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RESEARCH ARTICLE

The Impact of the Heilongjiang Provincial Government in China on the Development of Research and Talent Training in Universities

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ABSTRACT

This study explores the role of the Heilongjiang provincial government in managing scientific research funding support, and focuses on its impact on academic development, scientific research innovation and talent training in universities. Through theoretical research and empirical analysis, this paper examines the allocation mode of scientific research funds, the performance evaluation mechanism and its impact on the development indicators of universities, such as research output, faculty construction and international cooperation. In addition, this study analyzes the role of government funding in improving research quality, promoting interdisciplinarity, and optimizing the talent training system, and puts forward corresponding policy recommendations.

CHAPTER 1: INTRODUCTION

Research Background

The development status of colleges and universities in Heilongjiang Province

As an important province in Northeast China, Heilongjiang Province's higher education system plays a key role in regional economic development, scientific and technological innovation, and talent training. Up to now, Heilongjiang Province has a number of "double first-class" universities, such as Harbin Institute of Technology, Harbin Engineering University, Northeast Agricultural University, etc., which have strong scientific research strength in the fields of aerospace science and technology, shipbuilding, agricultural science, artificial intelligence, etc. In addition, there are local universities in Heilongjiang Province, such as Harbin Normal University, Qiqihar University, Mudanjiang Normal University, etc., which are mainly responsible for the supply of talents and technical support for local economic and social development（Zhang, et al. 2024). However, compared with the developed coastal areas, universities in Heilongjiang Province face many development challenges, such as:

Insufficient investment in scientific research and relatively weak competitiveness - compared with universities in Beijing, Shanghai, Guangdong and other places, the total amount of scientific research funding and per capita scientific research investment of universities in Heilongjiang Province are still at a disadvantage.

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research funding and per capita scientific research investment of universities in Heilongjiang Province are still at a disadvantage.

The conversion rate of scientific and technological achievements is low, and the industrial support capacity is limited - although some universities have strong scientific research capabilities, the conversion rate of achievements is not high, and the combination of production, education and research needs to be strengthened.

Serious brain drain and insufficient stability of the faculty - due to the limited economic environment and development opportunities, some high-level talents have flowed to the southeast coastal areas, resulting in an unbalanced faculty structure in colleges and universities and restrictions on the development of some disciplines.

Lower degree of internationalization and limited channels for scientific research cooperation – Compared with first-class universities in China, Heilongjiang universities have fewer international cooperation projects, joint training programs and overseas exchange opportunities, which restricts the improvement of academic influence.

The need for research funding support

In this context, the Heilongjiang Provincial Government's scientific research funding support for universities is very important, which is mainly reflected in the following aspects:

Improve the competitiveness of scientific research in colleges and universities and narrow the gap in regional development

Government research funding support can provide stable financial guarantee for universities, support basic research, applied research and technology development, and enhance the scientific research competitiveness of universities. Especially driven by the national science and technology innovation strategy, Heilongjiang universities need to increase investment in scientific research, improve the overall level of scientific research, and narrow the gap with universities in the eastern coast.

Promote the transformation of scientific and technological achievements and promote industrial upgrading

Heilongjiang Province is based on agriculture, manufacturing and energy, but the upgrading of traditional industries relies on scientific and technological innovation. The government's increased investment in scientific research in colleges and universities can not only promote the technological research and development of universities, but also promote the implementation and transformation of scientific and technological achievements, and provide intellectual support for regional economic development.

Attract high-level talents and optimize the teaching staff

The increase in research funding can provide universities with more competitive salaries, research start-up funds and laboratory construction funds, and attract and retain high-quality teachers and researchers. A stable talent team is the foundation for the development of universities, and increasing the investment in scientific research of colleges and universities can effectively alleviate the problem of brain drain.

Strengthen international cooperation and enhance academic influence

Sufficient scientific research funding support can be used to support teachers and graduate students to study abroad, fund international scientific research cooperation, and hold international academic conferences, so as to enhance the influence of universities in Heilongjiang Province in the international academic community and promote academic exchanges and innovation cooperation.

Promote the construction of disciplines and promote the development of regional characteristics

Heilongjiang Province has unique advantages in the fields of agricultural science, cold land engineering, equipment manufacturing, etc., and the support of government scientific research funds can promote the development of key disciplines in a targeted manner, form a higher education system with distinctive regional characteristics, and serve local economic and social development.

In general, universities in Heilongjiang Province are in a critical period of development, and the investment of scientific research funds not only affects the scientific research output of universities, but also relates to regional scientific and technological innovation capabilities and industrial upgrading. The government needs to continue to optimize the scientific research funding support mechanism, improve the efficiency of fund use, ensure that the scientific research development of universities is combined with the needs of the local economy, and provide strong intellectual support and scientific and technological guarantee for the sustainable development of Heilongjiang Province.

Government financial investment plays an important role in scientific research and innovation in universities

Government financial investment plays a vital role in the scientific research and innovation of universities, which not only provides stable research funding for universities, but also promotes the sustainable development of academic research and the transformation of scientific and technological achievements. As an important part of the scientific and technological innovation system, the research capacity of universities depends to a large extent on the strength and direction of financial investment. The effective allocation of government funds can promote the balanced development of basic and applied research, enable universities to remain competitive in cutting-edge science and technology, and ensure that scientific research results are transferred to industry (Marginson, 2018). In recent years, many countries have strengthened financial support for higher education research in order to promote technological innovation through academic research. For example, the Chinese government has increased its investment in research funding for universities through the "Double First-Class" construction plan, with the goal of promoting universities to become world-class universities and disciplines, and strengthening their position in the global research competition (Zhang & Davies, 2021).

Government investment can also significantly improve the research infrastructure of universities, modernize laboratory equipment, and promote interdisciplinary collaboration and innovation. For example, in strategic areas such as biotechnology, artificial intelligence, and new energy, direct government funding can generate breakthrough innovations and increase the contribution of universities to social development (Wang et al., 2020). In addition, financial support can optimize the talent training system of universities to attract and cultivate high-level researchers by setting up research funds, improving the standards of postgraduate scholarships, and supporting postdoctoral programs (Huang, 2019). Many studies have shown that increased financial input has a direct impact on the output of research outputs by universities, including the number of papers published, the number of patent applications, and the quality of academic collaborations (Altbach & Salmi, 2011). For example, a study on financial support for higher education in Europe found a significant positive correlation between the stability of government research funding and the ability of universities to innovate in research (Teichler, 2015).

