changeable, and there is still a problem of incompatibility between innovation ability and high-quality development requirements. The government work report also pointed out that it is still necessary to actively implement the new development concept, optimize the economic structure, change the driving force of economic growth and create a new engine of economic growth. Through the internal drive of "scientific and technological innovation", we should solve the "difficulties" of development, eliminate the "pain points" and unblock the "blocking points" to realize the green transformation of enterprise development model and high-quality economic development. The level of environmental protection has steadily improved^[2].

In November 2018, when General Secretary Xi visited Shanghai, he pointed out that efforts should be made to "enhance the ability of innovation policy source". In March 2019, Shanghai made clear the goal and path of building an international innovation policy source. As a result, the new concept of "innovative strategy source

capability" has been widely concerned. Green transformation requires the collection of green resources, the creation of green innovation policy source capacity, and the construction of a green innovation policy source system. How to attract and gather innovative resources from all aspects, build a reasonable policy development system of regional innovation policy source capacity, how to build China into the source of scientific and technological innovation and industrial transformation, realize the strategic goal of industrial power, and then occupy a dominant position in the global innovation system, It is a real problem for China's industry to break the constraints of resources and environment and realize leapfrog development under the background of the new development pattern of "double circulation" and the construction of innovative industrial power. Based on this, based on defining the connotation of green innovation policy-making ability, this paper analyzes the characteristics and mechanism of green innovation policy-making ability. Then, the evaluation index system of regional green innovation policy source ability is constructed. To enrich the related contents of the research on innovation policy-making ability, and provide new ideas and references for the development evaluation of regional green innovation policy-making ability in China, "promoting construction through evaluation" can improve China's green innovation policy-making ability.

2. LITERATURE REVIEW

2.1. Connotation research of green innovation policy source capability

As a new concept, the basic meaning of green innovation policy source is still in the preliminary discussion stage, and there is no consensus connotation and extension at present. Chen Chao (2018) put forward that "the ability of innovation policy source is not only an original ability but also the source of influence of innovation center and a real core competitiveness". Its essence is to gather and cultivate top innovative talents^[3]. Chen Shouming and other scholars believe that the ability of innovation policy source not only needs to enhance the ability of scientific and technological innovation, but also pay attention to the enhancement of the thickness of basic research, and also pay attention to industrial innovation, to form strategic leading modern industrial clusters and innovative enterprise clusters. Comparatively speaking, the initiative is an aspect where the ability of innovation policy source is more emphasized. It is necessary to strengthen the cultivation and construction of various innovative behaviors and innovative forces. Chen Qiang (2019) believes that, from the conceptual level, "strategic source" refers to the "from scratch" of new academic ideas, new scientific discoveries, new technological inventions, and new industrial directions. From the perspective of action logic, "policy source"

includes two specific action directions: "policy" and "source". Together, it constitutes an integral part of the capacity building of innovation policy sources. "Source" emphasizes the construction of conditions, which is mainly reflected in policy design and institutional arrangement. It is necessary to construct the basic conditions and framework system of technological innovation according to a certain logic, to attract and gather innovative resources such as talents, technology, capital, and management. "Policy" emphasizes more concrete actions, Focusing on planning, organizing, and arranging various activities to release the energy contained in the "source"^[4]. Dang Qianna (2020) thinks that the concept of innovation policy source is related to ability and motivation, which includes the source innovation ability and the driving force for innovation and development. Innovation policy source has four connotations: gathering, creating, transforming, and leading. It is a whole-process activity that gathers innovation resources, creates great achievements, effectively transforms and leads future development^[5]. Ren Shengce(2020) understands the ability of innovation policy source from the two abilities to raise and solve innovation problems and then divides it into four links: original innovation, applied innovation, commercialization, and innovation diffusion^[6].

Based on the above research results, this paper holds that the ability of green innovation policy source is the ability to attract, gather, allocate and transform various innovative production factors based on the original innovation and green innovation ability. "Policy" emphasizes the ability to plan and allocate innovative resources, while "source" emphasizes the ability to gather innovative resources. In the process of the dynamic cycle of innovation capability, more emphasis is placed on integrating the concept of green development and value leading, realizing the harmonious unity of regional industrial environment, living environment, and innovation and entrepreneurship environment, and discovering the value leading role of green innovation. Based on the perspective of innovation input and output, the ability of green innovation policy source can be specifically divided into the basic ability of green innovation, the ability to gather green innovation resources, the ability to transform green innovation achievements, and the ability to lead green innovation.

