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Contribution of Scientific and Technological Innovation in Central and Western China's Universities to High-Quality Economic Development: An Empirical Analysis Across 18 Provincial-Level Administrative Divisions in China

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Abstract

As a novel driving force for high-quality economic development, scientific and technological innovation in universities is of great significance to promoting high quality regional economic development and achieving overall coordinated development of the national economy. In order to objectively present the impact mechanism of scientific and technological innovation capabilities of universities on high-quality economic development in the central and western regions and give full play to the driving role of scientific and technological innovation in universities on economic development in the central and western regions, the economic development data of 18 provinces, municipalities and autonomous regions in the central and western regions from 2011 to 2020 and the scientific and technological innovation data of universities in the previous year were selected. The entropy method was used to calculate the level of high-quality economic development and the scientific and technological innovation capabilities of universities, and the two-way fixed effect panel model was used to examine the impact of scientific and technological innovation on high-quality economic development. The study found that the scientific and technological innovation capabilities of universities are closely related to the level of economic development in the central and western regions; the three major elements of scientific and technological innovation in universities have a significant positive impact on high-quality economic development; the input and output of scientific and technological innovation in universities have a significant impact on economic innovation development, and the process of scientific and technological innovation has a significant positive impact on economic openness and shared development; the regional heterogeneity test shows that there are differences in the impact of scientific and technological innovation results of universities on high-quality economic development in the central and western regions, while the regional heterogeneity test shows that there are differences in the impact of scientific and technological innovation results of universities on high- quality economic development in the central and western regions. In summary, the government should start from the aspects of financial investment in scientific research and the formulation of scientific and technological innovation goals, promote the improvement of scientific and technological innovation capabilities of colleges and universities, and drive the high-quality economic development of the central and western regions.

Keywords: *Central and western regions, Scientific and technological innovation in universities, High-quality economic development*

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1. Introduction

The report of the 20th CPC National Congress clearly pointed out that high-quality development is the primary task of building a modern socialist country in an all-round way. We should adhere to the theme of promoting high-quality development and focus on promoting regional coordinated development (The Central People's Government of the People's Republic of China, 2022) . The problem of unbalanced and inadequate development in the central and western regions[1] (The Central People's Government of the People's Republic of China., 2020; 2021), and the development gap with the eastern region is still large, which has become the key to restricting the high-quality development of my country's overall economy and the shortcoming and weak link in the construction of a socialist modern power. Studies have shown that the growth rate of per capita GDP in the central region is slow, and the per capita GDP in the western region has also been steadily increasing since the implementation of the western development strategy, but there is still a large gap between the per capita GDP of the central and western regions and that of the eastern region (Guo, Q., 2020). At present, we must grasp the main contradictions, work hard to overcome difficulties, and promote the leap in the level of economic development in the central and western regions.

As a strategic endogenous force for the development of the central and western regions, higher education in the central and western regions has a considerable impact on the overall revitalization of the central and western regions and the overall high-quality development of my country. The Party Central Committee attaches great importance to the development of higher education in the central and western regions. Based on the strategies of "Western Development" and "Rise of the Central Region", it has formulated and issued a number of policies to revitalize higher education in the central and western regions. On September 1, 2020, General Secretary presided over the 15th meeting of the Central Committee for Deepening Reform to review the "Opinions on Revitalizing Higher Education in the Central and Western Regions in the New Era", emphasizing the need to stimulate the endogenous motivation and development vitality of higher education in the central and western regions and promote the formation of a higher education system that matches the development and opening-up pattern of the central and western regions (The Central People's Government of the People's Republic of China, 2021). In September 2021, the General Office of the CPC Central Committee and the General Office of the State Council officially issued relevant documents. Comprehensively improving the quality of talent training, scientific research and innovation, and social service capabilities of higher education in the central and western regions has become a major strategic task for the reform and development of higher education in the central and western regions in the new era. We must enhance innovation as the first driving force, adhere to the main battlefield of the economy, give full play to the important role of universities in scientific research, and form a strategic force to promote high-quality economic development (The Central People's Government of the People's Republic of China., 2020). As the intersection of science and technology as the first productivity, talent as the first resource, and innovation as the first driving force, universities are of self-evident importance to the high-quality development of the economy. Under the current strategic goal of realizing socialist modernization and promoting the revitalization of the central and western regions, it is particularly important to clarify the logical reasoning of how scientific and technological innovation of universities in the central and western regions affects the high-quality economic development.

1.1. The Relationship Between Scientific and Technological Innovation of Universities and Regional Economic Development

Education has the function of promoting the development of science and technology and is the key link in transforming science and technology into real productivity. As the first driving force for development, scientific and technological innovation is the strategic support for building a modern economic system. As an important part of the education system, higher education plays the same role in scientific and technological innovation and economic development. This paper examines the impact of scientific and technological innovation in universities on high-quality economic development based on this assumption. Every scientific and technological revolution in human society will bring about tremendous development of the economy and society. Since the "university-industry-government" triple helix theory (Etzkowitz, 2005) was proposed, the scientific and technological innovation status of universities has begun to receive widespread attention from scholars at home and abroad, and the relationship between universities and regional economic development has entered the field of vision of researchers.

[1] According to the National Bureau of Statistics' economic regional division method, the central region includes six provinces, namely Shanxi, Anhui, Jiangxi, Henan, Hubei and Hunan; the western region includes 12 provinces, namely Inner Mongolia, Guangxi, Chongqing, Sichuan, Guizhou, Yunnan, Tibet, Shaanxi, Gansu, Qinghai, Ningxia and Xinjiang.

2. Literature Review

Foreign scholars have conducted in-depth research on the scientific and technological innovation capabilities of universities and their impact on high-quality economic development. First, through summary, it is found that the scientific and technological innovation capabilities of universities mainly include the scientific and technological innovation input, output and achievement transformation of universities. Among them, Bolli *et al*. believe that the factors that have the greatest impact on the scientific and technological innovation capabilities of universities are the number of scientific researchers and scientific research funds in scientific and technological innovation input (Bolli *et al*., 2018) , and the scientific and technological innovation capabilities of universities are closely related to the scale of scientific research funding investment (Hin *et al*., 2015). Sergio *et al*. research further shows that compared with scientific research funding, the quality of scientific researchers has a greater impact on scientific and technological innovation capabilities (Sergio *et al*., 2016) . Secondly, the scientific and technological innovation capabilities of universities have a promoting effect on economic development. Bouhajeb et al. examined the cointegration relationship between innovation, higher education and economic growth in developed and developing countries, and proved the positive impact of higher education innovation on economic growth (Bouhajeb *et al*., 2018). Other researchers took Turkey as an example and found through Engel Granger and error correction models that technological progress and innovation have a significant impact on economic growth (Adak, 2015).