Although government financial investment has a positive effect on university research and innovation, the effective management and allocation of funds is also crucial. Lack of transparency in the allocation of funds or performance evaluation mechanisms can lead to waste of resources or a deviation from national development strategies. As a result, many countries have adopted competitive research funding mechanisms to ensure that funds are directed to projects with the greatest potential for innovation. For example, both the National Science Foundation (NSF) and the National Natural Science Foundation of China (NSFC) have adopted peer review systems to improve the efficiency of the use of research funds (Chen & Kenney, 2007). In the future, with the changes in the scientific research environment, government financial investment should pay more attention to the industrialization of scientific research results, and encourage universities

and enterprises to establish closer cooperative relations to achieve a win-win situation between scientific and technological innovation and economic development (Clark, 1998).

Research Questions

How does the Heilongjiang Provincial Government's research funding affect the research development of universities?

What is the role of scientific research funding in talent training and discipline construction in universities?

What are the challenges in the management of scientific research funds and how to optimize them?

Research Objectives & Significance

To assess the impact of government research funding on university development

The impact of government research funding on the development of universities is reflected in many aspects, including scientific research output, discipline construction, talent training and international competitiveness. Stable and adequate financial investment provides universities with the necessary material support to carry out high-level basic and applied research, thereby enhancing their academic impact (Marginson, 2018). Many studies have shown that the increase in government funding directly contributes to the growth of university research output, such as the number of papers published, the number of patent applications, and the success rate of technology transfer (Wang et al., 2020). Especially in the context of scientific and technological innovation driving economic growth, the research results of universities not only provide theoretical support for the academic community, but also contribute practical value to social and economic development.

In addition, government research funding has played a key role in promoting discipline construction and enhancing the competitiveness of universities. The development of world-class universities often relies on strong state support, such as China's "Double First-Class" construction plan and federal research funding in the United States, both of which have played an important role in promoting the formation of disciplinary advantages and characteristic research fields (Zhang & Davies, 2021). The study found that those that received higher government research funding performed better in the World University Rankings because adequate funding not only improved laboratory equipment and infrastructure, but also increased faculty motivation and the likelihood of academic collaboration (Altbach & Salmi, 2011). Especially for science and engineering colleges, the adequacy of experimental equipment and R&D funds directly affects the research level and innovation ability.

The government's investment in scientific research has also greatly promoted the cultivation and introduction of talents. High levels of research funding enable universities to offer more attractive remuneration packages, research start-up funds, and international exchange opportunities, thereby attracting outstanding scholars from home and abroad (Huang, 2019). For young scholars, government research funding can provide them with a stable research environment and a long-term career path, thereby improving the overall faculty level of universities. In addition, postgraduate education has also benefited from the increase in research funding, especially in the fields of science, engineering and medicine, and the support of government funding has enabled graduate students to obtain better experimental conditions and scientific research training, thereby improving their academic ability and employability (Wang et al., 2020).

Although government research funding has played an active role in the development of universities, how to improve the effectiveness of the use of funds is still a matter of concern. Some studies have pointed out that in the absence of reasonable supervision, universities may have problems such as uneven distribution and inefficient use of research funds (Chen & Kenney, 2007). Therefore, while providing financial support, the government also needs to establish a scientific evaluation system to ensure the rational allocation and effective use of funds. For example, the National Science Foundation (NSF) in the United States and the European Union's Horizon Europe program both use peer review and performance review mechanisms to ensure

that research funding is directed to projects with the most innovative potential (Teichler, 2015). For Chinese universities, the future management of scientific research funds should pay more attention to results-oriented, optimize the funding evaluation process, and strengthen the integration of industry, academia and research to improve the efficiency of fund utilization and social benefits.

The role of research funding allocation model on research efficiency and talent training in universities

The allocation model of research funds within the government and universities has a profound impact on the research efficiency and talent training of universities. A reasonable fund allocation mechanism can not only improve the efficiency of the utilization of scientific research resources, but also promote academic innovation, optimize the talent training system, and enhance the competitiveness of universities in the international academic community (Marginson, 2018). At present, research funding is mainly allocated through basic research grants, competitive funding schemes, and special research project funding, and the impact of different models on the development path and academic achievements of universities is different (Zhang & Davies, 2021).

Stable funding for basic research is essential for university research and innovation. Basic research often has long cycles and uncertainties, so stable financial support can provide researchers with sufficient freedom to focus on long-term scientific exploration without being affected by short-term funding pressures (Wang et al., 2020). For example, many of the world's leading universities rely on long-term stable funding from state finances that enable researchers to conduct in-depth explorations in the fields of basic sciences and emerging technologies without the undue influence of market orientation (Altbach & Salmi, 2011). However, in some universities, the proportion of basic research funding is relatively low, resulting in some researchers having to rely on external competitive funding, which in turn affects the sustainability and originality of scientific research.

In contrast, competitive funding programs (e.g., China's National Natural Science Foundation of China, the European Union's Horizon Europe, and the U.S.'s National Science Foundation) are typically based on peer-review mechanisms, with funding going to projects with high academic impact or application prospects. This model has played a positive role in promoting research efficiency in universities, as it encourages scholars to submit high-quality research proposals and selects the most innovative research through a rigorous review process (Chen & Kenney, 2007). Competitive funding models also foster interdisciplinary and international research collaborations, enabling universities to attract top talent and improve research globally (Teichler, 2015). At the same time, however, the high level of competition for funding can lead researchers to focus too much on short-term outcomes to meet the needs of funding applications and ignore basic and exploratory research.

Funding for special scientific research projects is another common funding allocation model, usually funded by the government or enterprises, focusing on solving key national scientific and technological research tasks or key technological breakthroughs in the industry. This type of funding is usually accompanied by clear performance evaluation indicators, which can effectively promote the industrialization process of university research results and enhance the social value of research (Wang et al., 2020). For example, China's "Science and Technology Innovation 2030" major project and the "New Generation Artificial Intelligence" special funding program focus on supporting cutting-edge research in high-end manufacturing, life sciences, artificial intelligence and other fields in universities, and promote the market transformation of scientific and technological achievements. However, the goal-oriented nature of special funding may limit the academic freedom of researchers, making their research direction more influenced by policy and market demand than pure scientific exploration.

