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Analysis of the Current Situation of Scientific and Technological Achievements Transformation and Suggestions for Countermeasures

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Abstract

Taking Huizhou City as an example, this study discusses in depth the status quo, existing problems and improvement countermeasures of scientific and technological achievements transformation. This study adopts the literature research method and comparative analysis method, combines the official data and literature released by Huizhou Municipal Government, based on the importance of transformation of scientific and technological achievements to the high-quality development of the economy, analyses the role of transformation of scientific and technological achievements in Huizhou City on the enhancement of the economic development and the regional innovation capacity, identifies and solves the key problems in the process of transformation of scientific and technological achievements, and puts forward optimization countermeasures. The results of the study show that although Huizhou City has made progress in the transformation of scientific and technological achievements, there are still problems such as insufficient long-term cooperation mechanisms and low levels of cooperation. The conclusion points out that Huizhou needs to establish a long-term cooperation mechanism, upgrade the level of cooperation, strengthen the participation of local universities and research institutes, and improve the service system for the transformation of scientific and technological achievements in order to promote the effective transformation and industrialisation of scientific and technological achievements.

Keywords

Transformation of scientific and technological achievements; Huizhou; Industry-university-research co-operation; Policy support; Innovation ecology.

1. Introduction

The transformation of scientific and technological achievements is a key factor in promoting high-quality economic development, which can not only apply the results of scientific research to actual production, but also promote the upgrading of industrial structure and the transformation of economic growth mode. Under the active promotion of the governments of Guangdong Province and Huizhou City, the transformation of scientific and technological achievements has become an important strategy for regional development.

Located in the southeastern part of Guangdong Province, Huizhou City is adjacent to Shenzhen and Dongguan, and is an important part of the Guangdong-Hong Kong-Macao Greater Bay Area. This unique geographic location gives Huizhou a significant locational advantage in the transformation of scientific and technological achievements, enabling it to conveniently access the scientific and technological resources and market information of the Greater Bay Area, and promoting the rapid transformation and industrialization of scientific and technological achievements. At the same time, Huizhou has a solid industrial foundation and a perfect

industrial chain, especially in the field of electronic information, petrochemical energy and new materials and other industries with strong competitiveness, which provides good industrial support for the transformation of scientific and technological achievements. In addition, the economic characteristics of Huizhou in the transformation of scientific and technological achievements should not be ignored. In 2023, the output value of Huizhou petrochemical energy new materials cluster reached 347.9 billion yuan, and the output value of electronic information industry cluster reached 526.6 billion yuan. The industrial cluster has already had a certain scale, which provides a broad application scene and market demand for the transformation of scientific and technological achievements. Huizhou city has unique geographical advantages and industrial foundation in the transformation of scientific and technological achievements, along with the active promotion and policy support of the government, the transformation of scientific and technological achievements is playing an increasingly important role in the economic development of Huizhou city.

The transformation of scientific and technological achievements is a key factor in promoting the high-quality development of the economy, and its significance is particularly significant for Huizhou City. First of all, the transformation of scientific and technological achievements can effectively promote the optimization and upgrading of the economic structure of Huizhou City, improve the technological level and added value of the industry, thus promoting the sustainable and healthy development of the economy. Secondly, the transformation of scientific and technological achievements assists in enhancing the regional innovation capability of Huizhou City, and through the transformation and application of scientific and technological achievements, it can attract more innovative resources and talents, form a good innovation ecology, and then improve the competitiveness of the whole region. In recent years, the Guangdong Provincial Government and Huizhou Municipal Government have issued a series of policies on the transformation of scientific and technological achievements, which provide strong support for the economic development of Huizhou and the enhancement of regional innovation capacity. The Regulations of Guangdong Province on Promoting the Transformation of Scientific and Technological Achievements clearly define the scope and principles of the transformation of scientific and technological achievements, and emphasize the role of the government in the transformation of scientific and technological achievements as a guide and service, which provides a legal guarantee for the transformation of scientific and technological achievements in Huizhou City. Meanwhile, the Interim Measures of Huizhou Science and Technology Bureau on Encouraging the Transfer and Transformation of Scientific and Technological Achievements further stimulates the vitality of scientific and technological achievements transformation and promotes the transformation of scientific and technological achievements in Huizhou City by providing financial subsidies, talent training and platform construction. In addition, the introduction of “Several Measures for Huizhou to Build a Preferred Place for the Transfer and Transformation of Scientific and Technological Achievements in the Guangdong-Hong Kong-Macao Greater Bay Area” has positioned Huizhou as an important node for the transfer and transformation of scientific and technological achievements within the Guangdong-Hong Kong-Macao Greater Bay Area, which not only helps Huizhou to attract more scientific and technological achievements and innovation resources, but also lays the foundation for enhancing its innovation status in the Greater Bay Area and even in the country as a whole. Overall, the transformation of scientific and technological achievements plays an important role in the economic development of Huizhou and the enhancement of regional innovation capacity, and the policy documents issued by the Guangdong Provincial Government and the Huizhou Municipal Government have provided policy support and practical guidance for the realization of this goal.