On the basis of clarifying the elements of scientific and technological innovation capability of universities and the level of high-quality economic development, domestic scholars have deeply explored the impact of scientific and technological innovation capability of universities on economic development. First, the elements of scientific and technological innovation capability of universities are mainly input, process, output and achievement transformation. In the study, scholars defined scientific and technological innovation input as human resources input, hardware resources input and financial resources input (Ke and Yao, 2021). The scientific and technological innovation process mainly includes the total number of scientific and technological projects and international scientific and technological exchange and cooperation research (Li and Guo, 2020). The output indicators of scientific and technological innovation include the number of scientific and technological works published, the number of scientific and technological projects, the number of academic papers published, the number of invention patents authorized, and the number of awards for achievements (Zhu *et al*., 2021). The specific awards are divided into the National Natural Science Award, the National Technological Invention Award, and the National Science and Technology Progress Award (Li and Sun, 2023). The indicators of scientific and technological innovation achievement transformation select the actual income of technology transfer in the year and the actual income of patent sales in the year (Ma and Wu, 2021). Some scholars have also added the number of patent sales (Wang *et al*., 2021). Although scholars use different methods to analyze the efficiency of scientific and technological innovation in universities, they are all based on the basic principle of input-output efficiency. Secondly, the impact of scientific and technological innovation capability of universities on economic development, domestic related research mainly involves two aspects: first, the impact of scientific and technological innovation capability of universities on the high-quality development of regional economy. Zhang Menglu measured the scientific and technological innovation of colleges and universities by the output of scientific and technological achievements of universities, divided high-quality development into three dimensions of economy, environment and society, and took transaction efficiency as a moderating variable, and explored the relationship between scientific and technological innovation and high-quality development of universities in 30 provinces of China (Zhang, 2023). Huang Yan, Zhou Hongyu and others established the scientific and technological innovation capability index of universities, and used the regional development and livelihood index as a proxy for high-quality regional economic development. They examined the relationship between the innovation level of universities and regional economic development across the country and found that the driving force of scientific and technological innovation in universities was significantly positively correlated with regional economic development (Huang *et al*., 2023), and the scientific and technological innovation capability of universities had a significant spatial promotion effect on regional economic development. Li Ming and others studied the relationship between scientific and technological innovation results and economic output in various provinces and regions, and found that the support role of scientific and technological innovation in universities in the eastern region for regional economic development was significantly higher than that in the central and western regions (Li and Li, 2018). Other researchers took cities as the research object, used panel models, and used regression analysis to examine the impact of high tech innovation input, output, talent training and transformation of scientific and technological achievements on the high-quality development of urban economy (Li, 2020). In addition to empirical research, some researchers conducted theoretical research to explore how scientific and technological innovation in universities in ethnic minority areas can lead regional economic development, (Zhang and Zhao, 2019) how local

industry-specific universities can deeply integrate and develop with the regional economy (He *et al*., 2020), and how to transform scientific and technological achievements and efficiently serve local social and economic development (Jiang and Liu, 2021). Second, the synergy or coupling coordination between scientific and technological innovation in universities and economic development. Wang Haiyan *et al*. analyzed the coupling coordination degree of scientific and technological innovation and regional economy in 30 provinces in China, and found that the coupling coordination degree was eastern-northeastern-central-western from high to low, which was affected by government intervention, marketization level, financial support, digital economy level and science popularization (Li *et al*., 2020). On the basis of establishing that the indicators of economic development level include economic scale, economic quality and economic structure, and the level of scientific and technological innovation covers the input and output of scientific and technological innovation, Li Yan et al. used the entropy method and multi-factor regression model to analyze the synergy level and influencing factors between the scientific and technological innovation capability and economic development level of universities in Guangzhou, Shenzhen, Hong Kong and Macao (Wang and Su, 2023). Li Jiawen et al. established a high-quality economic evaluation index system including five dimensions of economic scale, economic quality, economic structure, development potential and development cost, and a three-dimensional index system of scientific and technological innovation capability of universities including human, financial and material resource input, innovation process and innovation results. Through the coupling coordination model, it was found that there were spatial differences in the coupling coordination between scientific and technological innovation of universities and regional economic development. The overall coupling coordination in the west was poor, while the coupling coordination in most provinces in the central region was good (Li *et al*., 2020). Peng and Wang (2018) took the input of human, financial and material resources for scientific and technological innovation and the output of scientific and technological innovation in talent training, scientific research and social services as independent variables, and the scale, quality and structural level of economic development as dependent variables, and conducted coupling coordination analysis, discovering the spatial characteristics of "high in the east and low in the west". Through multivariate regression analysis, the factors affecting the coupling coordination between scientific and technological innovation of universities in different regions and regional economic development were explored.

In summary, domestic and foreign scholars have conducted a lot of research on the scientific and technological innovation capabilities of universities and the relationship between the scientific and technological innovation capabilities of universities and regional economic development, and the relevant research has a great reference for this article. However, there are also certain shortcomings: in terms of research objects, the main focus is on the national scope, and some scholars study a certain region, but there is a lack of research specifically targeting the central and western regions, and the in depth exploration of the relationship between scientific and technological innovation of universities in the central and western regions and high-quality development of regional economy is insufficient; in terms of research content, current research mainly analyzes the spatial differences in the impact of scientific and technological innovation of universities on regional economic development and the spatial differences in the degree of coupling coordination between scientific and technological innovation of universities and regional economic development, and summarizes the law of "high in the east and low in the west", but lacks a systematic analysis of the mechanism of the impact of scientific and technological innovation of universities in the central and western regions on high-quality economic development.

As an important source of power for high-quality economic development, scientific and technological innovation is particularly important in the context of building a socialist modern power and promoting high-quality economic development in the central and western regions. To this end, this study uses the panel data of scientific and technological innovation of universities in the central and western regions from 2010 to 2019 and high-quality economic development from 2011 to 2020 as samples to explore the spatiotemporal evolution characteristics of scientific and technological innovation and high-quality economic development in universities in the central and western provinces, and examines the impact mechanism of scientific and technological innovation of universities on high-quality economic development based on a two-way fixed effect panel model, explores the role of scientific and technological innovation factors of universities on high-quality economic development in the region, enriches theoretical research on high-quality economic development in the central and western regions, and at the same time, provides directional guidance for improving the ability of scientific and technological innovation of universities in the central and western regions to serve the high-quality development of the regional economy.