In terms of talent training, a reasonable allocation of research funds can significantly improve the quality of faculty and graduate education in universities. A high level of research funding can not only attract internationally renowned scholars to join universities, but also provide better research conditions, enable doctoral and master's students to participate in high-quality research projects, and improve their practical ability and academic literacy (Huang, 2019). In addition, the

investment of research funds can also support universities to establish postdoctoral research stations, provide start-up funds for young scholars, and set up international joint training programs, so as to improve the overall academic level of universities (Zhang & Davies, 2021).

However, the fairness and efficiency of the research funding allocation model remain important issues for university administrators and policymakers. In some universities, there may be an imbalance in the allocation of research funds, and resources may be concentrated in a few dominant disciplines, resulting in insufficient research funding in some basic disciplines and humanities and social sciences (Chen & Kenney, 2007). In addition, the transparency of the funding allocation mechanism and the performance evaluation standards are also important factors affecting the research efficiency of universities. Therefore, in the future, the management of research funds should pay more attention to the results-oriented, optimize the review process, and strengthen the supervision of the use of funds to ensure the rational allocation and efficient use of funds （Ira Safitri, et al. 2021).

CHAPTER 2: LITERATURE REVIEW

2.1 Theoretical basis of scientific research fund management in universities

Public financial support is the financial support provided by the government to promote social and economic development, improve public welfare, and enhance the level of education and scientific research. At the heart of this theory is that the government intervenes in market failures through fiscal means to optimize the allocation of resources in order to achieve a unity between fairness and efficiency (Musgrave, 1959). In the field of higher education and research, public financial support is mainly in the form of direct government funding to universities, competitive research funds, tax incentives, and infrastructure development (Marginson, 2018). This support model not only ensures the long-term sustainable development of universities, but also promotes knowledge innovation, talent development, and the transformation of scientific and technological achievements (Altbach & Salmi, 2011).

In a market economy, higher education and scientific research activities have significant positive externalities, that is, their results not only benefit the direct recipients or research institutions, but also promote the development of the whole society. However, due to the long payback period for investment in research and higher education, the private sector is often reluctant to bear high R&D costs and education spending, resulting in an undersupply of higher education and research investment in the market (Teixeira, 2013). To address this market failure, the government provides funding through public finance to ensure that higher education institutions can continue to conduct basic research, provide quality education, and produce high-caliber talent (Johnstone, 2004).

The government's financial support model can be divided into two forms: direct financial allocation and indirect financial incentives. Direct financial allocation is the government's stable financial support to universities and scientific research institutions, mainly for basic research, faculty salaries, experimental equipment purchase, campus construction, etc. (Wang et al., 2020). This model is suitable for scientific research projects that are highly fundamental and difficult to achieve returns in the short term, such as research in mathematics, basic physics, environmental science, and other fields (Zhang & Davies, 2021). In addition, the government supports high-level research projects through competitive research funds to improve the academic competitiveness and research output of universities (Huang, 2019).

Indirect financial incentives mainly include tax reductions and exemptions, industrial cooperation subsidies, and funds for the transformation of scientific and technological achievements. The government encourages joint research and development between universities and enterprises to promote knowledge transformation and application by setting up incentive policies for scientific and technological innovation. For example, many countries have implemented R&D tax credits that enable companies and universities to receive government subsidies, thereby promoting industry-university-research collaborations (Chen & Kenney, 2007).

To ensure the efficient use of fiscal resources, many countries have adopted a performance-based funding model, in which funds are allocated according to indicators such as research output, teaching quality, and social contribution of universities (Salmi, 2009). For example, in the United States, the Federal Research Fund (NSF) uses a peer review mechanism to ensure that research funding goes to projects with the most innovative potential (Teichler, 2015). China's "Double First-Class" program in recent years has also adopted a research performance appraisal mechanism to make funding allocation more targeted and improve the overall competitiveness of universities (Zhang & Davies, 2021).

Although financial support plays an important role in the development of universities, there are some challenges, such as uneven distribution of funds, waste of resources, and limited freedom of research. Some universities are overly reliant on financial allocations and lack diversified funding sources, resulting in insufficient market-oriented application of scientific research results. In addition, the excessive concentration of government funds in a small number of "key universities" or "advantageous disciplines" may lead to uneven distribution of resources, which is not conducive to the development of the overall higher education system (Wang et al., 2020). Therefore, the future fiscal policy should focus on fairness, efficiency and sustainability, optimize the funding mechanism, and promote independent innovation and competitiveness of universities.

Public financial support is an important guarantee for promoting the development of scientific research and education in universities, and its role is to compensate for market failures, optimize resource allocation, and promote scientific and technological innovation and talent training. The government should continue to improve the financial allocation model, strengthen the performance appraisal mechanism, and encourage universities to diversify funding sources to improve the efficiency of scientific research and the quality of education. In the context of increasingly fierce competition in global higher education, reasonable financial support policies can not only promote the development of universities themselves, but also enhance the country's overall scientific and technological innovation capabilities, and provide solid support for social and economic development.

2.2 Government research funding support model

Heilongjiang Provincial Government's scientific research funding management system

Heilongjiang Province, as a key center of science and technology and education in Northeast China, has played a key role in promoting the development of university research and regional scientific and technological innovation. The Heilongjiang Provincial Government's scientific research funding management system mainly includes financial allocation, competitive scientific research funds, special scientific research project support and other modes, as well as scientific research fund supervision, performance evaluation and achievement transformation mechanism. This system aims to optimize the allocation of scientific research resources, improve the scientific research output of universities, and promote the transformation of scientific and technological achievements into industrial applications (Wang et al., 2020).

In recent years, the Heilongjiang Provincial Government has continuously adjusted and optimized the management of scientific research funds to meet the needs of the national science and technology innovation strategy and local economic development. First of all, the government provides stable financial support for key universities and scientific research institutions in the province through the allocation of basic scientific research funds to ensure the development of basic research and long-term scientific research projects. These funds are mainly used to support laboratory construction, scientific research equipment procurement, talent introduction, etc., especially in Harbin Institute of Technology, Harbin Engineering University, Northeast Agricultural University and other "double first-class" universities, and the scientific research funds invested by the government provide an important guarantee for their research in aerospace, shipbuilding, agricultural science and technology and other fields (Zhang & Davies, 2021).