This study aims to deeply analyze the current situation of the transformation of scientific and

technological achievements in Huizhou, identify and solve the key problems encountered in the process of transformation of scientific and technological achievements, and promote the effective transformation and application of scientific and technological achievements. Specifically, the study will propose practical countermeasures to optimize the environment for the transformation of scientific and technological achievements, and to improve the commercialization and industrialization of scientific and technological achievements, so as to promote scientific and technological progress and economic development in Huizhou City and the wider region. This study can provide theoretical guidance and practical reference for the transformation of scientific and technological achievements in Huizhou City and even in other regions, and provide decision-making support for creating a preferred place for the transfer and transformation of scientific and technological achievements in Guangdong, Hong Kong and Macao Greater Bay Area. The main contents of this study include the following: sorting out the existing policies, mechanisms and processes for the transformation of scientific and technological achievements in Huizhou City. It analyzes the main factors affecting the transformation of scientific and technological achievements, such as financial support, human resources, market demand, etc.. It also discusses the obstacles and challenges in the process of transformation of scientific and technological achievements.

2. Literature Review

2.1. Theoretical Basis for the Transformation of Scientific and Technological Achievements

As the theoretical foundation of transformation of scientific and technological achievements involves multidisciplinary theories and methods, the core of which is the process and mechanism of revealing how scientific and technological achievements are transformed into actual productive forces, previous studies in the literature have provided different theoretical perspectives. Resource-Based View (RBV) argues that universities can improve the efficiency of innovation resource allocation and promote the emergence of new products, technologies and services by gathering heterogeneous resources (Ma Yongxia et al., 2024), which emphasizes the fundamental role of universities in the allocation of innovation resources. And Dynamic Capability Theory (DCT) further deepens the understanding of the resource-based view, emphasizing the ability to adapt to market demand, accelerate technological innovation, improve talent support, and promote the development of new-quality productivity through dynamic adjustment (Ma Yongxia et al., 2024). This theoretical perspective highlights the ability of universities in adapting to the dynamic changes in the market.

In addition, according to Duan Yongbiao et al. (2024), Expectancy Theory (ET) provides a theoretical basis for the study of the motivation of scientific and technological achievements transformation subjects, which argues that the strength of incentives depends on the ability of the rewards received by an individual to satisfy the expectation value. This theory explains the motivation of researchers in the transformation of scientific and technological achievements through the relationship between expectation and potency. Other scholars have pointed out that the theory of the new national innovation system emphasizes taking national strategic scientific and technological forces as the traction, strengthening the position of enterprise innovation main body, optimizing the allocation of innovation resources, as well as the support of the whole chain and all the elements, building the system of basic research in a sustained manner, accelerating the process of the industrialization of original and subversive scientific and technological achievements, and effectively realizing the in-depth fusion of science and technology and the economy (Chen Boqiang et al., 2024).

It can be found that the theoretical foundations of the transformation of scientific and

technological achievements cover a variety of aspects such as resource allocation, dynamic capabilities, individual incentives and national innovation system. These theories not only provide a multi-dimensional perspective for understanding the transformation of scientific and technological achievements, but also provide theoretical guidance and strategic suggestions for promoting the transformation of scientific and technological achievements in practice.

