Research on the Relationship between Government Supporting Role and Innovation Performance in Industry-University-Research Collaborative Innovation

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Abstract: This article focuses on the internal relationship between government support role and innovation performance under the collaborative innovation scenario of Industry-University-Research. At a time when innovation drive has become the core driving force of economic development, it is of great significance to clarify the relationship between the two to optimize the innovation ecology and enhance the innovation effect. The research adopts the method of combing theory and role analysis, and systematically expounds the collaborative innovation theory, government support theory and innovation performance theory of Industry-University-Research. On this basis, this article analyzes the role orientation of the government in the collaborative innovation of Industry-University-Research, such as policy makers, resource allocators, guidance coordinators and supervisors and evaluators, and probes into the influence mechanism of each role on innovation performance. It is found that policy support can create a good institutional environment, resource allocation provides key elements for innovation, coordination and guidance ensure smooth cooperation, and supervision and evaluation ensure the direction and quality of innovation. To sum up, it is an important path to enhance innovation performance, promote the sustainable development of Industry-University-Research collaborative innovation, and help high-quality economic growth by strengthening the precise efforts and coordination of government roles.

1. Introduction

In today's era of global economic integration and increasingly fierce competition in science and technology, innovation has become the core driving force to promote sustained economic growth and enhance competitiveness of countries and regions [1]. Industry-University-Research collaborative innovation, as an effective mode to integrate the knowledge innovation ability of universities and scientific research institutions with the technology transformation ability of enterprises, has attracted wide attention from all walks of life [2]. Industry-University-Research collaborative innovation can break the boundaries between universities, scientific research institutions and enterprises, realize the efficient flow and deep integration of innovative elements such as knowledge, technology and capital, accelerate the transformation of scientific and technological achievements into real productive forces, and then enhance the innovation level of regions and even countries [3]. However, the process of Industry-University-Research collaborative innovation is not smooth sailing, and there are many obstacles such as asymmetric information, uneven distribution of benefits, imperfect cooperation mechanism and so on. This makes the government's support particularly critical [4].

With its unique resource allocation ability, policy-making power and macro-control function, the government can play multiple roles in the collaborative innovation of Industry-University-Research [5]. On the one hand, the government can create an institutional environment conducive to Industry-University-Research cooperation by formulating appropriate policies and regulations, and guide all parties to actively participate in collaborative innovation [6]. On the other hand, the government can allocate key resources such as funds and talents to provide a solid material

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foundation and intellectual support for Industry-University-Research cooperation.

It is of great theoretical and practical significance to study the relationship between government's supporting role and innovation performance in Industry-University-Research collaborative innovation. Theoretically, this will help to further enrich and improve the theoretical system of Industry-University-Research collaborative innovation and clarify the mechanism of government action. Practically speaking, it can provide scientific basis for the government to formulate more targeted and effective support policies, enhance the overall efficiency of Industry-University-Research collaborative innovation, and promote high-quality economic development. In view of this, it is urgent to explore the relationship between government support role and innovation performance in Industry-University-Research collaborative innovation.

2. Theoretical basis

Industry-University-Research collaborative innovation theory emphasizes that enterprises, universities and scientific research institutions carry out cooperative innovation based on common goals through resource sharing and complementary advantages [7]. Universities and scientific research institutions focus on knowledge creation, while enterprises focus on technology transformation and commercialization. The collaborative process aims to break organizational boundaries, achieve efficient integration of innovation elements, and enhance the overall innovation capability. The theory of market failure points out that in the Industry-University-Research cooperation, due to externalities, information asymmetry and other problems, the market mechanism can not effectively allocate resources and needs government intervention [8]. By means of policy formulation and resource allocation, the government corrects market failure and creates a good innovation ecology. The theory of public goods shows that some of the achievements produced by the collaborative innovation of Industry-University-Research have the attributes of public goods, and the government should bear the responsibility of providing and supporting them. Innovation performance is used to measure the achievements and benefits of innovation activities, covering many dimensions such as the quantity and quality of innovation output and its contribution to economic and social development. Input-output theory provides an analytical framework for it, that is, through the comparative analysis of the input resources (manpower, material resources, financial resources, etc.) and output results of innovation, the efficiency and effect of innovation activities are evaluated.

3. Analysis of government's supporting role in Industry-University-Research collaborative innovation

3.1. The role of policy makers

In the collaborative innovation system of Industry-University-Research, the government plays a vital role, supporting and guiding innovation activities in various ways [9]. As a policy maker, the government can create a good institutional environment for Industry-University-Research collaborative innovation by issuing a series of policies and regulations. For example, formulate preferential tax policies to reduce a certain proportion of taxes for enterprises participating in Industry-University-Research cooperation and reduce the innovation cost of enterprises; Introduce intellectual property protection policies, clarify the ownership and protection rules of intellectual property rights in Industry-University-Research cooperation, and protect the legitimate rights and interests of all parties. Table 1 lists some common policies:

Table 1: Examples of Industry-University-Research Collaborative Innovation Policies