2.2. Research on influencing factors of green innovation policy source ability

The existing researches on the influencing factors of green innovation policy-making ability are mostly based on the enterprise perspective or a certain research object is selected for quantitative research. Hu Bin (2020) selected enterprises related to artificial intelligence as research samples and researched according to three levels: basic level, technical level, and application level.

Using the stochastic frontier analysis method, this paper studies the influence of government support, innovation consciousness, enterprise scale, and knowledge stock on the innovation source capability of three levels of artificial intelligence enterprises respectively. The research shows that the basic-level enterprises have a stronger ability of innovation policy source than the application-level enterprises. Government support and knowledge stock have played a positive role in promoting the development of enterprises at three levels. Innovation and enterprise-scale play a negative role in hindering enterprises at the basic level and play a positive role in promoting enterprises at the application level. There is a negative correlation between innovation and technology-level enterprises, and a positive correlation between enterprise-scale and technology-level enterprises^[7]. Bao Na(2021) studied the innovative strategy source ability of anti-tumor drugs in Shanghai. Information mining was conducted on the patent data of anti-tumor drugs in Shanghai from three aspects: high-level patents, science, and technology innovation community, and patent achievement transformation. It is found that the promotion of the ability of scientific and technological innovation policy sources needs to increase the output of high-level patents and enhance the transfer and transformation of patent achievements^[8]. Xin Puyang (2021)focused on the ability of innovation policy sources in Songjiang District, Shanghai. A regional innovation mechanism is designed for the integration of Industry-University-Research in Shanghai, to improve the city's energy level and core competitiveness^[9]. Dunshuai(2021)built a topological model of the influence mechanism of innovation policy-making ability based on the Bayesian network from eight factors including academic input, technical elements, scientific achievements, industry performance, and industrial base. It is found that technical R&D personnel, technical R&D institutions, and technical R&D funds directly affect the technical elements, and then indirectly affect the ability of technological new inventions and innovation sources. Among them, R&D funds have the most significant effect on the ability of innovation policy sources^[10].

2.3. Evaluation of green innovation policy source capability

There have been some research results on the composition and evaluation of innovation policy source capability. Zhuang Jun (2019) put forward "six forces", that is, the contribution to global knowledge creation, the concentration of global innovation resources, the international influence of scientific and technological achievements, the development leading force of emerging industries, the attraction of innovation and entrepreneurship environment and the radiation driving force of scientific and technological innovation^[11]. Chen Chao (2018)thinks that the ability of innovation policy sources consists of academic and scientific innovation,

technological innovation, and industrial innovation, all of which have an extremely important influence and leading position in the world^[3]. Zhu Mengfei (2020)constructed the evaluation index system of regional innovation policy source capability from four aspects: new academic ideas, new scientific discoveries, new technological inventions, and new industrial directions. Using the statistical data of 31 provinces and cities in China, the AHP-TOPSIS method is used to determine the evaluation value of innovation policy source ability, and the SOM algorithm is used for cluster analysis to classify the innovation ability of each region. The research shows that there is a big gap in innovation policy-making ability among provinces and cities, which can be divided into four echelons. The top four in the first gradient are Beijing, Jiangsu, Guangdong, and Shanghai. The fourth gradient is remote provinces and agricultural provinces. The first-tier developed cities in the eastern part of China have a strong ability of innovation policy source, while the backward areas in the western edge are relatively weak^[12]. Pu Yue (2021)analyzed the influencing factors of the innovation strategy capability of the artificial intelligence industry, built a five-force evaluation system, and quantitatively evaluated the innovation strategy capability of the artificial intelligence industry in 31 provinces and cities in China. It also points out the unbalanced development of innovation policy-making ability between the eastern and central and western regions of China. It also emphasizes that the improvement of the ability of innovation policy source needs government innovation governance as important support^[13]. Based on the patent information, Zhao Wenhua (2020) constructed an evaluation system from three aspects: input capacity of technological innovation policy sources, the output capacity of technological innovation policy sources, and quality evaluation of technological innovation policy sources. He believes that high-quality patents can more accurately reflect the ability of technological innovation policy sources, so the patent quality dimension is included in the evaluation system. Further, by using the calibration ratio method, the feasibility, and practicability of the evaluation system are verified by selecting sample cities to evaluate the innovation policy source capability^[14].