2.2. Status of Domestic and Foreign Scientific and Technological Achievements Transformation

The transformation of scientific and technological achievements is a key factor in promoting economic growth and social progress, and its development status varies significantly in different countries and regions. In developed countries, such as the United States, the transformation of scientific and technological achievements benefits from a sound system of laws, regulations and policy support. The Baidu Act in the U.S. provides clear guidance for the attribution and transformation of scientific and technological achievements, and promotes the transfer and commercialization of scientific and technological achievements through government decentralization and benefit incentives. In addition, U.S. universities have effectively promoted the transformation of scientific and technological achievements through the establishment of the Office of Technology Transfer (OTL), which specializes in the management of patent affairs, such as the model of Stanford University's Office of Technology Licensing, which has greatly facilitated the university's transformation of scientific and technological achievements (Huang Min, 2023). In Germany, the transformation of scientific and technological achievements is likewise strongly supported by the government, and the efficient transformation and industrialization of scientific and technological achievements has been realized through the establishment of platforms, such as national technology transfer centers (Wei Xinghua et al., 2024). Germany's industrial laboratory model integrates technological innovation and technology transfer, forming a new industrial community research and development model.

In contrast, the overall level of transformation of scientific and technological achievements in China is relatively low. Although China has made some progress in the transformation of scientific and technological achievements in recent years, there is still a big gap between China and developed countries. The main problems facing the transformation of scientific and technological achievements in China include insufficient laws, regulations and policy support, inadequate institutions, lack of specialized talents, low quality of scientific and technological achievements, and an imperfect system of benefit distribution (Huang Min, 2023). There are drawbacks in China's science and technology system, and the lack of an effective synergy mechanism between research institutions and enterprises has led to the long-term separation of science and technology from the economy. At the local level, Shenzhen, as one of the cities with active science and technology innovation in China, has constructed a relatively complete system of industrialization of science and technology achievements by introducing a series of policies, such as Several Measures on Further Promoting the Industrialization of Science and Technology Achievements in Shenzhen. Shenzhen's main initiatives in the industrialization of scientific and technological achievements include policy leadership, financial investment, platform construction and service system improvement (Wei Xinghua et al., 2024).

Above all, foreign countries are more mature in the transformation of scientific and technological achievements, which is mainly due to the perfect policy system, professional management and operation mechanism, and effective market orientation. Although China has made some progress in the transformation of scientific and technological achievements, it still faces many challenges and problems, and needs to further strengthen the construction of laws

and regulations, improve the management mechanism, cultivate specialized talents and improve the benefit distribution system.

2.3. Practical Cases of Transformation of Scientific and Technological Achievements

In recent years, universities and research institutions have made remarkable progress in the transformation of scientific and technological achievements, especially in some universities in the United States, where technology transfer centers play an important role. In the United States, university technology transfer centers promote the transformation of scientific and technological achievements in a variety of ways. For example, the University of Pennsylvania, through its Innovation Center, provides a platform for scientific research achievements to collaborate with the private sector, which promotes the commercialization of scientific research achievements. The Cornell University, through its fast-track entrepreneurial licensing program, supports startups based on the technological achievements of the University with low technology licensing fees, which reduces the financial pressure on startups (Yang Qianzi et al., 2024).

Yang Qianzi et al. (2024) pointed out in their study that university technology transfer centers need to seek breakthroughs in promoting innovation and entrepreneurship, and analyzed the innovation and entrepreneurship practice cases of technology transfer centers in six universities in the United States through a combination of case studies and theoretical analysis. The study found that these universities have a favorable innovation and entrepreneurship atmosphere, diversified talent cultivation and flexible talent flow mechanism, a large innovation and entrepreneurship collaboration network, and innovation and entrepreneurship practice experience focusing on breakthroughs in dominant subject areas.

