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The impact of academic resource sharing on university development and talent training in Heilongjiang Province, China

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Abstract: Against the backdrop where academic resource sharing emerges as a pivotal driver for university development and talent cultivation, this study delves into its impact on universities in Heilongjiang Province, China. Data were collected from three representative institutions—Harbin Engineering University, Qiqihar University, and Heihe University. Employing quantitative approaches involving SPSS and AMOS, it analyzed the correlation between academic resource sharing and university development. Findings indicate that such sharing significantly enhances universities' research capabilities, spurs interdisciplinary collaboration, and improves teaching quality. It also optimizes talent cultivation by providing extensive high-quality learning materials, faculty expertise, and international academic networks. However, challenges like uneven resource distribution, administrative bottlenecks, and lack of institutional incentives impede its full potential. Consequently, this study proposes policy recommendations, including improving resource-sharing mechanisms, strengthening inter-university cooperation, and bolstering institutional support frameworks. These measures can contribute to the long-term development of universities and the establishment of a more innovative and globally competitive higher education system in Heilongjiang Province.

Keywords: *Academic resource sharing, Educational policy, Higher education, Institutional innovation, Knowledge transfer, Research collaboration, Talent cultivation, University development.*

1. Introduction

1.1. Background

As an important education and scientific research base in Northeast China, Heilongjiang Province has a number of high-level universities and scientific research institutions, covering engineering technology, agricultural science, aerospace, materials science and other disciplines. In recent years, the Heilongjiang Provincial Government has increased its investment in scientific research in colleges and universities, and promoted the development of scientific research in universities through policy support, scientific research funding support, and international cooperation. These measures not only enhance the academic competitiveness of universities, but also promote the transformation of local economies and the improvement of scientific and technological innovation capabilities [1].

The university system in Heilongjiang Province is centered on Harbin Institute of Technology, Harbin Engineering University, Northeast Agricultural University and other "double first-class" universities, supplemented by local comprehensive universities and vocational colleges, which together constitute a relatively complete higher education and scientific research system. Among them, Harbin Institute of Technology (HIT), as one of the top engineering universities in China, is a national leader in aerospace, robotics, materials science and other fields, and has established close cooperation with China Aerospace Science and Technology Corporation, COMAC and other institutions [2]. In addition,

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Harbin Engineering University has strong scientific research advantages in marine engineering, shipbuilding, artificial intelligence and other disciplines, and has made important contributions to national defense science and technology research based on its military background [3].

In the field of agricultural science, Northeast Agricultural University has long focused on the research of modern agricultural science and technology, especially in cold agriculture, animal husbandry, and grain crop improvement. Through cooperation with the government and enterprises, the university has promoted the transformation and application of agricultural scientific and technological achievements, and improved the agricultural productivity of Heilongjiang Province and even the whole country [4]. In addition, universities such as Heilongjiang University and Harbin Normal University also have certain academic influence in the fields of linguistics, chemical engineering, ecological and environmental protection, and actively participate in international scientific research cooperation to promote interdisciplinary development [5].

Although universities in Heilongjiang Province have made certain achievements in scientific research development, compared with the top universities in the eastern coastal areas of China, there are still problems such as insufficient scientific research funds, low conversion rate of scientific research results, and international influence to be improved. According to the statistics released by the Ministry of Education, the scientific research funding of universities in Heilongjiang Province is still at a low level compared with Beijing, Shanghai, Guangdong and other places, which affects the development of scientific research projects and the introduction of high-level talents to a certain extent [6]. In addition, due to the constraints of geographical location and economic development level, the industry-university-research cooperation of some universities is still relatively limited, and the conversion rate of scientific and technological achievements to the market is low.

In order to enhance the status of universities in Heilongjiang Province in the domestic university system, the government and universities need to strengthen the integration of scientific research resources, promote university alliances and cross-university cooperation, optimize the allocation mechanism of scientific research funds, and improve the level of international academic exchanges. In the future, with the continuous promotion of the national "double first-class" construction and the continuous increase of policy support in scientific and technological innovation in Heilongjiang Province, the scientific research capacity and academic influence of universities in the region are expected to be further improved [1].

Academic resource sharing refers to the interconnection of scientific research equipment, data resources, academic achievements, teaching resources and talents through a collaborative mechanism among universities, scientific research institutions and other academic organizations to improve the efficiency of academic research, promote knowledge innovation and optimize resource allocation [7]. Academic resource sharing covers many aspects, including but not limited to scientific research infrastructure sharing, data open sharing, academic publication sharing, international academic cooperation, distance education sharing, etc. [1].