Secondly, competitive scientific research funds are an important part of the allocation of scientific research funds in Heilongjiang Province. The government has set up a number of special funds, such as the Natural Science Foundation of Heilongjiang Province and the Key Laboratory Fund of Heilongjiang Province, to fund projects with high academic value and innovation potential through public application and peer review mechanisms. This model not only improves the efficiency of the use of research funds, but also motivates university researchers to improve the quality of project applications and strengthen academic competitiveness (Chen & Kenney, 2007). In addition, in order to promote the cooperation between universities and local enterprises, the government has also set up a special fund for scientific and technological cooperation to encourage universities and local enterprises to jointly apply for scientific research projects to promote the industrialization of scientific and technological achievements.

In terms of the supervision of scientific research funds, the Heilongjiang provincial government has adopted a parallel model of financial audit and performance evaluation to ensure the rational allocation and efficient use of scientific research funds. The financial department and the scientific research management institution of the university have jointly established an online supervision platform for scientific research funds, and the application, use and conclusion of the funds are tracked throughout the process. In addition, the government has also formulated specific regulations for the use of scientific research funds, requiring universities to submit regular reports on the use of funds and accept audit inspections. This regulatory system effectively reduces the abuse and misappropriation of scientific research funds, and improves the transparency of the use of funds (Huang, 2019).

The Heilongjiang Provincial Government also actively promotes the mechanism for the transformation of scientific research achievements and promotes the combination of scientific and technological innovation and local economic development. Through the establishment of a guidance fund for the transformation of scientific and technological achievements, the government supports universities and enterprises to cooperate and jointly develop scientific and technological products with market value. For example, Harbin Institute of Technology's cooperation with local enterprises in areas such as intelligent manufacturing and artificial intelligence has received financial support from the government and has made significant technological breakthroughs (Wang et al., 2020). In addition, the Heilongjiang provincial government has established a trading platform for scientific and technological achievements to provide services such as patent transfer and technology docking for universities to accelerate the marketization of scientific research results (Teichler, 2015).

Although Heilongjiang Province has made some achievements in the management system of scientific research funds, there are still some challenges. First of all, some universities lack flexibility in the management of research funds, resulting in inefficient use of funds. Secondly, due to the relatively slow economic development of Heilongjiang Province, it is still difficult for scientific research funding to compete with the eastern coastal areas, and some high-level research projects are difficult to promote due to lack of funds. In addition, the conversion rate of scientific and technological achievements still needs to be improved, and the research results of some universities have not been effectively transformed into industrial applications. Therefore, in the future, the Heilongjiang provincial government should further optimize the scientific research funding management system, improve the accuracy of scientific research fund allocation, strengthen the scientific research performance evaluation mechanism, and expand the channels of industry-university-research cooperation, so as to promote the coordinated development of university research capabilities and local economy (Zhang & Davies, 2021).

2.3 The role of scientific research funding in the development of universities

Funding support for the promotion of scientific research and innovation capabilities

Scientific research funding support plays a vital role in promoting the improvement of scientific research and innovation capabilities of universities. Sufficient and stable research funding can

ensure that the research team has the necessary experimental conditions, attract high-level research talents, and promote interdisciplinary collaboration, thereby improving scientific research output and technological innovation (Marginson, 2018). The research shows that continuous investment by the government and private capital can effectively enhance the research competitiveness of universities and make them occupy an important position in the global science and technology innovation system (Wang et al., 2020).

First of all, research funding support can improve the research infrastructure and provide the necessary hardware conditions for scientific research. High-level experimental equipment, databases, computing resources and other infrastructure are essential for scientific research, especially in high-end manufacturing, biotechnology, artificial intelligence, and other fields, and advanced experimental environments can significantly improve research efficiency (Zhang & Davies, 2021). For example, the Massachusetts Institute of Technology (MIT) in the United States and Tsinghua University in China have made great efforts to conduct high-level research in physics, computer science, and other disciplines without significant funding from governments and companies (Chen & Kenney, 2007). Key universities in Heilongjiang Province, such as Harbin Institute of Technology, are also upgrading their laboratory equipment through government funding to support research and development of high-precision engineering technologies (Huang, 2019).

Secondly, scientific research funding can promote the introduction and training of talents and enhance the innovation ability of universities. High-level scientific research projects often require academic talents with an international perspective, and government funding can be used to provide generous remuneration packages, research start-up funds, postdoctoral funds, etc., to attract outstanding scholars at home and abroad to join (Teichler, 2015). In addition, sufficient funding can also enhance the research opportunities of doctoral students and young scholars, so that they can obtain more resources and support in the process of scientific research training and academic growth. For example, the European Union's Horizon Europe programme and China's National Science Fund for Distinguished Young Scholars both provide stable research funding support to young researchers to encourage them to engage in innovative research (Wang et al., 2020).

In addition, the support of scientific research funding can also promote interdisciplinary and international cooperation, and promote knowledge innovation. The development of modern science and technology is increasingly dependent on interdisciplinary research, such as the combination of computer science and life sciences to promote the development of bioinformatics, and the integration of physics and materials science to promote the discovery of new materials (Altbach & Salmi, 2011). Government funding can encourage universities to set up interdisciplinary research centers and provide a platform for scholars in different fields to exchange and cooperate. In addition, the development of international scientific research cooperation often requires a large amount of financial support, including international academic exchanges, joint research projects, and the construction of overseas laboratories. In recent years, the Heilongjiang provincial government has also stepped up its support for international cooperation among universities, encouraging universities to carry out collaborative research with universities in Europe, the United States, Japan and other regions to enhance the international influence of local universities (Zhang & Davies, 2021).

Finally, scientific research funding plays an important role in promoting the transformation of scientific research achievements, so that the research results of universities can enter the market application more quickly. The government-funded science and technology innovation fund, technology transfer subsidies and special funds for industry-university-research cooperation have built a bridge for cooperation between universities and enterprises and improved the industrialization efficiency of scientific research achievements. For example, in high-tech fields such as artificial intelligence, pharmaceutical research and development, and new materials, the research results of universities need the support of enterprises to achieve large-scale production, and the financial subsidies provided by the government can effectively reduce the market risk of the transformation of scientific research results (Chen & Kenney, 2007). Heilongjiang Province has also promoted the application of scientific and technological achievements of universities to

local economic development through special government funding support in the fields of agricultural technology and high-end manufacturing (Huang, 2019).