3. Research Methods and Model Construction

First, this study uses the entropy method to assign weights to the scientific and technological innovation capabilities of universities and the indicators of high-quality economic development. Secondly, quantitative analysis is used for the empirical analysis part. In the first step, the multivariate linear regression model is used to explore the impact of the scientific and technological innovation capabilities of universities on the

high-quality economic development, and further examine the comprehensive impact of the three factors of scientific and technological innovation input, process and results of universities on the high-quality development of the local economy; in the second step, the multivariate linear regression model is used to analyze the impact of the secondary indicators of scientific and technological innovation of universities on the high-quality development of the local economy; in the third step, the seemingly unrelated regression model (Seemingly Unrelated Regression Estimation, referred to as SUR) is used to examine the impact of the three factors of scientific and technological innovation input, process and results of universities on the specific five dimensions of high-quality economic development, so as to overcome the bias caused by unobservable variables (such as self-planning and intrinsic motivation of each province) on model estimation. Construct the following basic model:

$$HQED_{i,t} = \alpha_0 + \beta_0 utech_{i,t-1} + \theta X_{i,t} + \lambda_t + \mu_i + \varepsilon_{i,t} \quad ...(1)$$

Among them, *HQED* represents the explained variable, the level of high-quality economic development in the region, the subscript *i* represents provinces, municipalities and autonomous regions, and *t* represents the year. α_0 is a constant term; utechi,$_{t-1}$ is the explanatory variable of the previous period, the scientific and technological innovation capability of universities. Considering that the impact of scientific and technological innovation of universities on high-quality economic development has a lag, the explanatory variable is selected to be one period ahead. $X_{i,t}$ is a control variable, including human capital level (LAB), economic development level (PGDP), government intervention level (IGOV), information level (IFL), and university research and development institution level (URDL). β_0 and θ (represent the regression coefficients of the explanatory variable and the control variable, respectively. λ_t represents the time effect that does not change due to individual heterogeneity, μ_i represents the individual effect that does not change with time, and ($\varepsilon_{i,t}$ is a random disturbance term.

The fourth step is to explore whether there is regional heterogeneity in the impact of the three major factors of university scientific and technological innovation on high quality economic development through an interactive model. On the basis of formula (1), the interaction term $utech_{i,t-1} \times middledum$ between the university's scientific and technological innovation capability and whether it is in the central region is added. The specific model is as follows:

$$HQED_{i,t} = \alpha_0 + \beta_0 \text{utech}_{i,t-1} + \beta_1 utech_{i,t-1} \times middledum + \theta X_{i,t} + \lambda_t + \mu_i + \varepsilon_{i,t} \quad ...(2)$$

β_1 is the coefficient of the interaction between the three major factors of scientific and technological innovation of universities and whether they are located in the central region. The meanings of other variables are the same as those in formula (1).

The overall research idea is shown in Figure 1:

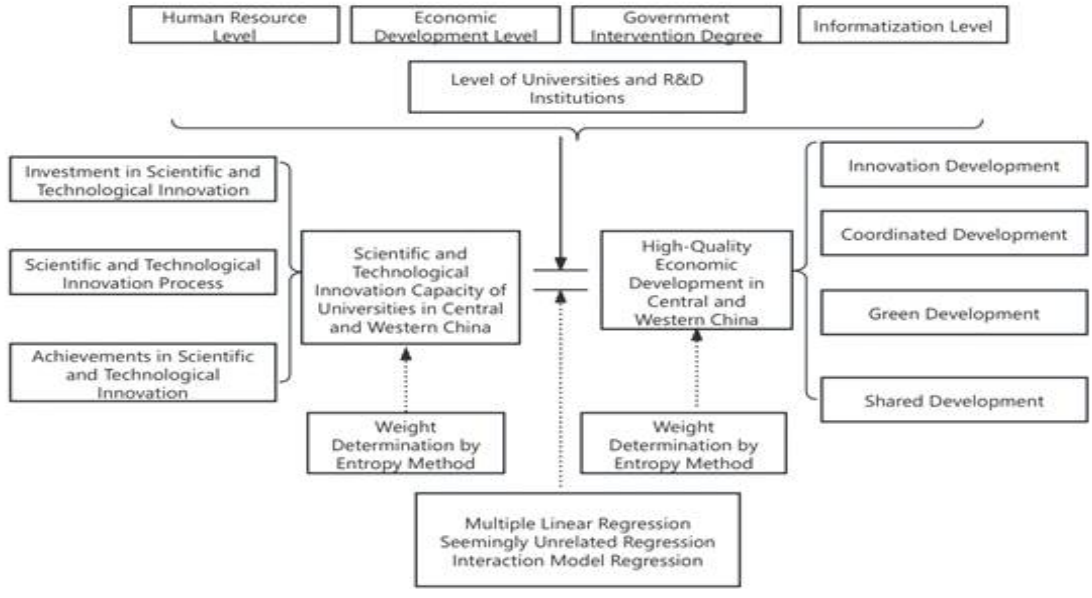

Figure 1: Schematic Diagram of the Research Framework

4. Interaction Model Regression

4.1. Data Sources and Indicator Selection

4.1.1. Data Source

The data on the scientific and technological innovation capability of colleges and universities are mainly derived from the 2010-2019 China Science and Technology Statistical Yearbook, the Compilation of Science and Technology Statistical Data of Colleges and Universities, and the China Education Statistical Yearbook. The data on the indicators of high-quality economic development and the control variable data of the central and western provinces are mainly derived from the 2011-2020 China Statistical Yearbook, the China Education Statistical Yearbook, and the China Environment Statistical Yearbook. For missing data in individual years, linear interpolation or mean method is used to fill in the missing data.

4.2. Indicator Selection

(1) Explained Variable: The level of high-quality economic development

The 19th CPC National Congress Report proposed for the first time that my country's economy has shifted from a high-speed growth stage to a high-quality development stage (The Central People's Government of the People's Republic of China, 2017, October 27). The Central Economic Work Conference held in the same year proposed eight key tasks to promote high-quality economic development (The Central People's Government of the People's Republic of China, 2017, December 20), involving social livelihood, ecological civilization, regional coordinated development and other aspects. It can be seen that high-quality economic development has a wide range of connotations. In addition to the economic scope, it also comprehensively covers social, scientific and technological, ecological and other aspects. The CPC Central Committee's resolution on the major achievements and historical experience of the Party's century-long struggle clearly emphasized that "it is necessary to achieve high-quality development with innovation as the first driving force, coordination as the endogenous feature, green as the universal form, openness as the only way, and sharing as the fundamental purpose, and promote changes in the quality, efficiency and driving force of economic development" (The Central People's Government of the People's Republic of China, 2021, November 16). This fully reflects the important position of the new development concept in high-quality economic development. Therefore, the level of high-quality economic development should be measured from the new development concept, taking into account foresight and operability, and considering data availability, to build an evaluation index system for high-quality economic development covering five dimensions of innovative development, coordinated development, green and sustainable development, open development and shared development, including 14 secondary indicators and 20 specific measurement indicators, as shown in Table 1. The entropy method is used to clarify the weight of each indicator, and the comprehensive score of the economic development level of each region is calculated based on the indicator weight and the collected indicator data.