To sum up, the innovation strategy capability is still a new concept, and the research is still at the initial stage. The existing research mainly focuses on influencing factors and capability evaluation. There is no unified conclusion on the meaning of green innovation policy-making ability. Different scholars have different research perspectives when evaluating, and most of them choose a certain enterprise or region as the evaluation object. As a result, the evaluation index system is inevitably point-to-area, lacks empirical support, and has poor adaptability. Because of the wide coverage of green innovation policy source capability, numerous influencing factors, systematic, complex, and dynamic characteristics, it is

necessary to make a systematic and comprehensive dynamic analysis. Therefore, this paper tries to set up a nationwide evaluation index system of green innovation policy-making ability to provide a more comprehensive and systematic evaluation basis for the promotion of regional green innovation policy-making ability in China.

3. CONSTRUCTION OF EVALUATION INDEX SYSTEM OF GREEN INNOVATION POLICY SOURCE CAPABILITY

3.1. Construction principles of evaluation index system

This paper follows the principles of systematicness, scientificity, comprehensiveness, dynamics, and operability when constructing the evaluation index system of green innovation policy source capability. Make full use of the existing important research results for more detailed and in-depth research to ensure that the evaluation index system is scientific and rigorous.

3.2. Construction ideas of the evaluation system of green innovation policy source capacity

The connotation of green innovation policy source capability is complex, there is no authoritative definition yet, and there are many influencing factors. Technological innovation and a "double-cycle" economy are included in the whole production system, which not only involves the close relationship and extensive flow of domestic and foreign production factors, science, and technology but also involves the virtuous circle of natural resources. This requires that enterprises should fully consider the characteristics of systematicness, mutual benefit, ecology, and so on when promoting the ability of green innovation policy sources. Therefore, it is necessary to cover all aspects of regional original innovation, innovation technology introduction, innovation resource input, innovation achievement transformation and application, innovation environment foundation, ecological environment protection and ultimate value guidance, etc. when evaluating. The evaluation index system of regional green innovation policy-making ability needs to be multi-dimensional and multi-angle, to build a scientific, reasonable, and comprehensive evaluation index system.

This paper starts from the connotation of innovation policy source, and "source" refers to innovation resources, including labor force, capital, material base, policy system, information, and other elements. "Policy" refers to the allocation and application of innovative resources. Based on the input-output perspective, The mechanism of green innovation policy source generally constitutes a circular path according to the basic allocation of green innovation, the convergence of green innovation

resources, the transformation of green innovation achievements, and the guidance of green innovation value. In the whole path, various innovative resources are gathered and allocated by green innovation subjects and allocated by green innovation subjects, and the core value of green innovation resources is brought into play through system arrangement, policy design, and innovation activity planning. Thereby improving the ability of green innovation policy sources. The main body of green innovation policy source mainly includes four main bodies: enterprises, universities, government, and scientific research institutions. Enterprises are responsible for technological innovation, universities and research institutes are responsible for knowledge innovation and output, and the government focuses on institutional innovation. The four innovation subjects depend on each other, check and balance each other, and play an active role in innovation drive. Under the "double circulation" open pattern, the development of the market economy provides good domestic and international markets for enterprises, accelerates the transnational flow of production factors, and promotes the introduction and dissemination of green technologies. The transfer and diffusion of technology also promoted the accumulation of technology stocks among countries and improved economic benefits. The technological innovation of enterprises needs the accumulation of original resources, Support, and guidance of government policies and systems. And universities and research institutes can not do without the financial support of the government, and the transfer and transformation of scientific research achievements also need cooperation between schools and enterprises. According to the above ideas, this paper draws a schematic diagram of the evaluation model of green innovation policy source capability, as shown in Figure 1.