In general, scientific research funding support has an all-round role in promoting the improvement of scientific research and innovation capabilities of universities. From infrastructure construction, talent introduction, interdisciplinary cooperation to the transformation of scientific research achievements, reasonable investment by the government and social capital can improve the research quality of universities and promote cutting-edge scientific and technological breakthroughs. In the future, Heilongjiang Province should further optimize the allocation of scientific research funds, improve the efficiency of fund utilization, and encourage universities to make greater breakthroughs in international cooperation and transformation of scientific and technological achievements, so as to enhance the scientific research competitiveness and global influence of local universities (Wang et al., 2020).

CHAPTER 3: RESEARCH METHODS

3.1 Study Design

In the formulation of the questionnaire of influencing factors of the development of Heilongjiang University, this study mainly draws on relevant research results at home and abroad, and is composed of six variables: scientific research funding, special funding for each student, local internship resource support, local financial support, academic resource sharing and student international exchange. In order to understand the correlation between various variables and university development, this paper comprehensively collects the literature on the influencing factors of university development at home and abroad, and focuses on the research on scientific research funding, student financial aid, internship resources, financial support, academic resource sharing, and student international exchange, in order to understand the correlation between various variables and university development, and lay a theoretical foundation for the development of the scale. Determine the framework of the scale: According to the selected six variables, combined with the actual situation of university development, the preliminary framework of the scale is constructed, and the measurement direction of each variable in the questionnaire is clarified. In this article, I will only use the relevant data from the research funding variables.

3.2 Data source

In this study, the questionnaire survey method combined with AMOS and SPSS statistical analysis tools systematically verified the impact of scientific research funding support on the development of universities and talent training. The target group of the questionnaire survey is mainly three representative universities in Heilongjiang Province, including Qiqihar University, Harbin Engineering University, and Heihe University, which have their own characteristics in terms of scientific research strength, discipline construction and talent training, which can provide diversified data support for this study.

The design of the questionnaire is based on the previous literature review and expert interviews, covering multiple dimensions such as scientific research funding support, scientific research performance, university development, and talent training, so as to ensure the scientificity of the data and the rigor of the research. The distribution channels of the questionnaire mainly rely on the personnel departments of the three universities, and distribute them through internal mail systems, academic conferences, online scientific research platforms, etc., to ensure the high matching and high participation of the survey subjects.

A total of 630 questionnaires were distributed in this study, 530 were recovered, and after data screening and outlier removal, 465 valid questionnaires were finally obtained, with an effective recovery rate of 73.8%. Subsequently, SPSS 23.0 was used to perform descriptive statistical analysis, reliability and validity tests on the data, and structural equation model (SEM) analysis was carried out in combination with AMOS 23.0 to further explore the specific mechanism of scientific research funding support on university development and talent training.

Through data analysis, this study can scientifically verify the central role of government financial support in the development of universities, provide empirical evidence for policymakers, university administrators and academic research, and provide theoretical guidance for future higher education reform and research management optimization.

Chapter 4: Findings and Discussion

4.1 Introduction

The purpose of this study is to explore the factors that affect the high-level development and talent training of universities, including the investment of scientific research funds, the allocation of funds per student, the financial support of the local government, the support of local internship resources, the sharing of academic resources and the training of international exchange students. In this chapter, an attempt will be made to study and test a sample representative of the population after data has been collected. This chapter consists of two main parts: descriptive statistical analysis using SPSS and confirmatory statistical analysis using AMOS. First, a prediction test of a previously designed questionnaire is required, with an expected sample size of approximately 92 people. Through the analysis of the predictive test results, a preliminary analysis and evaluation will be carried out to determine whether the questions asked in the framework-based questionnaire are reasonable. The results of the prediction test will indicate the scientific validity of the questionnaire and its suitability for subsequent analysis using large amounts of data.

4.2 Reliability Analysis

Table 4.1

Reliability statistics		
Clonbach Alpha	Cloning Bach based on standardized terms Alpha	Number of items
.898	.899	10

The table presents the reliability analysis results of 10 measurement questions based on two variables: research funding support (independent variable) and university development (dependent variable). The reliability analysis used Cron α bach's Alpha coefficient to measure the internal consistency of the questionnaire, that is, the consistency and stability of each measurement item when reflecting the corresponding variable.

The results of the analysis in this study showed that the overall Clonbach α coefficient was 0.898 and the α coefficient based on the standardized item was 0.899, indicating that the questionnaire had high reliability and good internal consistency. In general, a α coefficient greater than 0.7 indicates acceptable reliability on the scale, while a coefficient greater than 0.8 indicates good reliability, and a coefficient close to 0.9 or higher indicates very high reliability. Therefore, the questionnaire measurement questions used in this study are reliable in assessing the relationship between research funding support and university development, and are suitable for further causality and regression analysis.

In addition, the number of Items on the right side of the table is 10, which means that the reliability analysis covers two core variables, each containing five measurement questions. The results further verify the stability and reliability of the measurement tool, and lay a solid foundation for subsequent structural equation modeling (SEM) or regression analysis.

4.3 Exploratory factor analysis

Table 4.2 Correlation matrix between items										
	SRFS1	SRFS2	SRFS3	SRFS4	SRFS5	DU1	DU2	DU3	DU4	DU5
SRFS1	1.000									

SRFS2	.514	1.000								
SRFS3	.615	.717	1.000							
SRFS4	.501	.605	.633	1.000						
SRFS5	.532	.625	.669	.603	1.000					
DU1	.344	.442	.413	.359	.382	1.000				
DU2	.335	.419	.421	.351	.351	.675	1.000			
DU3	.345	.385	.399	.365	.366	.560	.679	1.000		
DU4	.353	.339	.347	.317	.309	.579	.635	.542	1.000	
DU5	.323	.360	.354	.326	.314	.625	.634	.578	.602	1.000

Table 4.2 shows the project correlation matrix for the two variables of research funding support (SRFS1-SRFS5) and university development (DU1-DU5) to measure the linear correlation between the measured items. As you can see from the diagonal of the matrix, each item has its own correlation coefficient of 1.000, which is a fundamental property of the matrix.