In the university research system, academic resource sharing is usually carried out through cross-university cooperation, national or regional research platforms, international joint research projects, open access databases, etc. For example, the sharing of large scientific equipment can reduce the cost of research and improve the utilization of experimental facilities, while open data sharing can promote the transparency and reproducibility of research and increase the speed of scientific discovery [8]. In addition, the rise of online education platforms in recent years has also prompted higher education institutions to collaborate more broadly on curriculum resources, teaching methods, and educational technologies [9].

In the context of globalization, the sharing of academic resources has become an important means to enhance the competitiveness of university research, promote interdisciplinary cooperation and promote high-quality education. Many countries and regions have established national or international academic resource sharing platforms to promote collaboration between universities and research institutions. For example, the European Union's "Horizon Europe" program, China's National Science and Technology

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Resource Sharing Service Platform, and the National Science Foundation (NSF) data sharing policy in the United States have all played an important role in promoting the openness of scientific research data, the sharing of scientific research equipment, and international scientific research cooperation [10].

First, academic resource sharing can reduce the duplication of investment in scientific research institutions, improve resource utilization, and promote interdisciplinary research. For example, open data sharing enables researchers from different disciplines to use the same dataset to drive interdisciplinary innovation [5]. In addition, the scientific research equipment sharing platform enables universities and research institutions to share advanced instruments between different laboratories, thereby improving the efficiency of experimental research [11].

Second, in the global higher education system, the sharing of academic resources can help universities expand international cooperation and improve academic influence. For example, Open Access Publishing makes scholarly papers freely available to researchers around the world, facilitating knowledge dissemination and increasing the international visibility of universities [12]. In addition, the establishment of an international research collaboration network enables universities to participate in global scientific research projects and improve academic competitiveness [13].

Thirdly, the sharing of online educational resources, such as Massive Open Online Courses (MOOCs), enables students across the globe to receive high-quality education. For example, platforms such as Coursera and edX have partnered with the world's top universities to provide free or low-cost online courses, making high-quality educational resources accessible to students in under-resourced areas [14]. In addition, the sharing of academic resources promotes educational equity, enabling universities in developing countries to access advanced research materials and compensate for the lack of research resources.

Finally, the sharing of academic resources not only promotes the development of basic research, but also accelerates the application and transformation of scientific research results. Collaborative research platforms between governments, enterprises and universities can improve the marketization of scientific and technological achievements and promote industrial technology upgrading. For example, Germany's "Fraunhofer model" enables the efficient sharing of academic resources and the rapid industrialization of scientific and technological achievements through in-depth cooperation between universities and enterprises [15].

In summary, the sharing of academic resources has become an important trend in the development of the global higher education system, which not only helps to improve the efficiency and academic influence of scientific research, but also optimizes the allocation of educational resources and promotes scientific and technological innovation and economic development. In the future, universities and governments should further improve the academic resource sharing mechanism, promote cross-border academic cooperation, promote the popularization of open data and open publishing, and promote the transformation of scientific and technological achievements into the market, so as to better serve social and economic development.

1.2. Research Implications

The sharing of academic resources plays an important role in promoting the development of universities and talent training in Heilongjiang Province. As an important educational and scientific research base in Northeast China, Heilongjiang Province has a number of universities with strong scientific research capabilities, such as Harbin Institute of Technology, Harbin Engineering University, and Northeast Agricultural University. However, due to the influence of regional economic development level and geographical location, universities in Heilongjiang Province still have certain limitations in terms of scientific research resource allocation, talent flow, and academic exchange [16]. The sharing of academic resources can effectively alleviate these problems, promote scientific research and innovation in universities, improve the quality of talent training, and enhance the academic competitiveness and social influence of universities in Heilongjiang Province.

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First of all, the sharing of academic resources is helpful to improve the scientific research level and innovation ability of universities. By establishing a cross-university research cooperation mechanism and sharing platform, universities in Heilongjiang Province can make more effective use of limited scientific research equipment, laboratory and database resources, avoid duplication of investment, and improve research efficiency. For example, sharing high-end experimental instruments and experimental data can reduce research costs, allowing universities to devote more funds to core research projects [17]. In addition, the open sharing of academic resources can also accelerate the transformation of scientific and technological innovation achievements, improve the scientific and technological service capabilities of universities, and provide stronger technical support for local economic development [18].

Secondly, the sharing of academic resources can optimize the talent training system and improve students' scientific research literacy and practical ability. Sharing high-quality course resources and academic exchange platforms enables students from different universities to enjoy richer academic resources and broaden their knowledge horizons. For example, through the sharing of online courses and the mutual recognition of credits between universities, students from universities in Heilongjiang Province can take special courses from other universities while studying the core courses of their majors in their own universities, so as to improve their interdisciplinary learning ability [19]. In addition, the cross-university collaborative research project and supervisor co-mentoring mechanism enables graduate students to receive guidance from supervisors from different disciplinary backgrounds, improve the quality of scientific research training, and enhance academic independence and innovation ability [20].