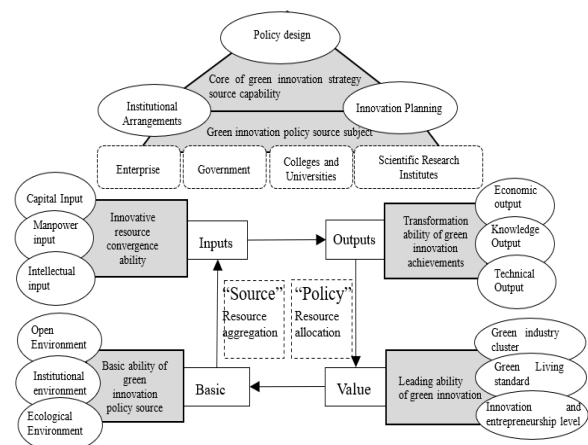


Figure 1 Evaluation model of regional green innovation policy source capability

3.3. Selection of evaluation indicators and system construction

Starting from the connotation of green innovation

strategy capability, this paper analyzes the influencing factors of green innovation strategy capability around the innovation input-output process, dynamic mechanism, realization path, etc. Combined with the above construction principles and ideas, based on consulting a large number of literature and referring to the existing classical evaluation systems, the evaluation index system of regional green innovation policy-making ability suitable for the new development pattern of "double-cycle" is constructed. The evaluation system includes 4 first-level indicators, 12 second-level indicators, and 40 third-level indicators, as shown in Table 1.

3.3.1. Basic ability of green innovation policy source

The occurrence of innovation needs to be carried out based on a certain material environment, and the promotion of green innovation policy-making ability depends based on the open market economy, green innovation technology policy system, and ecological environment. These primitive basic capabilities provide a virtuous circle of innovation environment, a standardized and reasonable institutional system, and a good ecological foundation. It determines the basic level of regional green innovation policy-making ability.

3.3.2. Green innovation resource convergence ability

Green innovation resources are roughly divided into human resources, financial resources, and material resources. Talent, as the source element of innovation strategy ability, mainly includes basic research talents and entrepreneurial talents. The ability to gather talent resources can be measured by investment, cultivation, and attraction. Innovation needs the local government's financial funds and the enterprise's strength as the guarantee. The implementation of innovation activities can not be separated from material accumulation. It can be said that manpower, financial resources, and material resources are the basic power sources for innovative activities.

3.3.3. Transformation ability of green innovation achievements

Green innovation output can be divided into economic output, knowledge output, and technology output. Output can directly improve the socio-economic level and enhance the international competitiveness of the market. Relying on knowledge innovation, application, and wide dissemination, knowledge output can reflect great cultural value. Cultural output sublimates the quality and structure of China's industrial economy. It has increased the knowledge content and scientific and technological content, and enhanced the power for the development of market economy, thus enhancing the soft power and competitiveness of national culture. Technology output can break through the situation of technology monopoly and realize self-research and application.

3.3.4. Leading ability of green innovation

Based on the perspective of urban development, the ability of green innovation policy source is the core competitiveness of a city, which plays a leading and supporting role in urban development. Innovation strategy means "instigating the future", and the strong ability of green innovation strategy can lead the future regional development. Finally, the enhancement of the green policy-making ability needs to be tested by industrial clusters, innovation and entrepreneurship clusters, and living environments. The promotion of regional innovation ability can not be separated from the cooperation of soft environment and hard environment. Therefore, it is necessary to fully consider the impact of economic development on the urban environment and pay attention to the benchmarking and leading role of the city when evaluating the ability of green innovation policy sources. Therefore, The evaluation of green innovation leading ability can be measured from three aspects: green industrial clusters, residents' green living standards, and entrepreneurs' innovation and entrepreneurship level.

Table 1. Evaluation index system of regional green innovation policy source capability

Primary index	Secondary index	Three-level index	Index explanation and calculation method
The basic ability of green innovation policy source	Economic opening foundation	Smooth degree of economic circulation	Foreign trade coefficient =total import and export/regional GDP
		market scale	Foreign investment ratio =(direct investment + indirect investment) / regional GDP
		tariff barrier	Measured by the tariffs that enterprises need to bear.
	Institutional	Government supervision ability	Measured by the degree of perfection of policies and regulations.