(2) Explanatory variables: University scientific and technological innovation capabilities

Considering that the scientific and technological innovation capability of universities is a comprehensive concept, referring to the CIPP (consisting of context evaluation, input evaluation, process evaluation, and product evaluation) evaluation model and system theory, and drawing on previous research, an indicator system including three primary dimensions of university scientific and technological innovation input, scientific and technological innovation process, and scientific and technological innovation results, 8 secondary dimensions, and 16 specific measurement indicators was constructed, as shown in Table 2. The entropy method was used to clarify the weight of each indicator, and the comprehensive score of the scientific and technological innovation capability of universities in each region was calculated based on the indicator weight and the collected indicator data.

The investment in scientific and technological innovation includes human, material and financial resources. Human resources are the most active and the most important factor in the scientific and technological innovation capabilities of universities. Generally speaking, the higher the professional title and academic qualifications of scientific researchers, the richer the scientific research experience and knowledge, and can provide higher knowledge and ability support for scientific research activities. Human resource investment mainly selects the proportion of full-time research and development personnel and senior professional titles of scientific researchers; material resource investment refers to the proportion of fixed asset purchase expenses in the total amount of scientific and technological

Table 1: Index System For High-Quality Economic Development

Level 1	Level 2	Specific Indicator Name/Unit	Weight	Nature
Innovative development	Innovation Vitality	1. Proportion of science and technology fiscal expenditure in public fiscal expenditure	0.0643	+
	Innovation	20,000 people have patent authorizations/pieces	0.0770	+
		3. Technology market transaction amount/10,000 yuan	**0.2274**	+
Coordinated development	Urban-rural structure	4 Urbanization rate/%	0.0145	+
		5 Ratio of disposable income of urban and rural residents	0.0399	+
	Industrial Structure	6% of the added value of the tertiary industry in GDP	0.0168	+
Green Development	Greening and Environmental Protection	7Forest coverage/%	0.0623	+
		8Completed investment in industrial pollution control/10,000 yuan	0.0078	—
	Resource consumption	9Total amount of wastewater discharged/10,000 tons	0.0261	—
		10Total industrial waste gas emissions/10,000 tons	0.0047	—
		11 Comprehensive utilization of general industrial solid waste/10,000 tons	0.0140	—
Open Development	Foreign investment opening	12Total foreign investment/US$ billion	0.1056	+
	Foreign trade opening	13 Total import and export value of goods/10,000 USD	0.0875	+
Shared Development	Income benefits	14Residents' per capita disposable income/yuan	0.0240	+
	Medical Benefits	15 Number of beds in medical and health institutions per thousand people/bed/thousand people	0.0262	+
	Cultural facilities	16. Public library collection per capita/volume	0.0340	+
	Educational benefits	17 General public budget education funds/10,000 yuan	0.0487	+
	Public Transportation	18 Public transport vehicles/standard platforms per 10,000 people	0.0239	+
		19 Urban road area per capita/square meter	0.0208	+
	Pension security	20 Number of participants in basic pension insurance/10,000 people	0.0745	+

funds, and the assets of teaching and scientific research instruments and equipment in the scientific and technological funds; financial resources refer to the investment and expenditure of scientific research funds, and select the internal expenditure of national research and experimental development (R&D) funds/10,000 yuan and the proportion of university science and technology funds allocated to GDP. The process of scientific and technological innovation includes the number of R&D projects and international scientific and technological exchange and cooperative research. The achievements of scientific and technological innovation include talent training, scientific research output and social services. Talent training mainly selects the number of graduates of master's and doctoral students and the number of graduates of ordinary undergraduates; scientific research is generally presented in the form of papers, monographs, etc., and selects published academic papers, published scientific works, and national science

Table 2: Index System of Scientific and Technological Innovation Capabilities of Universities

Level 1	Level 2	Specific Indicator Name/Unit	Weight	Nature
Investment in scientific and technological innovation	Human resources	1. Research and development full-time staff/ person-year	0.0499	+
		2. % of researchers with senior professional titles	0.0139	+
	Material investment	3. Proportion of fixed asset purchase expenses in total science and technology funds/%	0.0144	+
		4. Teaching and scientific research equipment assets/10,000 yuan	0.0457	+
	Financial investment	5. Internal expenditure of R&D funds/10,000 yuan	0.0695	+
		6. The proportion of university science and technology funding to GDP (%)	0.0539	+
Technological innovation process	Research	7. R&D projects	0.0471	+
	International Exchange	8. International scientific and technological exchange and cooperation research/person-time	0.0610	+
Scientific and technological innovation achievements	Talent cultivation	9. Number of ordinary undergraduate graduates	0.0422	+
		10. Number of graduate students	0.0492	+
	Scientific research	11. Published academic papers	0.0470	+
		12. Published scientific and technological works/ volumes	0.0510	+
		13. National science and technology awards	**0.1204**	+
	Social Services	14. Number of patent authorizations	0.0918	+
		15. Number of technology transfer and sales contracts	**0.1143**	+
		16. Actual income from technology transfer in the current year/1,000 yuan	**0.1287**	+

Note: All indicator data are collected and sorted manually; weight data are obtained by entropy method.

and technology awards; scientific and technological output realizes the function of serving the society through transfer and transformation, which is mainly reflected in patent authorization and technology transfer, and selects the number of patent authorizations, the number of technology transfer and sales contracts and the actual income of the year.

(3) Control variables: Taking into account other factors affecting high-quality economic development and drawing on existing research (Huang *et al*., 2023; Luo and Xiong, 2022), the following control variables are selected: Human capital level (LAB), represented by the proportion of the number of students enrolled in regional colleges and universities to the total population of the region at the end of the year; economic development level (PGDP), expressed by per capita GDP; government intervention level (IGOV), expressed by the proportion of general budget fiscal revenue to regional GDP; informatization level (IFL), measured by the Internet penetration rate; level of university research and development institutions (URDL), measured by the number of research and development institutions of higher education institutions in each region, and data from 2011-2020 were selected.