In addition, the sharing of academic resources can promote international cooperation and academic exchanges between universities, and improve the internationalization level of universities in Heilongjiang Province. In recent years, global higher education has increasingly moved towards an open and shared model, and universities can more easily conduct international academic exchanges through academic conferences, international joint research projects, and remote research collaborations [21]. By establishing a scientific research cooperation network with domestic and foreign universities, universities in Heilongjiang Province can introduce international advanced research methods, improve the academic level of local researchers, and attract high-level talents to work or study locally, so as to enhance the academic influence of regional universities [22].

Finally, the sharing of academic resources can promote the equity of higher education and improve the efficiency of the use of educational resources. There is a certain imbalance in the distribution of educational resources in universities in Heilongjiang Province, and some universities have difficulty obtaining high-level teaching and research resources due to financial or geographical constraints. By establishing an open academic resource sharing platform, teachers and students from small and medium-sized universities and universities in remote areas can also obtain high-quality scientific research materials, online courses and experimental equipment, thereby narrowing the academic resource gap between universities and improving the quality of higher education in the whole region [2].

To sum up, the sharing of academic resources is of far-reaching significance for the development of colleges and universities in Heilongjiang Province and the cultivation of talents. It can not only enhance the scientific research and innovation ability of colleges and universities, optimize the talent training system, but also promote international cooperation and educational equity, and promote the overall improvement of the comprehensive strength of universities. In the future, the government and universities should increase investment and further improve the policies and mechanisms for sharing academic resources, so as to give full play to their role in promoting the development of higher education.

1.3. Research Objectives and Questions

The core objective of this study is to explore how the sharing of academic resources affects the development and talent training of universities in Heilongjiang Province, and to put forward suggestions for optimization. In the context of the increasing openness of global higher education, the

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sharing of academic resources has become an important means to improve the scientific research ability of universities and optimize the talent training model. As an important education and scientific research base in Northeast China, Heilongjiang Province has a certain foundation in scientific research cooperation, discipline development, talent training, and international academic exchanges, but it still faces problems such as uneven distribution of resources, insufficient scientific research cooperation, and limited talent flow [16]. This study will analyze the mechanism of academic resource sharing from multiple perspectives, and put forward optimization countermeasures based on the research results to promote the high-quality development of universities in Heilongjiang.

First, this study will evaluate the current situation of academic resource sharing among universities in Heilongjiang Province, focusing on the cooperation models of scientific research facilities, data platforms, academic publishing, talent mobility, and course sharing. Through questionnaires, interviews, and data analysis, this study will identify the main challenges faced by universities in the process of resource sharing, such as imperfect sharing platform construction, insufficient discipline cooperation, and insufficient policy support [19].

Secondly, this study will analyze the impact of academic resource sharing on the research ability and academic influence of universities. The development of universities is inseparable from high-level scientific research activities, and the sharing of academic resources can improve research efficiency, promote interdisciplinary cooperation, and promote the output of innovative results. This study will use quantitative and qualitative analysis methods to explore how shared resources can promote research collaboration, improve the quantity and quality of publications, and promote technological innovation and knowledge transfer [17].

In addition, this study will also explore how the sharing of academic resources can optimize the talent training model. Through the sharing of high-quality curriculum resources, joint training of graduate students, and academic exchanges among teachers, colleges and universities can improve students' learning experience, enhance scientific research training, and improve the quality of talent training. This study will focus on analyzing how universities can improve the academic competence of undergraduate and graduate students through resource sharing, and examine the impact of this sharing model on employability competitiveness.

Finally, this study will put forward optimization suggestions based on the research results to provide policy reference for governments, universities and research institutions. Suggestions may include: strengthening the integration of resources between universities, improving scientific research equipment and data sharing platforms, promoting cross-university joint research, improving the level of international academic cooperation, and optimizing the talent training system [2]. These measures will help improve the overall scientific research level and talent competitiveness of Heilongjiang universities, and promote the sustainable development of regional higher education.

Research the question:

What is the current status of academic resource sharing in universities in Heilongjiang Province?

What is the impact of resource sharing on the scientific research level and discipline construction of universities?

How to optimize resource sharing through policies to enhance the comprehensive strength of universities?

1.4. Research Methods

In this study, quantitative analysis was used to analyze the data through statistical software such as SPSS and AMOS, so as to explore the impact of academic resource sharing on the development of universities and talent training. The data collection mainly relies on three representative universities in Heilongjiang Province - Harbin Engineering University, Qiqihar University and Heihe University, covering engineering, comprehensive disciplines and regional universities respectively, so as to ensure the breadth and representativeness of the data.

