The Policy Study of the Combination of Science and Technology and Economy in Guangdong University

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Abstract. Under the guidance of the innovation-driven development strategy, as an important bridge for the integration of science and technology with the economy, the entrepreneurship incubation system and mechanism of universities in Guangdong play a key role in the high-quality development of the regional economy. Based on the practical demands of the integration of science, technology and economy in universities in Guangdong Province, through theoretical analysis and empirical analysis, this paper reveals the current institutional and mechanism obstacles, constructs a trinity analysis framework of "mechanism - system - policy", and puts forward practical countermeasures and suggestions. It is expected to provide solid theoretical support and clear practical paths for optimizing the allocation of innovation resources in colleges and universities and improving the efficiency of the transformation of scientific and technological achievements.

Keywords: Universities in Guangdong; Integration of science and technology and economy; Entrepreneurship incubation; Institutional mechanism; Total factor productivity

1 Introduction

Globally, the deep integration of science and technology with the economy has become the core engine for enhancing the competitiveness of countries and regions. The 2023 Global Innovation Index Report shows that the global center of scientific and technological innovation is accelerating its shift to the Asia-Pacific region. China ranks 12th in terms of innovation capacity, and the degree of integration of science and technology with the economy has become a key indicator for measuring regional development potential. As the largest economic province, Guangdong achieved a regional GDP of 13.57 trillion yuan in 2023, growing by 4.8%. However, it is confronted with the pressure of industrial upgrading and the demand for the transformation of old and new growth drivers. The construction strategy of the Guangdong-Hong Kong-Macao

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Greater Bay Area clearly states that it aims to "build a globally influential science and technology innovation center". As the source of innovation and a talent highland, universities' ability to transform scientific and technological achievements directly affects the high-quality development process of the regional economy.[1]

This research is dedicated to deconstructing the institutional mechanisms of entrepreneurship incubation in universities in Guangdong, quantifying the integration degree of science and technology with the economy, and constructing a countermeasure system that conforms to the actual development of Guangdong. In terms of research methods, both qualitative and quantitative analysis means are comprehensively employed. Specifically, qualitative analysis is carried out based on the theories of the entrepreneurial ecosystem and dynamic competition. Empirical analysis is conducted using the mediating effect model and the stochastic Frontier Model (SFA), and in-depth research is conducted in combination with typical cases of entrepreneurship incubation in universities in Guangzhou, Shenzhen, Foshan and other places. The mediating effect model is chosen because it can effectively reveal the indirect effects among variables, while the stochastic frontier model can accurately measure the loss of technical efficiency. The combination of the two can comprehensively evaluate the influence mechanism of entrepreneurship incubation.

2 The Current Situation and Challenges of the Integration of Science and Technology with Economy in Guangdong Universities

2.1 Current Development Status

In terms of the construction of incubation carriers, the number of carriers such as makerspaces, incubators and accelerators is on the rise, but their regional distribution is extremely uneven. From the perspective of policy support, the provincial level has intensively introduced policies related to "mass entrepreneurship and innovation", but in the actual implementation process, their effectiveness has not been fully demonstrated. In terms of the transformation of achievements, the patent conversion rate of universities is far lower than the average level of 30% in developed countries.

2.2 Core Challenges

At the level of institutional obstacles, the internal scientific research evaluation system of universities overly focuses on the publication of papers and neglects the transformation of achievements, and the cross-disciplinary collaboration mechanism is seriously lacking. In terms of external collaboration, the benefit distribution mechanism among industry, academia and research institutions is ambiguous, and the intervention of venture capital is insufficient. In terms of mechanism predicaments, there is a serious mismatch between innovative resources (talents, technologies) and industrial demands, and the intermediary service system is still not perfect. In terms of scale and efficiency, the scale of incubation funds is limited and the financial support channels are single. In

terms of technical efficiency, the supply of customized technical services by enterprises is insufficient, and the maturity of the achievements is low. In terms of theoretical lag, the existing models are difficult to explain the evolution law of "new technologies - new business forms - new industries", and lack a localized theoretical framework. [2]

3 Quantitative Evaluation and Influencing Mechanism of the Integration Degree of Science and Technology and Economy

3.1 Construction of the Integration Degree Measurement Model

The contribution rate of scientific and technological progress is decomposed based on the Stochastic Frontier Model (SFA) to construct a measurement model for the integration degree of science and technology and economy. Specifically, the degree of integration of science and technology with the economy consists of four parts: the rate of technological progress, technological efficiency, allocation efficiency and scale efficiency. The adopted data are the panel data of the "Guangdong Statistical Yearbook" from 2010 to 2024, and the interference of capital and labor factors has been eliminated to ensure the scientificity and accuracy of the calculation results. The model assumes that the production function satisfies the invariance of returns to scale, and through the decomposition of the Malmquist index, the interference of capital and labor factors is eliminated to ensure that the measurement results only reflect the impact of technological progress.