Policy Name	Implementing Entity	Specific Content
Super Deduction for R&D Expenses	State Taxation Administration	Allow enterprises to deduct 175% of their R&D expenses before tax
Key R&D Program Special Projects	Ministry of	Establish special funds such as "Intelligent

	Science and Technology	Equipment" to support joint applications from enterprises and universities
Recognition of Industry-University-Research Joint Laboratories	Ministry of Education	Provide a construction subsidy of RMB 3 million for laboratories jointly established by enterprises and universities
Regulations on the Transformation of Scientific and Technological Achievements	National People's Congress	Clarify that the proportion of income distribution for researchers from the transformation of their achievements shall be no less than 70%
Construction of Innovative Industrial Clusters	National Development and Reform Commission	Provide funding of RMB 50 million per year for three consecutive years to selected clusters
Joint Talent Training Program	Ministry of Human Resources and Social Security	Implement joint training between enterprise postdoctoral workstations and universities, with a subsidy of RMB 150,000 per person per year
Intellectual Property Pledge Financing	National Intellectual Property Administration	Provide pledge loans of up to RMB 50 million for patents resulting from Industry-University-Research collaboration
Pilot Program for Cross-border Innovation Cooperation	Ministry of Commerce	Allow enterprises in free trade zones to conduct technical cooperation with overseas institutions, with an increased foreign exchange quota of up to USD 5 million per year

3.2. Resource allocator role

The government has abundant resource allocation capacity and can play a key role in the collaborative innovation of Industry-University-Research [10]. On the financial level, the relevant administrative departments set up a special Industry-University-Research Collaborative Innovation Fund to directly subsidize key cooperation projects. At the same time, departments should actively guide financial institutions to provide low-interest loans or venture capital for innovative enterprises, so as to broaden the financing channels of enterprises. At the level of human resources, relevant organizations hold talent exchange activities to promote the flow of talents among universities, scientific research institutions and enterprises, so as to deliver high-quality professionals for collaborative innovation. At the same time, the government can also allocate scientific research infrastructure resources, such as large-scale scientific research instruments and equipment sharing platforms, to improve resource utilization efficiency.

3.3. Guide the role of coordinator

Due to the differences in goals, cultures and interests, the parties in Industry-University-Research are prone to problems such as poor communication and uncoordinated cooperation. As a guidance coordinator, the government can play its neutral and authoritative position advantage. For example, professional institutions set up a platform for cooperation and exchange in Industry-University-Research, and regularly organize Industry-University-Research matchmaking meetings, achievement conferences and other activities to enhance information exchange among universities, scientific research institutions and enterprises. In view of the key issues such as the distribution of interests and the ownership of intellectual property rights in cooperation, the government can come forward to guide all parties to negotiate and formulate reasonable solutions to promote the smooth development of cooperation.

3.4. Role of supervisors and evaluators

In order to ensure that Industry-University-Research collaborative innovation activities achieve the expected goals, the government needs to assume the role of supervision and evaluation. Management departments need to formulate a scientific and reasonable evaluation index system, and regularly evaluate the progress, innovation achievements and economic benefits of cooperation

projects in Industry-University-Research. For outstanding projects with outstanding performance, the management department will commend them and provide further support. For those projects that fail to meet the expected goals, the management department urges them to carry out rectification. If the requirements cannot be met after rectification, the project will be terminated according to the law and regulations. Through effective supervision and evaluation, we can ensure the rational utilization of innovation resources and promote the sustainable and healthy development of Industry-University-Research collaborative innovation.

4. Influence mechanism of government support role on innovation performance

4.1. Policy Support and Innovation Performance

The different supporting roles played by the government in the collaborative innovation of Industry-University-Research have influenced the innovation performance in many ways. The government's policy support has laid the institutional foundation for Industry-University-Research collaborative innovation, which affects the innovation performance from multiple dimensions. Taking industrial policy as an example, the government guides all parties in Industry-University-Research to focus their innovation resources on these key areas by defining the key industrial areas to improve the pertinence and effectiveness of innovation. In terms of tax policy, the enterprises participating in Industry-University-Research cooperation will be given tax relief to reduce the innovation cost of enterprises, so that enterprises can invest more funds in R&D and increase innovation output. Table 2 shows the government policies and their specific impact paths and performance on innovation performance:

Table 2: Mechanism of Policy Support on Innovation Performance

Policy Type	Implementing Entity	Influence Path	Performance Outcomes	Empirical Cases
Industry Guidance	National Development and Reform Commission	Define strategic sectors such as integrated circuits, establish national industrial investment funds	Increase in R&D resource concentration by 37%, reduction in key technology breakthrough cycles by 28%	The National Integrated Circuit Industry Investment Fund has leveraged over RMB 500 billion in social investment
Tax Incentive	State Taxation Administration	Increase the deduction ratio for R&D expenses from 50% to 100%	Growth in enterprise R&D investment intensity by 19.6%, average annual increase in the number of high-tech enterprises by 24%	In 2022, the tax reduction from the increased deduction for R&D expenses exceeded RMB 400 billion
Financial Support	China Banking and Insurance Regulatory Commission	Establish a technology credit risk compensation fund, provide subsidized loans for Industry-University-Research (IUR) collaboration projects	Technology-based SME loan balance exceeds RMB 15 trillion, technology conversion rate increases to 32%	Jiangsu Province's "Technology Loan" has supported over 12,000 enterprises, driving the addition of 86,000 patents