5. Descriptive Statistics

The entropy method is used to perform weight analysis on each variable. On the basis of determining the weight, indicators are extracted from each variable to form the data for the empirical analysis of this study. The results of descriptive statistics of each variable are shown in Table 3.

Table 3: Descriptive Statistical Results

	Variable Name	Variable Meaning	Number of Samples	Mean	SD	Min.	Max.
Explanatory variables	USTI	Technological innovation in colleges and universities	180	0.2107	0.1721	0.0115	0.7323
	ISTI	Investment in scientific and technological innovation	180	0.0582	0.0351	0.0112	0.1941
	PSTI	Technological innovation process	180	0.0255	0.0210	0.0001	0.1052
	OSTI	Scientific and technological innovation achievements	180	0.1269	0.1164	0.0002	0.4318
Explained variable	HQED	Economic and high quality	180	0.2919	0.1116	0.1112	0.6806
	CDVP	Innovative development	180	0.0567	0.0599	0.0002	0.3238
	HDVP	Coordinated development	180	0.0305	0.0082	0.0128	0.0550
	GDVP	Green Development	180	0.0644	0.0177	0.0317	0.1103
	ODVP	Open Development	180	0.0424	0.0365	0.0007	0.1845
	SDVP	Shared Development	180	0.0980	0.0322	0.0204	0.1910
Control variables	LAB	Human capital level	180	0.0680	0.0341	0	0.1525
	PGDP	Economic Development Level	180	0.0646	0.0332	0	0.1503
	IGOV	Level of government intervention	180	0.0522	0.0221	0	0.1053
	IFL	Information level	180	0.1021	0.0581	0	0.2129
	URDL	Level of university research institutions	180	0.1053	0.0850	0	0.3790

6. Empirical Analysis

6.1. Analysis of Universities' Scientific and Technological Innovation Capabilities and The Level of High-quality Economic Development

1. The scientific and technological innovation capabilities and high-quality economic development levels of colleges and universities in central and western China continue to improve By calculating the original data using the entropy method, the comprehensive scores of the scientific and technological innovation capabilities and the high-quality economic development levels of universities in 18 provinces, municipalities and autonomous regions were obtained, as shown in Table 4. Overall, the scientific and technological innovation capabilities and high-quality economic development levels of universities have shown significant growth in the past 10 years, and the growth rate of scientific and technological innovation capabilities of universities has obviously lagged behind the speed of high-quality economic development. In addition, the scientific and technological innovation capabilities of universities in the central region are generally higher than those in the western region, which to a certain extent indicates that there may be a positive correlation

between the scientific and technological innovation capabilities of universities and the level of local economic development.

2. The scientific and technological innovation capabilities and high-quality economic development levels of colleges and universities in the central and western regions have increased, but the western provinces are generally lagging behind.

   The bottom six provinces in the ranking of scientific and technological innovation capabilities of universities are all in the western region, and Inner Mongolia, Guizhou, Xinjiang, Ningxia, Qinghai and Tibet have always been at a relatively low level. The comprehensive score of Tibet, which ranks last, increased from 0.018 in 2010 to 0.028 in 2019. The top ten are mainly provinces in the central region, concentrated in Hubei, Hunan and other provinces. Hubei, which ranks in the top three, has a comprehensive score that increased from 0.474 to 0.712; the bottom five provinces in the ranking of high-quality economic development level are all in the western region. Inner Mongolia, Ningxia, Xinjiang, Qinghai and Tibet are all at a relatively low level, and the increase in ten years is the smallest. Tibet, which has always ranked last, has a comprehensive score that increased from 0.120 in 2011 to 0.169, an increase of only 0.049. The provinces in the central region are ranked relatively high, accounting for 2/3 of the top six. Among them, Hubei has the largest increase, from 0.245 in 2011 to 0.681 in 2020, an increase of 0.436, which is nearly ten times that of Tibet.

Table 4: Comprehensive Scores and Rankings of Universities' Scientific and Technological Innovation Capabilities and High-Quality Economic Development

Province	Scores and Rankings of Universities' Scientific and Technological Innovation Capabilities							Scores and Rankings of High-Quality Economic Development						
	2010 Score	2013 Score	2016 Score	2019 Score	2019 Rank.	Rank. Change	Score Change	2011 Score	2014 Score	2017 Score	2020 Score	2020 Rank.	Rank. Change	Score Change
Shanxi	0.099	0.115	0.159	0.212	**9**	**+1**	**0.113**	0.176	0.200	0.229	0.279	**13**	**-4**	**0.103**
Anhui	0.336	0.479	0.343	0.372	**7**	**-3**	**0.036**	0.255	0.316	0.401	0.633	**3**	**0**	**0.379**
Jiangxi	0.131	0.147	0.189	0.231	**8**	**0**	**0.100**	0.232	0.280	0.348	0.467	**7**	**+2**	**0.235**
Henan	0.219	0.240	0.321	0.435	**5**	**+2**	**0.216**	0.226	0.277	0.345	0.469	**6**	**+4**	**0.243**
Hubei	0.474	0.448	0.490	0.712	**2**	**-1**	**0.238**	0.245	0.358	0.484	0.681	**1**	**+3**	**0.436**
Hunan	0.304	0.341	0.314	0.490	**4**	**+1**	**0.186**	0.238	0.289	0.384	0.570	**5**	**+2**	**0.332**
Inner Mongolia	0.064	0.066	0.091	0.105	**14**	**0**	**0.042**	0.174	0.194	0.230	0.268	**14**	**+1**	**0.094**
Guangxi	0.108	0.123	0.148	0.207	**10**	**-1**	**0.100**	0.231	0.262	0.313	0.447	**8**	**+1**	**0.216**
Chongqing	0.268	0.215	0.323	0.431	**6**	**0**	**0.163**	0.241	0.338	0.346	0.432	**9**	**-4**	**0.191**
Sichuan	0.365	0.347	0.487	0.732	**1**	**+2**	**0.367**	0.270	0.344	0.409	0.661	**2**	**-1**	**0.391**
Guizhou	0.063	0.071	0.092	0.146	**13**	**+2**	**0.084**	0.185	0.217	0.267	0.361	**11**	**0**	**0.175**
Yunnan	0.097	0.100	0.135	0.168	**11**	**0**	**0.071**	0.240	0.264	0.289	0.364	**10**	**-4**	**0.124**
Tibet	0.018	0.013	0.017	0.028	**18**	**0**	**0.010**	0.120	0.119	0.147	0.169	**18**	**0**	**0.049**
Shaanxi	0.416	0.458	0.482	0.695	**3**	**-1**	**0.279**	0.263	0.360	0.452	0.633	**4**	**-2**	**0.371**
Gansu	0.089	0.095	0.116	0.160	**12**	**0**	**0.071**	0.180	0.195	0.231	0.287	**12**	**0**	**0.107**
Qinghai	0.031	0.024	0.040	0.040	**17**	**-1**	**0.009**	0.155	0.162	0.191	0.218	**17**	**0**	**0.062**
Ningxia	0.029	0.037	0.054	0.058	**16**	**+1**	**0.029**	0.174	0.194	0.249	0.266	**15**	**+1**	**0.091**
Xinjiang	0.067	0.054	0.066	0.065	**15**	**-2**	**-0.001**	0.175	0.193	0.214	0.233	**16**	**-2**	**0.058**