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In this study, we designed and distributed a questionnaire through communication with the personnel departments of the three universities to collect first-hand data on the sharing of academic resources, the development of scientific research in universities, and the mode of talent training. The design of the questionnaire is based on the theory of academic resource sharing, talent training theory and university development model, covering scientific research cooperation, experimental equipment sharing, data resource openness, faculty exchange and curriculum sharing, etc., and is measured by Likert Scale. A total of X questionnaires was issued, and Y questionnaires were recovered, of which Z were valid, and the effective recovery rate was XX%.

Data analysis was performed using SPSS 23.0 and AMOS 23.0, which mainly included the following steps.

Firstly, descriptive statistical analysis is carried out: the basic statistical description of the collected data is carried out, including the gender, age, professional title, scientific research experience, subject area and other demographic characteristics of the questionnaire fillers, so as to understand the basic composition of the sample.

Then, the reliability and validity test were performed: the internal consistency reliability of the Cronbach's alpha test questionnaire was used to ensure the reliability of the scale. At the same time, confirmatory factor analysis (CFA) was performed to evaluate the construct validity of the measurement model using AMOS software.

Finally, the structural equation model (SEM) is used to analyze the structural equation model (SEM) to explore how the sharing of academic resources affects the scientific research development and talent training quality of universities through different paths. The path analysis of AMOS can verify the mediating effect and causal relationship to ensure that the model fits well.

2. Literature Review

2.1. The Role of Academic Resource Sharing in the Development of Universities

The sharing of academic resources plays an important role in the global higher education system, which can effectively enhance the scientific research ability, academic competitiveness and social influence of universities. For universities in Heilongjiang Province, the sharing of academic resources can not only help optimize the scientific research environment, but also improve the level of discipline construction and promote regional economic and social development [23].

First of all, the sharing of academic resources can improve the scientific research capabilities of universities and promote scientific and technological innovation. By sharing experimental equipment, research data and academic literature, research teams from different universities can more easily access advanced research resources, reduce duplicate investment, and improve research efficiency. For example, open access databases and cross-university laboratory collaborations provide universities with a wider range of research opportunities, allowing researchers to focus on the scientific problem itself without resource constraints [24]. In addition, research collaboration networks between universities enable interdisciplinary integration, promote the development of emerging disciplines, and promote the output of innovative outcomes [25].

Secondly, the sharing of academic resources can help enhance the academic influence and international competitiveness of universities. In the context of globalization, the academic reputation of universities is not only determined by their own research capabilities, but also by international cooperation and knowledge dissemination. By sharing scholarly publications, open educational resources (OER) and international research platforms, universities are able to enhance communication with global scholars and increase the visibility and citation rate of research results [1]. For example, many universities have established online academic resource platforms to enable the work of their researchers to be disseminated more quickly to the global academic community, promoting international collaboration and knowledge sharing [26].

In addition, the sharing of academic resources promotes the equity and coordinated development of higher education. For universities with relatively scarce resources, the sharing mechanism can obtain

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richer academic materials and experimental conditions, thereby narrowing the research gap with top universities [16]. This not only enhances the overall research strength of universities, but also provides more development opportunities for students and researchers in underdeveloped areas. For example, in China, the academic resources of "double first-class" universities have been opened to local universities, enabling more scholars to participate in high-level scientific research and improving the research quality of the entire higher education system [27].

Finally, the sharing of academic resources can help promote the interaction between universities and society and promote the transformation of scientific and technological achievements. By building an industry-university-research cooperation platform, the research results of universities can be applied to actual production and management by enterprises and government agencies more quickly, thereby promoting economic growth and industrial upgrading [28]. Especially in frontier fields such as information technology, artificial intelligence and biomedicine, in-depth cooperation between universities and industry has become an important way to enhance technological innovation capabilities. For example, some universities have established innovation centers in collaboration with local governments and enterprises, so that academic research can more directly serve the needs of society and increase the contribution of universities to economic and social development [29].

In summary, the sharing of academic resources not only enhances the scientific research ability and academic influence of universities, but also promotes educational equity, regional coordinated development and transformation of scientific and technological achievements. For universities in Heilongjiang Province, further strengthening the sharing of academic resources will help build a more open, cooperative and efficient higher education system, and promote the development of regional education and scientific and technological innovation.

2.2. The Impact of Academic Resource Sharing on Talent Training

Academic resource sharing plays a key role in the higher education system, which can provide a better learning environment and development platform for talent training. By sharing academic resources, students can obtain richer educational resources, improve their research capabilities, expand their international perspectives, and enhance their interdisciplinary collaboration capabilities [23]. Especially in universities in Heilongjiang Province, the sharing of academic resources can not only help improve the quality of local talent training, but also promote the development of regional higher education, narrow the resource gap between universities, and promote educational equity [30].