On the other hand, Zong Gang et al. (2012) emphasized the importance of specialized intellectual property management and technology transfer services, mentioning that the Intellectual Property and Technology Transfer Center of the Shanghai Institutes for Life Sciences, Chinese Academy of Sciences, has successfully realized the transfer of a number of technological achievements to domestic and foreign enterprises through specialized management, especially the technology licensing to the world's pharmaceutical giants. In addition, Cao Xi et al. (2023) explored the industry fund oriented to the transformation of ecological and environmental scientific and technological achievements, analyzed the successful ecological and environmental industry fund cases at home and abroad, and put forward the relevant suggestions for the problems of the operation of China's ecological and environmental industry fund, which, they believe, can improve the breadth and depth of investment and promote the transformation of scientific and technological achievements through the reasonable distribution of funds and the improvement of market mechanism. And in the process of transformation of scientific and technological achievements, the establishment of incentive mechanism is the key. Mei Shuang et al. (2023), based on a multi-case study of Guangdong Academy of Agricultural Sciences, found that the construction of a dual incentive mechanism of performance sharing and risk prevention and control can effectively promote the unit and scientific and technological talents to reach agreement on the goal motivation and realize win-win cooperation.

The above successful cases of transformation of scientific and technological achievements show that universities and research institutes need to establish an effective technology transfer mechanism to promote the commercialization and industrialization of scientific and technological achievements through professional management, the construction of incentive mechanisms and the support of funds and policies. These practice cases provide valuable

experience and inspiration for university technology transfer centers to carry out innovation and entrepreneurship work.

2.4. Effectiveness and Problems of Transformation of Scientific and Technological Achievements

The transformation of scientific and technological achievements is a key part of promoting scientific and technological innovation and economic and social development. In recent years, China has achieved remarkable results in the transformation of scientific and technological achievements, but at the same time, it also faces many challenges.

It is noteworthy that the policy system for the transformation of scientific and technological achievements has been further improved. For example, Shanxi Province has strengthened the institutional guarantee and promoted the implementation of the transformation of scientific and technological achievements by formulating the Regulations on Promoting the Transformation of Scientific and Technological Achievements in Shanxi Province and other policy measures (Wang Ruiping et al., 2024). For its part, Jiangxi Province has promoted the activity of transformation of scientific and technological achievements by building a technology transfer service system (Zhao Jihui et al., 2024). In terms of concrete results, the construction of Tianjin University Science Park is a successful case. Through policy support and financial investment, Tianjin has successfully introduced a large number of science and technology innovative enterprises and promoted the transformation and application of scientific and technological achievements (Yi Jinsheng, 2024). At the same time, some " double first-class " universities have promoted the diversified development of transformation of scientific and technological achievements through multi-principal cooperation and diversified forms of transformation (Shao Lingzhi et al., 2023). However, there are some problems in the process of transformation of scientific and technological achievements. For example, Nanjing faces problems such as insufficient policy synergy and poor connection between supply and demand of achievements in the transformation of scientific and technological achievements, resulting in a low rate of transformation of scientific and technological achievements (Huang Hao et al., 2024). In addition, in the transformation of frontier scientific and technological achievements, the mechanism of policy articulation is not optimized enough, the guidance of industrialization is insufficient, and the effectiveness of professional services needs to be improved (Liu Yumeng, 2023).

Overall, the process of transforming scientific and technological achievements still has a number of problems, and there is a need to continuously promote the high-quality development of scientific research institutions, strengthen the construction of public platforms, enhance the supply of results at the source, build a cross-regional technology trading market and improve the mechanism for investment in venture capital. Through these measures, the transformation of scientific and technological achievements can be further promoted, boosting economic and social development.

3. Research Methodology and Source Material

3.1. Research Methodology

3.1.1 Documentary Research Method

Literature research method is a research method to obtain information and knowledge by analyzing and interpreting existing literature. It is widely used in social sciences, humanities and other fields, and can help researchers understand the historical background, theoretical basis and research progress of the research topic. By reading books, journal articles, reports, archives and other materials, researchers can construct theoretical frameworks, identify

research problems, as well as validate or challenge existing theories.