6.2. Analysis of the Benchmark Estimation Results of the Impact of University Scientific and Technological Innovation on Economic Development Quality

The panel data of 18 provinces, municipalities and autonomous regions in the central and western regions of my country are used to estimate equation (1). The model is selected according to the Hausman test. The results show that the fixed effect model is more effective. Considering that the fixed effect model only includes individual effects and lacks residual correlation analysis at different times and in different regions, it may bring bias to the analysis results. Therefore, the time effect is added to the fixed effect model, and the two-way fixed effect model is used for the benchmark regression analysis to minimize the measurement error.

6.2.1. The Impact of the Three Major Elements of Scientific and Technological Innovation in Universities on High-quality Economic Development

Table 5 examines the relationship between university science and technology innovation input, science and technology innovation process, science and technology innovation output and high-quality economic development. From the estimation results of the first column of Table 5, the scientific and technological innovation capability of universities has

Table 5: Regression Results of the Impact of University Scientific and Technological Innovation and Innovation Input, Process, and Output on High-Quality Economic Development

	(1)	(2)	(3)	(4)	(5)
USTI	0.390***				
	(6.62)				
ISTI		1.408***			1.062***
		(6.00)			(4.69)
PSTI			2.564***		2.037***
			(6.48)		(5.28)
OSTI				0.109**	0.0285
				(2.06)	(0.63)
LAB	0.225	-0.489	-0.435	-0.283	-0.487
	(0.57)	(-1.48)	(-1.34)	(-0.77)	(-1.59)
PGDP	-0.253	1.905***	1.809***	2.239***	1.678***
	(-0.59)	(5.13)	(4.93)	(5.53)	(4.86)
IGOV	0.221	0.0367	-0.224	0.211	-0.184
	(0.66)	(0.13)	(-0.78)	(0.66)	(-0.67)
IFL	0.297	0.189	0.0667	0.139	0.136
	(1.26)	(0.94)	(0.34)	(0.63)	(0.73)
URDL	0.618***	0.405***	0.475***	0.552***	0.336***
	(6.09)	(4.50)	(5.61)	(5.78)	(3.96)
Constant	0.0735*	0.0612*	0.0799**	0.0815**	0.0457
	(1.84)	(1.84)	(2.48)	(2.18)	(1.44)
Province fixed	Yes	Yes	Yes	Yes	Yes
Fixed year	Yes	Yes	Yes	Yes	Yes
N	180	180	180	180	180
R^2	0.835	0.879	0.882	0.853	0.899

Note: The values in brackets are the t-values of the regression coefficients, where ***, **, and * indicate that the statistical values are significant at the 1%, 5%, and 10% significance levels, respectively. The same below.

a significant positive impact on high-quality economic development. This is also in line with the basic assumption that university science and technology innovation is an important driving force for promoting high-quality economic development. From the perspective of control variables, the level of economic development and the number of scientific research institutions in universities have a significant positive impact on high-quality economic development. That is, the higher the level of economic development and the more scientific research institutions in universities, the more conducive it is to promoting high-quality economic development. On the one hand, the higher the level of economic development, the more attractive it is to talents, and the more capable it is to provide financial support for scientific and technological innovation and environmental governance in universities, thereby promoting high-quality economic development. On the other hand, the more scientific research institutions in universities, the more they can cultivate scientific research talents, generate scientific and technological innovation results, and provide intellectual support for high-quality economic development.

From the results of regression analysis in the second, third and fourth columns of Table 5, it can be seen that the three major factors of university scientific and technological innovation input, process and results have a significant positive impact on the level of high-quality economic development in each province. Among them, the university scientific and technological innovation process (2.564) has the greatest impact on the level of high-quality economic development, followed by university scientific and technological innovation input (1.408), and finally university scientific and technological innovation output (0.109). It can be seen that under the backward development of the central and western regions, the role of university scientific and technological innovation input and process in promoting high-quality economic development is more obvious. We should focus on the previous scientific and technological input and process to lay a solid foundation for scientific and technological innovation output. The fifth column puts the three major factors of scientific and technological innovation in the same analytical framework. Through the analysis results, it can be found that the coefficient of scientific and technological innovation output of universities decreases, and the significance changes from 5% to insignificant. The possible reason is that there is collinearity between the three major factors, which leads to estimation bias. This conjecture is confirmed by the Person correlation test.

6.2.2. The Impact of the Three Major Elements of Scientific and Technological Innovation in Universities on Different Dimensions of High-quality Economic Development

Table 6 reports the test results of the seemingly unrelated regression model, which is used to reveal the specific relationship between the three dimensions of university scientific and technological innovation and the five dimensions of high-quality economic development. The data analysis results show that the Breusch-pagan test statistics of each model are significant at the 1% level, indicating that the error terms between the equations are indeed correlated, so the use of the seemingly unrelated regression model can effectively improve the estimation efficiency of the model. From the perspective of the five dimensions, the input and output of university scientific and technological innovation have a significant impact on economic innovation and development. The human, material and financial resources invested in scientific and technological innovation by universities provide resource guarantees for the creation of new knowledge, new technologies and new achievements. Research projects and international exchanges directly promote knowledge production. Scientific and technological innovation results then promote economic innovation. Technical patents are directly transformed into productivity; the process of scientific and technological innovation has a significant negative impact on economic innovation and coordinated development, but has a significant positive impact on economic open development and shared development, indicating that the impact of the scientific and technological innovation process on different dimensions of economic development levels is different; scientific and technological innovation results have a significant negative impact on the green, open and shared development of the economy. Considering that scientific and technological innovation results include the transformation of scientific and technological achievements, the environment may be polluted during the transformation process, and the patent itself will solidify the scope of sharing of innovative achievements, which is not conducive to openness and sharing. Among them, the estimated coefficient of scientific and technological innovation investment in universities is the largest and has a strong significance level, which once again proves the importance of scientific and technological innovation investment for high-quality economic development.