First of all, the sharing of academic resources can improve the teaching quality of colleges and universities and the academic ability of students. Through online educational resources, open academic databases, and cross-school course sharing, students can be exposed to higher-quality teaching content and expand the boundaries of knowledge. For example, the sharing of Massive Open Online Courses (MOOCs) and virtual labs allows students to freely choose courses between different universities, breaking through geographical restrictions and increasing learning flexibility [19]. In addition, the opening of academic resources enables students to access more cutting-edge research results, improve their literature reading ability and critical thinking, and thus enhance their scientific research literacy [26].

Secondly, the sharing of academic resources promotes the standardization of postgraduate training and scientific research training. The sharing of experimental platforms, scientific research facilities and supervisor resources enables graduate students to obtain more scientific research training opportunities and enhance their experimental ability and thesis writing level. Many universities have established joint training mechanisms to enable graduate students to conduct research in laboratories of different universities, thereby enhancing their academic experience and practical skills [31]. In addition, the cross-university collaborative doctoral training model also promotes the high-end training of talents, so that they have a broader academic vision and stronger innovation ability [32].

In addition, the sharing of academic resources promotes international exchanges and cooperation, and broadens the international path of talent training. Collaborative research projects and student

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exchange programs between universities allow students to participate in cross-border academic exchanges earlier and improve their academic communication and intercultural understanding skills [29]. In recent years, some universities in Heilongjiang Province have joined the Global Academic Alliance, providing students with more opportunities for international academic exchanges and improving the international competitiveness of talent training through joint research projects, academic conferences, and international mentorship [33].

Finally, the sharing of academic resources promotes interdisciplinary cooperation and enhances students' innovation ability. With the rise of modern interdisciplinary research, students of different majors can participate in scientific research projects through shared resources, and carry out in-depth cooperation in interdisciplinary fields such as bioinformatics, artificial intelligence, and environmental science [34]. This cooperation model not only enables students to acquire multidisciplinary knowledge in the process of scientific research, but also improves the ability to solve complex problems and promotes the cultivation of interdisciplinary talents.

In summary, the sharing of academic resources provides a more complete support system for the cultivation of talents in colleges and universities by optimizing teaching resources, improving the quality of scientific research and training, expanding international cooperation and promoting interdisciplinary research. For universities in Heilongjiang Province, further strengthening the integration and sharing of academic resources will help cultivate more high-level talents and enhance the overall competitiveness of regional higher education.

2.3. The Current Situation and Experience of Academic Resource Sharing in Universities at Home and Abroad

The sharing of academic resources has become an important trend in the development of global higher education, and universities in many countries and regions have improved the efficiency of scientific research and the quality of talent training by building sharing platforms, opening up scientific research data, and promoting academic cooperation. Different countries have their own characteristics in terms of academic resource sharing, and Chinese universities have been actively exploring resource sharing models suitable for their own national conditions in recent years [35].

Internationally, universities in Europe and the United States have established a sound academic resource sharing system earlier. In the United States, for example, the National Science Foundation (NSF) has promoted the establishment of several open science data platforms, such as the Open Science Framework (OSF), to encourage universities and research institutions to share scientific research data to improve the transparency and reproducibility of research [36]. In addition, U.S. universities generally adopt the model of cross-university laboratory cooperation, such as the EdX open course platform established by the Massachusetts Institute of Technology (MIT) in cooperation with Harvard University, which not only promotes the sharing of courses, but also promotes the circulation of global higher education resources [37].

European universities are also taking active steps in the sharing of academic resources. For example, the European Union's Horizon Europe research funding scheme requires all participating universities to share research results and ensure efficient use of research funding (European Commission, 2021). In addition, the European University Alliance (EUA) has launched Open Access Policies to encourage the free sharing of academic journals, conference papers, and research data to increase the presence of European universities in the global academic community [38].

Compared with Europe and the United States, the academic resource sharing system of Chinese universities is still developing. In recent years, the Ministry of Science and Technology and the Ministry of Education have successively introduced a series of policies to promote the sharing of academic resources. For example, China has established a national science and technology resource sharing service platform, covering multiple fields such as laboratory equipment, scientific data, and scientific and technological literature, to provide shared resources for universities and scientific research institutions across the country [39]. In addition, Chinese universities are gradually promoting cross-university cooperation, such as academic databases and joint research centers jointly established by

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universities such as Peking University and Tsinghua University, which provide strong support for the sharing of academic resources [22].

Despite this, Chinese universities still face many challenges in sharing academic resources. For example, there is an imbalance in the allocation of resources among some universities, and there is a large gap between key universities and ordinary universities in terms of research facilities and data sharing [26]. In addition, due to the influence of policies and management systems, there are still certain barriers to cooperation between universities, and how to optimize the sharing mechanism of scientific research funds and improve the mutual trust and willingness to cooperate among universities is still a problem that needs to be solved [25].