3.1.2 Comparative Analysis Method

Comparative analysis is a research method that analyzes and interprets data by comparing similarities and differences between two or more objects. This method is widely used in a variety of subject areas, including the social sciences, natural sciences, and humanities. Through comparisons, researchers can identify patterns, trends, and relationships that lead to conclusions or new hypotheses. Comparative analysis can be quantitative or qualitative, depending on the purpose of the study and the nature of the data.

3.2. Source Material

The data sources include the following aspects: firstly, the official statistics and policy documents issued by the Huizhou Municipal Government or the Science and Technology Bureau are the basic sources of information, and they provide the macro background of the transformation of scientific and technological achievements. Second, science and technology-based enterprises, universities and research institutes in Huizhou City are the key objects of data collection, and the micro data on the transformation of scientific and technological achievements can be obtained by understanding the patent application, technology licensing and new product development of these units. In addition, industry analysis reports, expert interviews, news reports, and databases of scientific and technological achievements transformation globally are also important sources of information, which are helpful to understand industry trends, expert opinions and the latest developments.

4. Analysis of the Current Situation of Transformation of Scientific and Technological Achievements in Huizhou

4.1. Overview of the Transformation of Scientific and Technological Achievements in Huizhou

In 2023, Huizhou City has made remarkable progress in the transformation of scientific and technological achievements. Huizhou City's research and development investment in 2023 has increased to 3.45%, and the added value of advanced manufacturing and high-tech manufacturing industries accounted for 64.9% and 39.7% of the added value in the industrial sector, respectively. In addition, Huizhou City has a total of 254 innovation platforms above the provincial level in 2023, including 1 provincial laboratory, 7 provincial key laboratories, 10 provincial new research and development institutions, and 236 provincial engineering and technology research centers. Meanwhile, the Huizhou branch of the South China Technology Transfer Center has been put into operation, and the city's turnover of technology contracts has increased by 47.28% (Xuanyu You, 2024). This shows that Huizhou has invested more resources and efforts in scientific and technological innovation and achievement transformation, which promotes the commercialization and industrialization of scientific and technological achievements.

The number of scientific and technological achievements transformed and scientific research institutions in Huizhou made a breakthrough in 2023, which indicates that the increase of scientific research institutions provides more platforms and resources for the transformation of scientific and technological achievements. The increase of scientific research institutions not only promotes the output of scientific and technological achievements, but also improves the transformation efficiency of scientific and technological achievements. In addition, the strong support of Huizhou government in science and technology innovation policy and the support for scientific research institutions are also important factors that promote the growth of the number of scientific and technological achievements transformation. Overall, Huizhou

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City has achieved positive results in the transformation of scientific and technological achievements. The increase in scientific research institutions has provided a solid foundation for scientific and technological innovation, while the growth in the number of scientific and technological achievements transformed has injected new vitality into the economic development of Huizhou City. In the future, Huizhou City is expected to continue to increase its efforts in scientific and technological innovation, promote the transformation of more scientific and technological achievements into actual productivity, and provide strong scientific and technological support for the sustainable development of the city.

4.2. Status of Transformation of Scientific and Technological Achievements in Huizhou

As one of the important cities in Guangdong Province, Huizhou has made remarkable progress in the transformation of scientific and technological achievements over the recent years, but it also faces some challenges.

The transformation of scientific and technological achievements in Huizhou City mainly adopts the mode of industry-university-research cooperation, i.e., cooperation among enterprises, universities and research institutions. The University-Industry-Research cooperation projects in Huizhou City are mainly concentrated in the field of manufacturing, and enterprises have become the main force of investment in the cooperation projects, showing the main position of enterprises in the University-Industry-Research cooperation (Hu Siqi et al., 2021). The government plays a key guiding role in promoting industry-university-research cooperation, which promotes exchanges and cooperation among enterprises, universities, and research and development institutions by providing financial support and organizing activities, such as science and technology fairs. The Huizhou Research Institute of Huizhou Research Institute of Guangdong University of Technology is one of the successful cases of scientific and technological achievements transformation in Huizhou. Relying on the scientific research and technological advantages of Guangdong University of Technology, the institute has established three core systems of technological research and development, transformation of scientific and technological achievements, innovation and entrepreneurship incubation, and provided specialized services for industries, such as intelligent terminals, lithium batteries, and footwear (Chen Lan, 2021). In addition, the institute has built the "Zhihui+" technology achievement transformation platform, which realizes the seamless connection between enterprise demand and technology resources, and promotes the transformation of scientific and technological achievements.