3.2 The Mechanism of Entrepreneurship Incubation in Colleges and Universities

The mediating effect model was used to verify the mechanism of entrepreneurship incubation in colleges and universities, and the results showed three key paths：①Resource integration promotes the improvement of allocation efficiency and thereby drives industrial innovation. A typical case is the joint laboratory of universities and enterprises. ②Venture capital helps enhance scale efficiency, thereby promoting enterprise growth, such as the participation of incubation funds in start-up projects. ③Technical services enhance technological efficiency and accelerate the transformation of achievements. The upgrading of the patent navigation industry is a typical example. Empirical results show that for every 10% increase in the scale of entrepreneurship incubation, the allocation efficiency will increase by 3.2%, the technical efficiency will increase by 2.5%, and the scale efficiency will increase by 1.8%.[3]

4 Reconstruction of the Institutional Mechanisms for the Deep Integration of Science, Technology and Economy in Guangdong's Universities

4.1 Mechanism level: Build a Three-Dimensional Collaborative Innovation System

In terms of innovating the industrialization mechanism, a closely interlinked chain of "basic research (universities) - application development (enterprises) - commercialization (parks)" should be established. For example, the integrated model of "research and development - pilot production - manufacturing" in Shenzhen Virtual University Park effectively realizes the seamless connection from knowledge innovation to industrial application. In terms of ecosystem mechanisms, it is necessary to strengthen the coordination among the main bodies, form a multi-party collaborative pattern of government (policy supply) + universities (knowledge production) + enterprises (demand-driven) + intermediaries (service support), and at the same time promote the flow of factors, establish cross-institutional talent part-time entrepreneurship and technology property rights trading platforms, and stimulate the flow and integration of innovation elements.

4.2 Institutional Level: Remove Institutional Obstacles

In the reform of university governance, the scientific research evaluation system has been innovated, and the indicator of "contribution to the transformation of achievements" has been added, and its weight is reflected in the professional title evaluation. At the organizational innovation level, a university-level "Center for the Integration of Science, Technology and Economy" is established to make overall planning and management for the incubation of interdisciplinary projects, break down disciplinary barriers, and gather resources from all sides to promote the process of the integration of science, technology and economy. Under the policy guarantee system, a provincial-level special fund for university incubation is established in terms of financial support. Dynamic assessment and allocation of funds are implemented based on the incubation results to ensure the accuracy and effectiveness of the capital input. In terms of legal regulation, the "Regulations of Guangdong Province on Promoting the Transformation of Scientific and Technological Achievements" was revised, clearly stipulating that the revenue distribution ratio is 30% for universities and 70% for teams. This is to safeguard the rights and interests of all parties in the form of laws and regulations and stimulate the motivation for the transformation of achievements. [4]

5 Countermeasures and Suggestions: Establish a System of "Precise Empowerment - Ecological Synergy - Institutional Guarantee"

5.1 Precise Empowerment: Enhance the Efficiency of Incubation Services

Establish an incubation project screening mechanism oriented by industrial demands, precisely focusing on strategic emerging industries such as artificial intelligence and biomedicine, to ensure that the incubation projects are highly consistent with the direction of industrial upgrading in Guangdong. At the same time, actively develop the "incubation + venture capital" model, guide social capital to participate in the establishment of university science and technology achievement transformation funds through policies, provide diversified sources of funds for entrepreneurial projects, help projects move from the laboratory to the market, and accelerate the implementation of science and technology achievement transformation.

5.2 Ecological Synergy: Optimizing the Allocation of Innovation Elements

Carefully build the "Guangdong-Hong Kong-Macao University Incubation Alliance" to promote in-depth cooperation among universities within the Guangdong-Hong Kong-Macao Greater Bay Area, achieve the sharing and common use of infrastructure such as laboratories and pilot bases, and enhance the efficiency of resource utilization. Vigorously cultivate the team of technology managers, establish the technology transfer specialist system of "universities - incubators - enterprises", strengthen the training of technology transfer talents, improve the professional level and service quality of technology transfer, and promote the effective connection between scientific and technological achievements and industries. [5]

5.3 Institutional Guarantee: Improve the Policy Support System

Implement the "Demonstration University for the Integration of Science, Technology and Economy" construction plan, provide policy preferences such as land use and taxation to the selected universities, give full play to the leading role of the demonstration universities, and drive the overall level of the integration of science, technology and economy in universities in Guangdong to improve. Establish a monitoring and evaluation system for integration degree, incorporate the decomposed indicators of the contribution rate of scientific and technological progress into the assessment system of universities, strengthen the sense of responsibility and goal orientation of universities in the integration of science and technology and economy, and promote universities to continuously optimize resource allocation and improve the performance of the integration of science and technology and economy.

6 Conclusion

The integration of science and technology with the economy in Guangdong's universities urgently needs to break through the institutional inertia of "emphasizing research and development over transformation". It is necessary to make coordinated efforts from the two dimensions of mechanism innovation and institutional supply in order to achieve remarkable results. Entrepreneurship incubation, as a key driving force, has become the core handle to smooth the "science and technology - industry - economy" cycle by significantly enhancing allocation efficiency, scale efficiency and technological efficiency, and plays an irreplaceable and important role in promoting the high-quality development of Guangdong's economy.Subsequent research should focus on deepening the study of the cross-regional incubation collaboration mechanism among Guangdong, Hong Kong and Macao, actively explore the effective realization path of the innovative model of "cross-border incubation + domestic acceleration", and inject new impetus into the construction of the international science and technology innovation center of the Guangdong-Hong Kong-Macao Greater Bay Area. At the same time, digital technologies such as blockchain and big data should be introduced to optimize the efficiency of innovation resource allocation and build an intelligent incubation ecosystem, so as to adapt to the new trends and requirements of the integrated development of science and technology and economy.

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