In general, domestic and foreign universities have their own advantages and challenges in terms of academic resource sharing. European and American universities have established mature open access systems and cross-university cooperation mechanisms earlier, while Chinese universities have been accelerating the pace of resource integration driven by government policies. In the future, China can learn from the experience of Europe and the United States, further improve the platform for sharing academic resources, strengthen international cooperation, and improve the overall scientific research level and talent training quality of universities.

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.

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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.

4. Empirical Analysis

4.1. Introduction

First, a predictive 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 applicability for subsequent analysis using large amounts of data.

Table 1.
Case Handling Summary.

		Number of cases	%
Cases	Effective	465	100
	Exclude	0	0
	Total	465	100

Note: a. Column deletion based on all variables in the process.

Table 2.
Reliability statistics.

Clonbach Alpha	Cloning Bach based on standardized terms Alpha	Number of items
0.887	0.888	10

4.2. Reliability Analysis

It can be seen from the case processing summary table that a total of 465 valid questionnaires were collected in this study, and no cases were eliminated, indicating that the data integrity was high and there were no missing values, so as to ensure the reliability of data analysis. In terms of reliability statistics, the Alpha coefficients of Clonbach were 0.887 and 0.888 (normalized terms), both close to 0.9, indicating that the scale had high internal consistency and the reliability of the measurement tools was ideal. The results show that the measurement dimension of academic resource sharing (ARS) on the high-level development (DU) of universities is relatively stable, and the data quality is high, which can support the subsequent quantitative analysis and structural equation model (SEM) construction. The high reliability of the data base also means that the reliability of the research conclusions is strong, which provides a solid statistical support for further exploring the role of academic resource sharing in the development of universities and talent training.

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Table 3.
Correlation matrix between items.

	ARS1	ARS2	ARS3	ARS4	ARS5	DU1	DU2	DU3	DU4	DU5
ARS1	1.000									
ARS2	0.674	1.000								
ARS3	0.617	0.617	1.000							
ARS4	0.711	0.624	0.606	1.000						
ARS5	0.631	0.598	0.603	0.581	1.000					
DU1	0.338	0.275	0.246	0.328	0.303	1.000				
DU2	0.356	0.275	0.302	0.331	0.305	0.675	1.000			
DU3	0.331	0.273	0.340	0.284	0.301	0.560	0.679	1.000		
DU4	0.314	0.263	0.275	0.294	0.283	0.579	0.635	0.542	1.000	
DU5	0.315	0.252	0.288	0.293	0.317	0.625	0.634	0.578	0.602	1.000

4.3. Exploratory Factor Analysis

Table 3 of the correlation matrix shows the correlation between the various measures of Academic Resource Sharing (ARS) and High Level of University Development (DU). It can be seen from the table that the correlation between the measurement items of ARS (ARS1-ARS5) is strong, and the correlation coefficient is above 0.6, indicating that the variable of academic resource sharing has a high consistency, and each measurement item can better reflect the connotation of this variable. Similarly, the measurement items of the DU variable (DU1-DU5) also showed a high internal correlation, with correlation coefficients ranging from 0.54 to 0.68, indicating that the measurement dimension of high-level development of universities was relatively stable.

In terms of the correlation between the independent and dependent variables, the correlation coefficient between the measured items of ARS and the measured items of DU is generally between 0.25 and 0.35, indicating that the sharing of academic resources has a certain positive impact on the high-level development of universities, although the correlation degree is relatively moderate. This indicates that the sharing of academic resources among universities can promote the development of universities to a certain extent, but its impact may be disturbed or limited by other factors. In addition, ARS4 had the highest correlation with DU1 and DU2, which were 0.328 and 0.331, respectively, indicating that this measurement item may play a key role in influencing the development of universities, which may be related to the depth, accessibility or cooperation mode of resource sharing. Overall, the results of the correlation analysis provide preliminary support for the subsequent structural equation modeling, indicating that there may be a causal relationship between academic resource sharing and university development.

4.4. Confirmatory Factor Analysis (CFA) via Individual Measurement Model

In this study, a single variable was assessed using a total of five measurement items to examine its structural integrity and measurement consistency. To ensure the construct validity and reliability of the measurement model, Confirmatory Factor Analysis (CFA) was conducted using AMOS 23.0.

Upon completing the analysis, the figure and table presented below illustrate key statistical outcomes, including standardized factor loadings, model fit indices, and reliability estimates such as composite reliability (CR) and average variance extracted (AVE). The factor loadings indicate the strength of the relationship between observed items and the latent construct, while the model fit indices assess how well the model aligns with the observed data. Furthermore, the reliability estimates validate the internal consistency of the measurement model.