Although Huizhou City has achieved certain results in the transformation of scientific and technological achievements, there are some problems. Firstly, there are fewer long-term cooperation, most of the cooperation projects are one-time cooperation, and there is a lack of stable strategic cooperative relationship (Hu Siqi et al., 2021). Secondly, the level of cooperation is low, mostly focusing on commissioned research and joint research, and lacking high-level cooperation methods such as industrial technology alliance. In addition, there are fewer cooperative projects between local universities and research institutes, which affects the source innovation ability of scientific and technological achievements. Difficulty in transforming scientific and technological achievements is also a prominent issue, with some of the achievements remaining in the research or pilot stage and failing to be industrialized. Taking the second China University Science and Technology Achievement Fair in 2018 as an example, 293 universities and 626 enterprises held hands, traded 732 scientific and technological achievements, and signed an amount of 4.06 billion yuan, which exceeded the signing amount of the first session of the Science and Technology Fair, while enterprises in Huizhou took over 501 of these achievements, with a signing amount of 2.58 billion yuan (Li

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Daisu et al., 2019) . This indicates that Huizhou has made remarkable progress in the transformation of scientific and technological achievements. However, compared with other cities in the Pearl River Delta (PRD), the number of technological achievements transferred by local colleges in Huizhou is low. In 2018, 139 technological achievements were transferred by local colleges in Huizhou, which ranked 8th in the Pearl River Delta (PRD), and is only about 1/5 of the average number of technological achievements transferred in the PRD (Hu Sq. et al., 2021). In addition, Huizhou College ranked 12th on the 2022 Guangdong patent transformation list, 16th on the 2022 Guangdong university industry-university-research cooperation list, and 20th on the 2022 Guangdong university transformation foundation list.

4.3. Analysis of Factors Influencing the Transformation of Scientific and Technological Achievements in Huizhou

In analysing the influencing factors of the transformation of scientific and technological achievements in Huizhou, we can explore the three dimensions of policy, economy and social culture.

The policy environment is an important factor affecting the transformation of scientific and technological achievements. The Huizhou Municipal Government has provided policy support for the transformation of scientific and technological achievements by formulating a series of policies and measures, such as the Action Programme for Promoting the Transfer and Transformation of Scientific and Technological Achievements in Huizhou. For example, the Huizhou Municipal Government has set up special funds for the transformation of scientific and technological achievements to support the transformation and industrialisation of scientific and technological achievements. However, the implementation effect of the policy is affected by many factors, such as the publicity strength of the policy, the implementation strength and so on. In Huizhou, there are problems such as insufficient long-term cooperation and low level of cooperation in industry-university-research co-operation, which limit the efficiency of transformation of scientific and technological achievements to a certain extent (Hu Siqi et al., 2021).

Economic factors have a decisive influence on the transformation of scientific and technological achievements. In the past five years, the proportion of the added value of high-tech manufacturing industry in Huizhou City to the added value of industry above designated size has been stable at about 40%. This indicates that Huizhou's inputs and outputs in the field of science and technology are at a high level and show a stable trend. However, insufficient capital investment in the process of transformation of scientific and technological achievements is still a prominent problem. Hu Siqi et al. (2021) pointed out that the lack of funds is one of the main obstacles affecting the transformation of scientific and technological achievements in Huizhou City, and 40.91% of the units face the dilemma of lack of funds in the cooperation between industry, academia and research and the transformation of achievements.

Social and cultural factors also play an important role in the transformation of scientific and technological achievements. Huizhou has a relatively open social and cultural environment, which is conducive to the acceptance and application of scientific and technological achievements. However, the degree of social cognition and acceptance of S&T innovation also affects the transformation effect. Over the past five years, the number of S&T activity personnel in Huizhou City has generally shown a stable growth trend, which shows that Huizhou's investment in S&T talents is increasing. However, the lack of high-level talents is still a bottleneck that restricts the transformation of scientific and technological achievements. Hu Siqi et al. (2021) found that there is a lack of high-level talents in the University-Industry-Research Co-operation (UIRC) in Huizhou City, which affects the deep

development of UIRC.