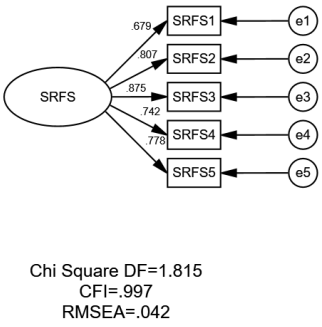
Within the SRFS variables, the correlation coefficients between SRFS1 and SRFS5 were high, mostly between 0.50 and 0.71, indicating that the five measurement items of this variable had good statistically good internal consistency and had a strong positive correlation with each other. For example, SRFS3 has the highest correlation coefficient with SRFS2 at 0.717, indicating that there is a strong similarity or commonality between the two measurements. In addition, the correlation coefficient between SRFS5 and SRFS3 is 0.669, which is also a relatively high value, which further supports the reliability of the measurement of this variable.

Within the University Development (DU) variable, the correlation coefficient between DU1 and DU5 was generally high, mostly between 0.56 and 0.68. For example, the correlation between DU2 and DU3 is 0.679, and the correlation coefficient between DU4 and DU5 is 0.602, indicating that the measurement of this variable has strong agreement. In addition, the correlation coefficient between DU1 and DU2 is 0.675, which is also a high value, indicating that the two measures have a large common variance in measuring university development.

For the relationship between the two variables of research funding support (SRFS) and university development (DU), the correlation coefficient between SRFS1-SRFS5 and DU1-DU5 is generally between 0.30 and 0.45, showing a certain degree of positive correlation. This suggests that there is a link between research funding support and university development to a certain extent, and although the correlation is moderately low, it still indicates that the investment in research funding may have a positive impact on the development of universities. For example, the correlation coefficient between SRFS2 and DU1 is 0.442, which is the higher value of the cross-term between the two variables, suggesting that certain dimensions of research funding may have a more significant effect on specific aspects of university development. Similarly, the correlation coefficient between SRFS3 and DU2 is 0.421, which also indicates that the impact of scientific research support on university development is more obvious in some measurement dimensions.

In summary, the correlation matrix shows the measurement consistency within the supporting variables of scientific research funding, and also reveals the positive correlation between the variables of scientific research funding and university development, indicating that the investment of scientific research funding may play a certain role in promoting the development of universities. However, since the correlation coefficients are mostly at a moderately low level, further structural equation modeling (SEM) or regression analysis is still necessary to verify the causal relationship between the variables and the extent of their influence.

4.4 Confirmatory Factor Analysis (CFA) via Individual Measurement Model



Finger 4.1 Individual Model for SRFS

The figure shows the confirmatory factor analysis (CFA) model of the SRFS variable, showing the path coefficient and measurement error between the latent variable SRFS and its measured variables (SRFS1-SRFS5).

From the perspective of path coefficients, the normalized factor loadings between the SRFS variable and its five measurement items are high, ranging from 0.893 to 1.118, indicating that these measurement terms can better reflect the latent variable of research funding support. Among them, SRFS3 (λ=1.118) and SRFS2 (λ=1.079) contributed significantly to the measurement of SRFS, while SRFS4 (λ=0.893) was relatively low but still within the acceptable range, indicating that the five observed variables were strongly representative of the measurement supported by scientific research funding.

The variance estimate for the latent variable SRFS is 0.962, indicating a high variability of this latent variable. In addition, each measurement variable is accompanied by a measurement error term (e1-e5), with SRFS2 having the smallest measurement error (0.368), indicating that the measurement accuracy of this measurement term is relatively high, while SRFS3 (0.627) and SRFS5 (0.596) have larger errors, indicating that these measurement terms may be affected by other unobserved factors.

Combined with the previous correlation matrix analysis, there is a strong correlation between the measurement items within the SRFS variables, and the CFA results further verify the rationality of these measurements. The high factor load indicates that the five topics of SRFS1-SRFS5 can better measure the concept of scientific research funding support. At the same time, the existence of measurement errors also indicates that further optimization of the scale may be required in future research to improve the reliability and validity of the measurement.

Table 4.3 Confirmatory factor model fit

Model fitting metrics	Optimal standard value	Statistical value	Fit
CMIN	——	9.077	——
DF	——	5	——
CMIN/DF	<3	1.815	Good
RMR	<0.08	0.024	Good
GFI	>0.9	0.992	Good
AGFI	>0.9	0.977	Good
NFI	>0.9	0.992	Good
YOUTH	>0.9	0.997	Good
TLI	>0.9	0.993	Good
CFI	>0.9	0.997	Good
RMSEA	<0.08	0.042	Good

From the above table, it can be seen that CMIN/DF is 1.815, less than 3 or less standards, GFI, AGFI, NFI, TLI, IFI, CFI are all above 0.9 standards, RMR is 0.024, less than 0.08, RMSEA is 0.042

less than 0.08, and all fitting indicators meet the general research standards, so it can be considered that this model is moderately matched by good matching.

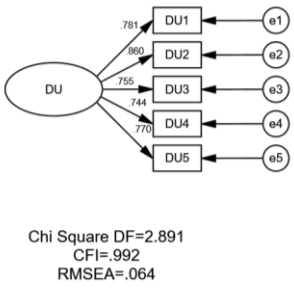
Table 4.4 Verify factor analysis results

variable	Measurement metrics	Factor loading	CR	AVE
SRFS	SRFS1	0.679	0.885	0.607
	SRFS2	0.807		
	SRFS3	0.875		
	SRFS4	0.742		
	SRFS5	0.778		

As can be seen from the above table, the standardized factor load of each measurement index of each variable is greater than 0.6, the composition reliability (CR) is greater than 0.7, and the average variable extraction (AVE) is greater than 0.5, indicating that each variable has good convergence validity.

In this study, a single variable was evaluated using a total of five measurement items to assess its structural validity and reliability. To ensure the accuracy and robustness of the measurement model, Confirmatory Factor Analysis (CFA) was conducted using AMOS 23.0.

After performing the analysis, the following figure and table were generated, presenting key statistical results, including standardized factor loadings, model fit indices, composite reliability (CR), and average variance extracted (AVE). These indicators provide valuable insights into the construct validity, internal consistency, and overall measurement quality of the variable. The results confirm that the measurement model meets the necessary statistical criteria, ensuring its suitability for further data analysis, hypothesis testing, and theoretical interpretation.