These findings offer a comprehensive evaluation of the measurement model, confirming its statistical robustness and suitability for further hypothesis testing, structural modeling, and theoretical interpretation within the study.

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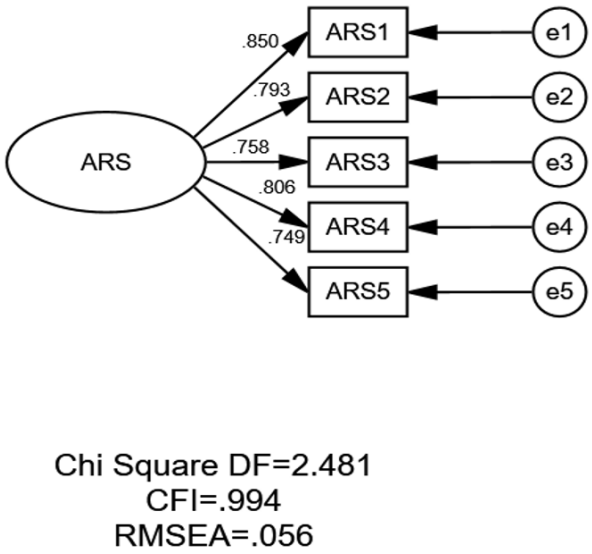

Figure 1.
Individual Model for ARS.

Table 4.
Confirmatory factor model fit.

Model fitting metrics	Optimal standard value	Statistical value	Fit
CMIN	——	12.406	——
DF	——	5	——
CMIN/DF	<3	2.481	Good
RMR	<0.08	0.019	Good
GFI	>0.9	0.989	Good
AGFI	>0.9	0.968	Good
NFI	>0.9	0.990	Good
YOUTH	>0.9	0.994	Good
TLI	>0.9	0.988	Good
CFI	>0.9	0.994	Good
RMSEA	<0.08	0.056	Good

From the above table, it can be observed that the CMIN/DF value is 2.481, which falls 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 standard of 0.9, suggesting that the model demonstrates a strong alignment with the observed data.

Furthermore, the RMR (Root Mean Square Residual) value is 0.019, and the RMSEA (Root Mean Square Error of Approximation) value is 0.056, both of which fall below the 0.08 threshold, indicating minimal residual error and further supporting the adequacy of the model.

Given that all major fit indices conform to commonly accepted research standards, it can be concluded that the model exhibits a strong and well-balanced fit, making it statistically sound and suitable for further interpretation and analysis.

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Table 5.
Verify factor analysis results.

variable	Measurement metrics	Factor loading	CR	AVE
ARS	ARS1	0.850	0.894	0.627
	ARS2	0.793		
	ARS3	0.758		
	ARS4	0.806		
	ARS5	0.749		

As observed from the above table, the standardized factor loadings for each measurement item across all variables exceed 0.6, indicating a strong correlation between the observed indicators and their respective latent constructs. Additionally, the composite reliability (CR) values are all greater than 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, ensuring strong explanatory power.

These findings collectively confirm that each variable exhibits good convergent validity, meaning that the measurement items effectively represent their intended theoretical constructs. This provides robust support for the reliability and validity of the model, ensuring its suitability for further statistical analysis, hypothesis testing, and theoretical interpretation.

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.

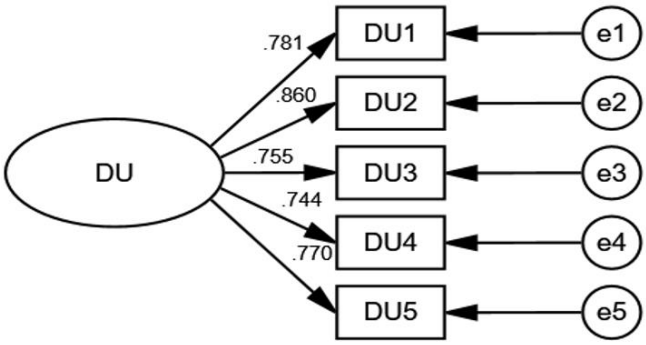

Figure 2.
Individual Model for DU.

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Table 6.
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 7.
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.

5. Conclusions and Policy Recommendations

5.1. Summary of the Study

This study focuses on the impact of academic resource sharing on university development and talent training in Heilongjiang Province, and explores how academic resource sharing can promote academic development, scientific research innovation and high-level talent cultivation in universities by

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combining theoretical research and empirical analysis. In this study, data were collected from Harbin Engineering University, Qiqihar University, and Heihe University, and statistical tools such as SPSS and AMOS were used to verify the role of academic resource sharing in the development of universities.