In summary, the transformation of scientific and technological achievements in Huizhou City is affected by policy, economic and socio-cultural factors. The policy level needs to further improve the implementation of the policy and publicity to ensure that the policy can be put into practice; the economic level needs to increase the financial support for the transformation of scientific and technological achievements to solve the problem of shortage of funds; the social and cultural level needs to strengthen the cultivation and introduction of talents to improve the social cognition and acceptance of scientific and technological innovation.

5. Problems in the Transformation of Scientific and Technological Achievements in Huizhou

5.1. Inadequate Long-term Cooperation Mechanisms

A notable problem in the transformation of scientific and technological achievements in Huizhou is the lack of a long-term cooperation mechanism. Although the number of industry-university-research co-operation projects is increasing, most of the co-operation projects are one-time co-operation and lack of stable strategic co-operation relationship. This short-term cooperation mode restricts the in-depth communication and cooperation between the cooperating parties in scientific and technological research and development and results transformation, resulting in insufficient continuity and stability of the cooperation results. In addition, due to the lack of guarantee for long-term cooperation, it is often difficult for enterprises, universities and research institutions to form an effective mechanism of collaborative innovation in the process of cooperation, which to a certain extent affects the efficiency and quality of the transformation of scientific and technological achievements.

5.2. Low level of cooperation

In the process of transformation of scientific and technological achievements in Huizhou City, the level of cooperation is generally low, mostly based on commissioned research, joint research, and lack of high-level cooperation modes such as industrial technology alliance. This low-level cooperation mode is often difficult to meet the needs of enterprises for high-end technology, and it is also difficult to form an effective mechanism for technological innovation and transformation of achievements. In addition, low-level cooperation modes often lack effective benefit-sharing and risk-sharing mechanisms, which to a certain extent affects the enthusiasm of both parties and the depth of cooperation.

5.3. Fewer Collaborative Projects with Local Universities and Research Institutes

Local universities and research institutes in Huizhou City have fewer co-operation projects in the process of transforming scientific and technological achievements, which to a certain extent affects the source innovation capacity of scientific and technological achievements. Local universities and research institutes are an important source of scientific and technological achievements, and if they have fewer cooperation projects, it will directly affect the output and transformation of scientific and technological achievements. In addition, fewer co-operation projects among local universities and research institutes will also make it difficult to form an effective industry-university-research co-operation network, which, to a certain extent, limits the efficiency and quality of the transformation of scientific and technological achievements.

5.4. Difficulty in Transforming Scientific and Technological Achievements

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An important problem faced by Huizhou City in the process of transformation of scientific and technological achievements is the difficulty of transformation of scientific and technological achievements. Some of the scientific and technological achievements stay in the research or pilot stage and fail to achieve industrialisation. This is mainly due to the fact that the docking between scientific and technological achievements and market demand is not close enough, as well as the lack of effective support and service system for scientific and technological achievements in the transformation process. In addition, insufficient capital investment and lack of talents in the process of transforming scientific and technological achievements are also important reasons for the difficulty in transforming scientific and technological achievements.

6. Countermeasures and Suggestions for the Transformation of Scientific and Technological Achievements in Huizhou

6.1. Establishment of a Long-term Cooperation Mechanism

Huizhou City needs to establish and improve a long-term mechanism for industry-university-research cooperation. This includes the formulation of a policy framework for long-term cooperation, the provision of stable financial support and talent protection, and the establishment of a mutual trust mechanism between the two parties to the cooperation. Through these measures, long-term co-operation between the two co-operating parties in scientific and technological R&D and results transformation can be promoted, and the stability and efficiency of co-operation can be improved.