	foundation	Government service efficiency	Measured by the time required to start a business.
		Market standardization	Measured by the proportion of sales output value of state-owned and holding enterprises to the industrial sales output value.
		Overall financing efficiency of enterprises	Measured by the loan balance ratio of financial institutions at the end of the year.
	Ecological basis	Environmental protection organization level	Measured by the number of local institutions with eco-environmental organizations.
		Environmental legislation	Measured by the total number of local effective environmental laws and regulations.
		Environmental governance capacity	Measured by the investment amount of industrial pollution control projects completed this year.
		Resource endowment	Measured by urban per capita green space area.
Innovative resource convergence ability	Talent resource agglomeration	Talent input ability	Measured by a full-time equivalent of R&D personnel
		Talent cultivation ability	Measured by the number of graduate students in colleges and universities.
		Talent attraction ability	Measured by the number of professional and technical personnel with senior professional titles
	Capital agglomeration	Capital investment ability	Measured by research and experimental development expenditure.
		Government financial support ability	Measured by GDP per capita
		Environmental protection investment capacity	Measured by the proportion of environmental protection expenditure in project financial expenditure.
Material resources gathering	Material capital investment ability	Measured by the proportion of fixed assets investment in scientific research and technical service industry to the total amount.	
Transformation ability of green innovation achievements	Economic output	Degree of economic structure optimization	Measured by sales revenue of new products
		Transformation level of technological achievements	Measured by patent ownership transfer and license income.
		Innovation project transformation ability	Measured by the quantity of industrial transformation of innovative projects.
		Product export market coverage capacity	Measured by export revenue of new products
	Knowledge output	R&D activity	Measured by the number of patent applications
		Quality of academic papers	Measured by the number of highly cited scientific papers published.

		Academic exchange degree	Measured by the number of seminars on scientific research achievements.
	Technical output	Technical output ratio	Measured by the export ratio of high-tech products, that is, the number of high-tech products exported/the number of merchandise exports
		Contribution of the high tech industry	Measured by the added value of high tech industry
		The trading scale of the technology market	Measured by the turnover of technology marketing activities
		Technical competitiveness	Measured by national or industry standard number
Leading ability of green innovation	Green industry cluster	Industrial development capacity	Measured by the number of emerging industry platforms
		The attraction of the green innovation industry	Measured by the number of employees in the high-tech industry
		Competitiveness of green industry	Measured by the output value of high-tech industry of Industrial Enterprises above Designated Size
		Advanced industrial structure	Measured by the proportion of high-tech industry's main business income in Industrial Enterprises above Designated Size
	Green living standard	Green living standard	Excellent rate of ambient air quality= number of days with air quality above grade 2 /365 days
		Green Travel	Measured by the number of buses per 10000 people in a city
		Green consumption	Measured by the growth rate of per capita household electricity consumption
	Innovation and entrepreneurship level	Entrepreneurial vitality	Measured by the number of enterprises applying for the science and Technology Innovation Board
		Innovation Incubation ability	Measured by the number of local science and technology innovation incubation platforms
		Maturity of government data openness	Measured by the availability of a dedicated open government data platform
		Innovation visibility	Measured by the media's attention to urban innovation

4. CONCLUSION

Under the new development pattern of "double-cycle", China's economic development is facing the huge impact and challenge brought by the changes of the internal and external environment. However, great progress has been made in expanding domestic demand, deepening reform, technological innovation, upgrading industrial structure, and improving quality and efficiency. With the proposal of innovation strategy source capability, all regions should actively improve the green innovation strategy source capability, To meet the new requirements of economic development. Therefore, how to measure the

source capacity of green innovation is a new problem that we should deeply explore. Green innovation strategy source capability is an important aspect of evaluating regional green innovation ability and core competitiveness, which provides a powerful driving force for the development of domestic and international market economy, promoting industrial transformation, technological innovation, and building a new development pattern. Based on the existing research, this paper defines the basic connotation of green innovation policy source capacity, analyzes the realization path of green innovation policy source ability promotion from the perspective of green innovation input-output, and constructs a comprehensive evaluation model of regional

green innovation policy source capacity in China. And then, by the principles of science, rationality, comprehensiveness, and system, The evaluation index system of green innovation policy source ability is constructed from four dimensions. To a certain extent, it enriches the research results in related fields and lays the foundation for the follow-up empirical research. However, due to the dynamic changes of economic, social, and ecological environment, there are differences among different regions, and innovation activities are always in dynamic evolution, At present, the evaluation index system should be changed over time, and more scientific methods should be used to screen and empower, to develop a more suitable evaluation index system for local development. This paper is a preliminary exploration on the evaluation of regional green innovation policy source capacity and will make quantitative analysis on the research results in the future, More detailed quantitative research should be carried out for specific areas.

PROJECT FUND

This paper is one of the phased achievements of the general project of the "young teacher development fund" of City College of Dongguan University of technology, namely, the evaluation and influencing factors of green innovation strategy source capacity of Guangdong, Hong Kong, and Macao Dawan district under the new development pattern of "double-cycle"(2021QJY001R).

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