By observing the results of the control variable analysis, it can be seen that university research institutions have a significant impact on the five dimensions of economic development. Except for the negative correlation with economic coordinated development, the other dimensions are positively correlated, indicating that the number of research institutions plays different roles in different dimensions. Research institutions can realize knowledge production,

Table 6: Sur Test of the Impact of the Three Major Factors of Scientific and Technological Innovation in Universities on the Five Dimensions of High-Quality Economic Development

	(1)	(2)	(3)	(4)	(5)
	CDVP	**HDVP**	**GDVP**	**ODVP**	**SDVP**
ISTI	1.138***	0.0502	0.0561	0.135	-0.00812
	(0.146)	(0.0346)	(0.112)	(0.0988)	(0.0849)
PSTI	-0.345*	-0.140***	0.0978	0.766***	0.691***
	(0.205)	(0.0488)	(0.158)	(0.139)	(0.120)
OSTI	0.0891**	0.0138	-0.0574*	-0.0466*	-0.0496**
	(0.0384)	(0.00911)	(0.0295)	(0.0260)	(0.0224)
LAB	-0.135	0.0166	0.227***	0.0716	0.0451
	(0.0886)	(0.0210)	(0.0680)	(0.0600)	(0.0516)
PGDP	-0.179**	-0.109***	-0.00405	0.147**	0.214***
	(0.0909)	(0.0216)	(0.0698)	(0.0616)	(0.0530)
IGOV	0.179*	0.0524**	0.0820	0.0150	-0.0789
	(0.102)	(0.0242)	(0.0783)	(0.0691)	(0.0594)
IFL	0.297***	0.00612	-0.107***	0.0255	0.133***
	(0.0493)	(0.0117)	(0.0379)	(0.0334)	(0.0287)
URDL	0.112***	-0.0232***	0.106***	0.130***	0.0899***
	(0.0368)	(0.00872)	(0.0282)	(0.0249)	(0.0214)
Constant	-0.0480***	0.0315***	0.0556***	-0.0145**	0.0422***
	(0.00830)	(0.00197)	(0.00637)	(0.00562)	(0.00483)
Province fixed	Yes	Yes	Yes	Yes	Yes
Fixed year	Yes	Yes	Yes	Yes	Yes
N	180	180	180	180	180

Note: The values in brackets are the *t*-values of the regression coefficients, where ***, **, and * indicate that the statistical values are significant at the 1%, 5%, and 10% significance levels, respectively.

innovation of results, and bring economies of scale. Professional knowledge can increase factor returns, improve the scale returns of the overall economy, and provide an innovative driving force for high-quality economic development. However, economies of scale will also ignore the coordination of economic development to a certain extent. The level of economic development and the level of informatization have negative and positive effects on economic innovation and development respectively. The higher the level of economic development, the less attention will be paid to innovation and development, while informatization development can provide more channels and platforms for economic innovation and development. The level of economic development and the level of government intervention have negative and positive effects on economic coordinated development respectively. The level of economic development itself pays more attention to GDP, and pays less attention to the coordinated development of industry and urban and rural areas. Government intervention helps to balance the gap between different industries and urban and rural development. The coefficient of human capital level on the green development of the economy is positive and significant, indicating that the higher the education level, the stronger the green environmental awareness, and the more obvious the role of informatization level on green development; the coefficient of informatization level on green development is negative, indicating that while informatization drives industrial development, it also increases environmental pressure and hinders the green development of the economy. There is a positive correlation between the level of economic development and economic openness. The possible reason is that the central and western regions are close to the border. In recent years, driven by the national “The Belt and Road Initiative” and other policies, the level of economic development has been

continuously improved and the degree of opening up has deepened. The level of economic development and the level of informatization have a significant positive impact on the shared development of the economy. This paper believes that the main reason is that the higher the level of economic development, the wider the scope of benefits from economic development dividends. The level of informatization helps to promote industrial upgrading and drive economic development, thereby improving the overall living standards of the people.

6.2.3. Test on the Regional Heterogeneity of the Impact of the Three Major Factors of Scientific and Technological Innovation of Universities on High-quality Economic Development

In order to examine whether there are significant differences between the central and western regions in the impact of the scientific and technological innovation capabilities of universities on the high-quality development of local economies, this study uses interaction terms to test. The estimated results are shown in Table 7 below.

Table 7: Heterogeneity Test of the Impact of the Three Major Factors of Scientific and Technological Innovation in Universities on High-Quality Economic Development

	(1)	(2)	(3)	(4)
USTI	0.438***			
	(6.41)			
ISTI		0.888***	1.048***	1.113***
		(3.49)	(4.59)	(4.92)
PSTI		2.197***	2.115***	1.858***
		(5.50)	(5.18)	(4.71)
OSTI		0.0378	0.0233	0.0822
		(0.83)	(0.51)	(1.54)
USTI×middledum	-0.122			
	(-1.38)			
ISTI×middledum		0.402		
		(1.48)		
PSTI×middledum			-0.487	
			(-0.60)	
OSTI×middledum				-0.168*
				(-1.86)
LAB	0.220	-0.483	-0.481	-0.378
	(0.56)	(-1.58)	(-1.57)	(-1.22)
PGDP	-0.266	1.584***	1.722***	1.702***
	(-0.62)	(4.53)	(4.87)	(4.97)
IGOV	0.332	-0.264	-0.145	-0.0396
	(0.96)	(-0.95)	(-0.51)	(-0.14)
IFL	0.285	0.136	0.123	0.167
	(1.21)	(0.74)	(0.66)	(0.91)
URDL	0.645***	0.278***	0.354***	0.356***
	(6.26)	(2.99)	(3.93)	(4.20)
Constant	0.0699*	0.0507	0.0463	0.0360
	(1.75)	(1.60)	(1.46)	(1.13)
Province fixed	Yes	Yes	Yes	Yes
Fixed year	Yes	Yes	Yes	Yes
N	180	180	180	180
R^2	0.837	0.901	0.899	0.901

Note: The values in brackets are the t-values of the regression coefficients, where ***, **, and * indicate that the statistical values are significant at the 1%, 5%, and 10% significance levels, respectively.