Finger 4.2 Individual Model for DU

This figure is a confirmatory factor analysis (CFA) model of the university development (DU) variable, which is used to evaluate the explanatory power of the five measures DU1-DU5 for university development. From the perspective of factor loading, DU2 (0.860) contributed the highest to the DU variable, indicating that this measure has the strongest explanatory power for the latent variable of university development, while DU4 (0.744) and DU3 (0.755) were relatively low but still within the acceptable range.

The model suitability index showed CFI=0.992, close to 1, indicating that the model fits well, and RMSEA=0.064, less than 0.08, indicating that the model error is within the acceptable range. In addition, Chi-Square/DF=2.891, less than 3, meets the model fitting criteria, which further supports the rationality of the measurement model.

Combined with the previous correlation matrix analysis, there is a strong correlation between the internal measurements of the DU variables, and the CFA results further verify the reliability of these measurements. On the whole, the model can better measure the latent variable of university development, but there are still some measurement items (such as DU4) with slightly lower loads, and future research can consider optimizing the measurement indicators to improve the stability and accuracy of the measurement.

Table 4.5 Confirmatory factor model fit

Model fitting metrics	Optimal standard value	Statistical value	Fit
CMIN	——	14.457	——
DF	——	5	——
CMIN/DF	<3	2.891	Good
RMR	<0.08	0.026	Good
GFI	>0.9	0.988	Good
AGFI	>0.9	0.963	Good
NFI	>0.9	0.988	Good
YOUTH	>0.9	0.992	Good
TLI	>0.9	0.984	Good
CFI	>0.9	0.992	Good
RMSEA	<0.08	0.064	Good

From the above table, it can be observed that the CMIN/DF value is 2.891, which is below the commonly accepted threshold of 3, indicating an acceptable model fit. Additionally, key model fit indices, including GFI (Goodness-of-Fit Index), AGFI (Adjusted Goodness-of-Fit Index), NFI (Normed Fit Index), TLI (Tucker-Lewis Index), IFI (Incremental Fit Index), and CFI (Comparative Fit Index), all exceed the recommended 0.9 standard, demonstrating a strong alignment between the model and the observed data.

Furthermore, the RMR (Root Mean Square Residual) value is 0.026, and the RMSEA (Root Mean Square Error of Approximation) value is 0.064, both of which are well within the acceptable range of less than 0.08, confirming that the model effectively captures the relationships within the dataset with minimal residual error.

Since all major fit indices conform to commonly accepted research standards, it can be concluded that the model exhibits a good degree of fit, making it statistically sound and suitable for further interpretation and analysis.

Table 4.6 Verify factor analysis results

variable	Measurement metrics	Factor loading	CR	AVE
Of the	DU1	0.781	0.888	0.613
	DU2	0.860		
	DU3	0.755		
	DU4	0.744		
	DU5	0.770		

As observed from the above table, the standardized factor loadings for each measurement item across all variables exceed 0.6, indicating strong correlations between the observed indicators and their respective latent constructs. Additionally, the composite reliability (CR) values are all above 0.7, demonstrating a high level of internal consistency and reliability within the measurement model. Furthermore, the average variance extracted (AVE) values surpass 0.5, signifying that each construct captures a sufficient proportion of variance from its indicators.

These findings confirm that each variable exhibits strong convergent validity, ensuring that the measurement items effectively represent their intended theoretical constructs and providing a solid foundation for further statistical analysis.

Chapter 5: Conclusions and Policy Recommendations

5.1 Summary of the study

This study analyzes the impact of government research funding on the development of universities in Heilongjiang Province, focusing on the relationship between research funding and university development and talent training. Through the data collection and empirical analysis of three universities in Heilongjiang Province, this study confirms the key role of government financial support in promoting the research capacity of universities, improving academic output, and optimizing talent training. The results show that stable and sufficient scientific research

funding can help universities improve the construction of scientific research infrastructure, enhance teachers' enthusiasm for scientific research, and improve the quality and quantity of overall scientific research results.

In terms of data analysis, AMOS and SPSS were used to validate the questionnaire data. Based on the 465 valid questionnaires collected, the study explored the intrinsic relationship between government research funding support and university development through structural equation modeling (SEM) and correlation analysis. The results show that the investment of scientific research funds has a significant positive impact on the scientific research innovation ability and talent training quality of universities. Among them, there is a strong correlation between the research funding support variable (SRFS) and the university development variable (DU), which further confirms the key role of government funding in promoting the sustainable development of universities.

In addition, the study also explores the impact of the allocation model of scientific research funds on the research efficiency of universities, and finds that the rational allocation of funds not only affects the research output, but also determines whether universities can attract and cultivate high-level academic talents. The effective management of scientific research funds can promote multidisciplinary research, improve the application and conversion rate of research results, and enhance the social service capacity of universities. At the same time, the role of the government's fund management system and funding model in scientific research and innovation cannot be ignored, and optimizing the financial allocation mechanism will help improve the efficiency of fund use and further promote the high-quality development of universities.

Overall, this study verifies the positive impact of government research funding support on the development of universities through empirical analysis, and points out possible challenges in the management and allocation of research funds. These research conclusions not only provide data support for the government to formulate university research funding policies, but also provide an important reference for universities in scientific research fund management and academic development strategies.

5.2 Policy Recommendations

The results of this study show that the Heilongjiang provincial government's support for university research funds plays an important role in promoting university development and talent training. However, there are still many challenges in the allocation, management and use of scientific research funds, such as inefficient use of funds, uneven development of disciplines, and low conversion rate of scientific research achievements. In order to further optimize the role of government financial support and improve the scientific research ability and academic competitiveness of universities, the following policy recommendations are of great practical significance.

First of all, the allocation mechanism of scientific research funds should be optimized to ensure the accurate allocation of funds. When formulating scientific research funding policies, the government should pay more attention to the discipline characteristics, research advantages and regional development needs of universities, so as to improve the utilization rate of funds. At present, the development of scientific research is limited due to insufficient funding in some universities, and the use of funds in some universities is inefficient, so the government should explore more flexible funding allocation models, such as a performance-based funding mechanism based on scientific research outputs, and establish a more transparent and fair scientific research funding evaluation system to ensure that funds flow to projects and teams with real scientific research value. In addition, universities should be encouraged to diversify funding sources, such as enterprise cooperation and international research funds, so as to reduce the single dependence on government finance and improve the sustainability of research funding.