6.2. Raising the Level of Cooperation

Huizhou City needs to promote the construction of innovation alliances for industry-university-research cooperation. This includes encouraging enterprises, universities and research institutes to establish industrial technology alliances, promoting high-level cooperation projects, and establishing effective benefit-sharing and risk-sharing mechanisms. Through these measures, the level and quality of co-operation can be improved and the efficient transformation of scientific and technological achievements can be promoted.

6.3. Increase the Number of Cooperation Projects with Local Universities and Research Institutes

Huizhou City needs to increase its support for local universities and research institutes and encourage them to participate in the process of transforming scientific and technological achievements. This includes the provision of financial support, policy incentives and the introduction of talents, among other measures, in order to promote cooperation between local universities and research institutes and enterprises, and to improve the ability to innovate at the source of scientific and technological achievements.

6.4. Facilitating the Transformation of Scientific and Technological Achievements

Huizhou City needs to establish and improve the support and service system for the transformation of scientific and technological achievements. This includes the establishment of a platform for the docking of scientific and technological achievements with market demands, the provision of measures such as financial support and the introduction of talents, and the establishment of a service system for the evaluation and transformation of scientific and technological achievements. Through these measures, the efficiency and quality of the transformation of scientific and technological achievements can be improved and the industrialisation of scientific and technological achievements can be promoted.

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7. Discussions and Conclusions

7.1. Discussions

On the basis of in-depth analysis of the current situation of transformation of scientific and technological achievements in Huizhou, we can find that although Huizhou has made some progress in the transformation of scientific and technological achievements, there are still some problems and challenges. Firstly, the insufficiency of long-term cooperation mechanism leads to the instability of cooperation, which not only affects the in-depth communication and cooperation between the two parties in scientific and technological research and development and results transformation, but also limits the sustainable transformation and application of scientific and technological achievements. Secondly, the low level of co-operation restricts the enterprises to meet the demand for high-end technology, and also affects the formation of the mechanism of technological innovation and achievement transformation. In addition, the lack of cooperation projects of local universities and research institutes affects the source innovation ability of scientific and technological achievements, while the problem of difficult transformation of scientific and technological achievements is directly related to whether scientific and technological achievements can be industrialised.

To address these issues, Huizhou needs to take a series of measures to improve the efficiency and quality of the transformation of scientific and technological achievements. Establishing and improving the long-term cooperation mechanism between industry, universities and research institutes, and providing stable financial support and talent guarantee are the keys to enhance the stability and efficiency of cooperation. Meanwhile, promoting the construction of innovation alliances for industry-university-research co-operation and encouraging enterprises, universities and research institutes to establish industrial technology alliances can improve the level and quality of co-operation. Increasing support for local universities and research institutes and encouraging them to participate in the process of transforming scientific and technological achievements can improve the source innovation capacity of scientific and technological achievements. Finally, establishing and improving the support and service system for the transformation of scientific and technological achievements, and providing measures such as financial support and the introduction of talents can improve the efficiency and quality of the transformation of scientific and technological achievements.

7.2. Conclusions

Although Huizhou City has made certain achievements in the transformation of scientific and technological achievements, it still faces many challenges. In order to further improve the efficiency and quality of the transformation of scientific and technological achievements, Huizhou needs to take comprehensive measures from the policy, economic and social culture levels. At the policy level, it is necessary to further improve and implement the relevant policies, provide stable financial support and human resources, and strengthen the publicity and implementation of the policies. At the economic level, it is necessary to increase financial support for the transformation of scientific and technological achievements, solve the problem of shortage of funds, and encourage enterprises to increase investment in research and development. At the social and cultural level, it is necessary to strengthen the cultivation and introduction of talents, and improve the social awareness and acceptance of science and technology innovation.

In addition, Huizhou city needs to strengthen the cooperation between industry, universities and research institutes, establish a long-term cooperation mechanism, raise the level of cooperation, promote the participation of local universities and research institutes, as well as establish and improve the support and service system for the transformation of scientific and

technological achievements. Through these measures, Huizhou can further improve the efficiency and quality of the transformation of scientific and technological achievements, promote the transformation of scientific and technological achievements into actual productivity, and provide strong scientific and technological support for the sustainable development of the city.

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