Platform Construction	Ministry of Science and Technology	Establish national technology innovation centers, promote the co-construction of IUR joint laboratories	Improvement in R&D efficiency of center-based enterprises by 41%, average annual growth in technology contract transaction volume by 35%	The National High-Speed Train Technology Innovation Center has driven industry R&D investment intensity to 5.8%
Talent Cultivation	Ministry of Education	Implement a "dual-mentor system" for joint engineering PhD training, establish a bidirectional talent flow mechanism between universities and enterprises	Increase in the proportion of enterprise R&D personnel to 12.4%, reduction in talent gaps for key technical positions by 43%	The Tsinghua University-Huawei joint training program has provided over 200 high-end talents in the 5G field
Intellectual Property	National Intellectual Property Administration	Establish a patent navigation system, implement a fast-track pre-examination for IUR collaboration achievements	Increase in the proportion of IUR collaboration patents to 28%, patent implementation rate exceeds 65%	The Yangtze River Delta Patent Collaborative Utilization Platform has facilitated technology transactions exceeding RMB 30 billion
International Collaboration	Ministry of Commerce	Establish "Belt and Road" joint laboratories, relax controls on technology import and export	Growth in the number of international collaborative R&D projects by 210%, average annual growth in technology export value by 18%	The Sino-German Smart Manufacturing Cooperation Pilot Park has achieved cross-border technology contract transactions exceeding EUR 5 billion

4.2. Resource allocation and innovation performance

As a resource allocator, the government's allocated resources are an important guarantee for innovation activities. In terms of financial resources, the special innovation fund set up by the government directly provides start-up funds for the Industry-University-Research cooperation project to solve the problem of capital shortage in the initial stage of the project and ensure the smooth development of the project. At the same time, the relevant administrative departments actively promote the rational flow of talents in the fields of human resource allocation such as universities, scientific research institutions and enterprises by formulating a series of preferential policies and building exchange and cooperation platforms. In this way, enterprises can acquire cutting-edge technical knowledge. Universities and scientific research institutions can also understand the market demand, and then optimize the direction of innovation, improve the practicality of innovation results, and ultimately improve innovation performance.

4.3. Coordinated guidance and innovative performance

In the cooperation of Industry-University-Research, the parties often have contradictions due to inconsistent goals and asymmetric information. The coordination and guidance of the government can effectively resolve these contradictions and promote the improvement of innovation

performance. The cooperation and exchange platform established by the government has enhanced information communication among all parties and reduced repeated research or cooperation disconnection caused by poor information. In terms of benefit distribution and coordination, the government guides all parties to formulate a fair and reasonable distribution plan to protect the interests of all parties, improve the enthusiasm and stability of cooperation, and enable all parties to focus more on innovation activities and improve innovation performance.

4.4. Supervision, evaluation and innovation performance

The government's supervision and evaluation provide quality control for Industry-University-Research collaborative innovation. Scientific evaluation index system can comprehensively and objectively evaluate innovative projects. Through regular evaluation, problems in the process of project implementation, such as technical route deviation and inefficient use of resources, are found in time, and the project team is urged to adjust and improve. The management department will also reward and promote outstanding projects to form a demonstration effect. This demonstration effect can encourage more Industry-University-Research cooperation projects to improve their own innovation performance, and then promote the improvement of the overall innovation level.

5. Conclusions

In this article, the relationship between government support role and innovation performance in Industry-University-Research collaborative innovation is deeply discussed. The research shows that the various roles played by the government have a significant and diverse impact on innovation performance. As a policy maker, the government has created a favorable institutional environment for Industry-University-Research collaborative innovation by introducing targeted policies, guided the rational allocation of resources, and enhanced the pertinence and enthusiasm of innovation. In the role of resource allocator, the effective allocation of key resources such as capital and talents by the government provides a solid material and human foundation for innovation activities. With the role of guiding and coordinating, the government has solved the contradictions in the cooperation between Industry-University-Research parties and promoted the smooth cooperation. As a supervisor and evaluator, the government ensures the quality and direction of innovative projects.

However, there are still some limitations in the current research, such as the lack of in-depth research on the synergistic effect among government support roles, and the research on the relationship between government support roles and innovation performance under different industry backgrounds needs to be strengthened. In the future, we should further deepen the research on these aspects, and provide a more perfect theoretical basis for the government to formulate more scientific and accurate support policies, so as to effectively improve the collaborative innovation performance of Industry-University-Research and promote the deep integration of scientific and technological innovation and economic development.

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