Second, it is necessary to strengthen the management and supervision of scientific research funds and improve the efficiency of the use of funds. The government can establish a stricter management system for scientific research funds, strengthen the monitoring of the whole process of the use of funds, and ensure the rational allocation and efficient use of scientific research funds.

At the same time, universities should improve their internal management level, improve the planning and auditing mechanism for the use of scientific research funds, and avoid the waste and inefficient use of funds. In addition, it is suggested that the government and universities should jointly establish an evaluation mechanism for scientific research funds, regularly evaluate the effectiveness of the use of funds, and make appropriate adjustments according to the evaluation results, so as to ensure that scientific research funds truly promote academic progress and scientific and technological innovation.

Third, strengthen the cultivation of talents and the construction of scientific research teams in colleges and universities, and enhance innovation capabilities. The government should increase support for young scholars and scientific research talents, such as setting up a special fund for young scholars and providing long-term and stable support for scientific research positions, so as to attract and retain high-level talents. At the same time, universities should be encouraged to strengthen international cooperation, introduce overseas high-level scientific research talents, and promote exchanges and cooperation between universities and internationally renowned research institutions. Universities should also optimize the training mode of postgraduate students, improve the scientific research practice ability of doctoral and master's students, and ensure that scientific research funds are not only used for research itself, but also can effectively promote the cultivation of high-level talents.

Fourth, promote the transformation of scientific research achievements and promote the deep integration of universities and industries. The government can introduce more incentive policies to promote the transformation of scientific research achievements of universities into enterprises, and form a benign industry-university-research cooperation mechanism. For example, the establishment of a fund for the transformation of scientific and technological achievements, to provide early financial support for scientific research projects with market potential, and to simplify the process of transformation of scientific research achievements and reduce institutional obstacles. At the same time, universities should strengthen cooperation with local enterprises, jointly set up industrial research centers and technology incubation platforms, and improve the market-oriented application rate of scientific research results, so as to better serve local economic and social development.

Finally, it is necessary to promote the internationalization of scientific research and enhance the global competitiveness of universities. In the context of globalization, the development of scientific research in universities should not only be based on local research, but also oriented to the world. The government should encourage universities to participate in international scientific research cooperation, set up special funds for international cooperative research, and support universities to carry out cross-border joint research. At the same time, we should actively introduce international scientific research resources, such as overseas high-level scholars, international frontier laboratories, and transnational academic projects, so as to expand the research horizons of universities and improve their international influence. Universities should also strengthen foreign academic exchanges, promote the participation of scientific researchers in international academic conferences and cooperation projects, and learn from international advanced experience to improve the overall level of scientific research.

To sum up, optimizing the management and use of scientific research funds, strengthening the scientific research capacity building of universities, and promoting the effective transformation of scientific and technological achievements are the keys to promoting the high-quality development of universities in Heilongjiang Province. The government, universities and enterprises should form a benign interaction, jointly promote the improvement of the scientific research level of universities through policy innovation and resource integration, and provide more powerful scientific and technological support for regional economic and social development.

5.3 Research Limitations and Future Directions

This study systematically analyzes the impact of government research funding support on the development of universities and talent training in Heilongjiang Province, and reveals the positive effect of scientific research funding on the scientific research ability, academic output and talent training quality of universities. However, this study still has some limitations, and needs to be further improved and expanded in future research.

First of all, the data source of this study is mainly based on the questionnaire survey of three universities in Heilongjiang Province, although it is representative, but there are still limitations at the regional and university levels. There are various types of universities in Heilongjiang Province, and there are differences in the use mode and management level of scientific research funds in different universities, and the sample of this study is mainly concentrated in some key universities, which may not fully reflect the situation of all universities. Therefore, future studies can expand the sample range to cover more universities at different levels, so as to improve the generalizability of research conclusions. In addition, since the cross-sectional data used in this study cannot fully reveal the long-term impact of research funding support on university development and talent training, longitudinal data analysis can be used in future studies to more accurately evaluate the long-term role of research funding.

Secondly, this study mainly used the questionnaire survey method and combined AMOS and SPSS for data analysis, although it can provide more reliable quantitative research results, but there is still a lack of in-depth qualitative analysis. Questionnaires may be subjectively biased, and respondents' perceptions of research funding management and university development may be influenced by personal experience or institutional policies. In addition, although structural equation modeling (SEM) can better verify the relationship between variables, it cannot delve into the specific mechanism in the allocation of research funds. Therefore, future research can combine qualitative methods such as interviews, case studies or experimental studies to further enrich the research conclusions, and deeply explore how to optimize the research funding management system to maximize its role in promoting the development of universities.

In addition, this study mainly focuses on the overall impact of research funding on the development of universities, but fails to distinguish the use of research funds in different disciplines in detail. For example, engineering and technology disciplines may rely more on experimental equipment and project funds, while humanities and social sciences disciplines may pay more attention to academic publishing and talent exchange. Therefore, future research can further refine the subject categories and compare and analyze the characteristics of different disciplines in the use of scientific research funds, so as to formulate more targeted financial support policies.

In terms of policy impact, although this study explores the role of government financial support, there is little discussion on the specific problems and optimization paths in the process of policy implementation. For example, factors such as the application process for scientific research funds, the method of disbursement of funds, and the performance evaluation mechanism may directly affect the efficiency of the use of funds and the output of scientific research results. Therefore, future research can focus on the details of scientific research fund management, analyze the advantages and disadvantages of different management models, and put forward more precise policy optimization suggestions.

Finally, with the changes in the global scientific and technological innovation environment, the way the government supports the scientific research of universities is also constantly adjusted. Future research should pay attention to the latest trends in the management of international higher education research funds, and learn from the experience of foreign universities in the allocation of scientific research funds, performance appraisal and transformation of scientific and technological achievements, so as to provide more scientific and effective policy suggestions for the scientific research management of universities in Heilongjiang Province and other parts of China.

Overall, this study provides important empirical evidence for understanding the impact of government research funding on university development, but there is still room for improvement. Future research can provide more comprehensive theoretical support and

practical guidance for optimizing the management of university research funds and improving scientific research output by expanding the scope of data, combining multiple research methods, in-depth analysis of the research funding needs of different disciplines, and exploring international experience.

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