The results show that the sharing of academic resources has a significant positive impact on the development of universities. Through the open sharing of resources, it can effectively improve the scientific research efficiency of universities, optimize the allocation of academic resources, promote academic cooperation between different universities, and improve the quality of research results. In addition, the sharing of academic resources also has a profound impact on talent training, which can provide students and teachers with a broader academic vision, improve the level of teaching and scientific research, and enhance the advantages of colleges and universities in talent competition.

The results of data analysis showed that the Clonbach α coefficients of each measured variable were within a reasonable range in the reliability test, indicating that the questionnaire data had high internal consistency. The correlation analysis further confirmed the close relationship between academic resource sharing, university development and talent training, and showed that resource sharing can not only promote the improvement of scientific research level, but also enhance the quality of talent training by optimizing the allocation of teaching resources.

In general, this study deeply explores the role of academic resource sharing in the development of universities, verifies the importance of resource sharing to enhance academic competitiveness, and provides a reference for university managers to optimize the allocation of academic resources. The conclusions of this study provide theoretical support for the government and universities to formulate academic resource sharing policies, and provide an empirical basis for further promoting the coordinated development of universities.

5.2. Policy Recommendations

Based on the analysis results of this study, universities in Heilongjiang Province should further strengthen the sharing of academic resources to promote the high-quality development of universities and the improvement of talent training system. First of all, it is necessary to establish a sound academic resource sharing platform to promote the integration and exchange of resources between universities, build a unified academic database through information technology, and realize the efficient sharing of literature, experimental equipment, scientific research data and other resources. Universities should strengthen cooperation and promote cross-university and cross-regional cooperation mechanisms for scientific research projects, so as to promote the rational allocation of resources and improve the influence of research results.

Second, the government should increase policy support for the sharing of academic resources, and formulate clear incentives to encourage universities and research institutions to take the initiative to open up and share resources. Financial support should be tilted towards the resource sharing system, providing special funds for universities to build resource sharing infrastructure, and encouraging enterprises and universities to build a sharing platform to promote the deep integration of industry, education and research.

In addition, colleges and universities should optimize their internal management mechanisms and promote the normalization of academic resource sharing. Establish a unified management system to ensure the sustainability of open sharing of academic resources, improve the performance appraisal system, incorporate the effectiveness of resource sharing into the evaluation criteria of universities, and encourage teachers and researchers to actively participate in academic cooperation and resource sharing.

Finally, it is necessary to improve the awareness of teachers and students on the sharing of academic resources, and strengthen relevant training and publicity. Through the holding of academic resource sharing lectures and training courses, teachers and students are guided to make full use of the sharing platform to improve the efficiency of academic research. At the same time, universities are encouraged to build an international cooperation network, establish close ties with well-known universities and

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research institutions at home and abroad, learn from international advanced experience, and enhance the academic influence of universities in Heilongjiang Province in the country and even the world.

Through the above measures, colleges and universities in Heilongjiang Province will be able to make more efficient use of academic resources, enhance academic competitiveness, promote high-level talent training, and provide strong intellectual support for regional economic and social development.

5.3. Research Limitations and Future Directions

Although this study explores the impact of academic resource sharing on the development of universities and talent training in Heilongjiang Province through empirical analysis, and draws conclusions with reference value, there are still some limitations. First of all, the research data mainly comes from three universities in Heilongjiang Province, and the sample range is relatively limited, which is difficult to fully reflect the situation of all universities in terms of academic resource sharing. Therefore, future studies can expand the sample to cover more types of universities to improve the generalizability of research conclusions.

Secondly, this study used a questionnaire survey method to collect data, although the questionnaire has been tested for reliability and validity, it may still be affected by the subjective judgment of the participants, resulting in a certain degree of bias. Future research can combine qualitative research methods such as interviews and case studies to better understand the mechanism and influencing factors of academic resource sharing in universities. In addition, cross-sectional data is mainly used for analysis, which is difficult to directly verify the long-term impact of academic resource sharing on university development and talent training. Therefore, follow-up research can use longitudinal data tracking to reveal how shared resources can promote the development of research and teaching in universities in the long term.

In addition, this study only focuses on the direct impact of academic resource sharing on the development of universities, but does not deeply explore other possible mediating variables and moderating factors, such as policy environment, government financial support, and independent innovation ability of universities. Future research can build more complex theoretical models and analyze the role of different variables in the development of universities, so as to go deeper.

Overall, although this study provides important empirical support for exploring the value of academic resource sharing, there is still room for further optimization. Future research can further improve the understanding of the academic resource sharing mechanism of universities by expanding the scope of data, optimizing research methods, and digging deeper into influencing factors, so as to provide more accurate theoretical support for policy formulation and university management.

Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

Copyright:

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