As can be seen from the first column, the scientific and technological innovation capabilities of universities have a significant positive impact on the high-quality development of the economy, but the interaction term between the scientific and technological innovation capabilities of universities and whether they are in the central region is not significant, indicating that compared with the western region, the scientific and technological innovation capabilities of universities in the central region are not significant in terms of the effect on the high-quality development of the economy. Columns 2 and 3 also show similar results. The interaction term OSTI× middledum between the scientific and technological innovation results of universities in the fourth column and whether they are in the central region is significant at the 10% statistical level, and the elasticity coefficient is negative, indicating that compared with the western region, the scientific and technological innovation results of universities in the central region have a significantly negative effect on the high-quality development of the economy. This may be caused by the different starting points of development in different regions. The central region is rich in resources. As an energy and raw material base and a grain production base, the industrial structure has long been "heavy", innovation investment is insufficient, and supporting resources (The Central People's Government of the People's Republic of China, 2021, July 23) need to be built, resulting in the inability to effectively transform scientific and technological innovation results, resulting in the loss of scientific and technological innovation results. In recent years, the overall development of the central region has been slow, showing a trend of collapse, and it has been unable to form a competitive and cooperative effect of scientific and technological innovation in universities on the high-quality development of the local economy.

7. Robustness Test

In order to ensure the robustness of the research results, robustness tests are conducted from two aspects. First, since the total factor productivity (TFP) is often used as a proxy variable in the current academic community to examine the level of high-quality economic development, it is used to replace the original explained variable and the model is estimated again; secondly, since there are large differences in the scientific and technological innovation capabilities of universities and the level of high-quality economic development among provinces, cities and autonomous regions, all continuous variables are Winsorized at the 1% level, and then the model is re-estimated to avoid the influence of data outliers on parameter estimation results. After data analysis, it is found that the empirical results of all models in the above situations are highly consistent with the previous results, which shows that the research results of this paper are highly robust.

8. Research Conclusions and Policy Recommendations

8.1. Research Conclusions

Based on the concept of scientific and technological innovation capability of universities and the definition of high-quality economic development, this study constructed evaluation index systems respectively. The evaluation index system of scientific and technological innovation capability of universities includes 3 first-level indicators, 8 second-level indicators and 16 third-level indicators with scientific and technological innovation input, process and results as the core. The index system of high-quality economic development covers 5 first-level indicators, 14 second-level indicators and 20 third-level indicators with innovation, coordination, green, openness and sharing as the core. The data of high-quality economic development indicators of 18 provinces, municipalities and autonomous regions in central and western China from 2011 to 2020 and the data of scientific and technological innovation indicators of universities in the previous year were used as samples to evaluate the scientific and technological innovation capability and high-quality economic development level of their universities, and the impact of scientific and technological innovation capability of universities on high-quality economic development in the region was deeply examined, and the following main conclusions were drawn:

First, the scientific and technological innovation capability of universities is closely related to the level of high-quality economic development, and the scientific and technological innovation capability of universities in the western region is significantly lower than that in the central region. Research shows that in the past 10 years, the scientific and technological innovation capability of universities in the central and western regions and the level of high-quality economic development have both shown an upward trend, but there is a certain differentiation in the growth rate. The growth rate of scientific and technological innovation capability of universities lags significantly behind the growth rate

of economic quality development, and the scientific and technological innovation capability of universities in the central region is significantly higher than that in the western region.

Second, the scientific and technological innovation capabilities of universities have a significant positive impact on the high-quality development of the economy. The study shows that the three major factors of university scientific and technological innovation investment, process and results have a significant positive impact on the level of high quality development of the local economy, and the impact of university scientific and technological innovation process is the greatest. The role of university scientific and technological innovation investment and process in promoting the high-quality development of the economy is more significant than that of university scientific and technological innovation results. In the analysis of the five dimensions of high-quality economic development, the impact of scientific and technological innovation investment and process is also robust and significant, and the positive impact coefficient is higher than the coefficient of scientific and technological innovation results.

Third, the regional heterogeneity analysis shows that there are regional differences in the impact of university scientific and technological innovation achievements on high quality economic development. The higher the scientific and technological innovation achievements in the western region, the more obvious the role of promoting high quality economic development, while scientific and technological innovation investment and innovation process do not show regional heterogeneity effects. Compared with other scientific and technological innovation factors, scientific and technological innovation achievements have a more direct advantage in promoting high-quality economic development, which means that if the western region can strengthen the output of scientific and technological achievements, it will help accelerate the pace of high-quality economic development in the region, narrow the gap in economic development with other regions, and achieve balanced regional economic development.

Fourth, from the perspective of control variables, the number of scientific research institutions in universities and the level of economic development have a steady positive impact on high-quality economic development. This means that strengthening the construction of scientific research institutions and striving to improve the level of economic development will help promote the improvement of high-quality economic development.

8.2. Research Suggestions

In the context of revitalizing the central and western regions and realizing the modernization of socialism with Chinese characteristics, the above research conclusions have important implications for how to give full play to the driving role of the scientific and technological innovation capabilities of universities in the high quality economic development of the central and western regions. Therefore, this paper puts forward corresponding policy recommendations from both the government and universities:

8.2.1. The Government Should Strengthen Investment in Scientific Research and Improve Policy Guarantees for Scientific Research and Achievement Transformation

First, the country should increase investment in scientific and technological innovation in the central and western regions. On the one hand, the government can directly increase investment in scientific research funds for colleges and universities in the central and western regions, or set up special funds for scientific and technological innovation in colleges and universities in the central and western regions, and provide sufficient funds for colleges and universities to establish cutting-edge laboratories and other scientific research institutions, purchase scientific research equipment, etc. On the other hand, considering the characteristics of scientific research innovation, long transformation cycle and large investment, the government can encourage financial institutions to cooperate with colleges and universities. Financial institutions can provide credit loans to colleges and universities that meet the evaluation standards through credit assessment and potential assessment of colleges and universities, meet their funding needs at different stages of scientific research, and serve the transformation of scientific and technological achievements.

Secondly, strengthen the monitoring of resource supply and demand and resource utilization. Make full use of the advantages of intelligence, establish a big data platform at the government level, timely monitor the supply and demand of scientific research resources in colleges and universities in the central and western regions, and make good use of the supply and allocation of human, material and financial resources according to the actual supply and demand situation to ensure that scientific and technological innovation has sufficient basic conditions. At the same time, use the collected data to accurately analyze the utilization of resources, rank the utilization rate of scientific research resources in various

colleges and universities, and establish a scientific reward and punishment system to promote colleges and universities to improve the utilization efficiency of scientific research resources and avoid waste of resources.

Thirdly, strengthen support for the transformation of scientific research results. The government can take the lead in establishing a scientific and technological innovation results transformation institution and communication platform, and support its rapid development by providing tax incentives and other policies, strengthen its connection with the scientific and technological achievements of universities, and ensure the smooth transformation of scientific research results. At the same time, improve the scientific and technological innovation management system and the distribution mechanism of the results transformation income, implement the distribution policy oriented to increase the value of knowledge, increase the proportion of scientific research personnel's results transformation income, stimulate the enthusiasm, initiative and creativity of all stakeholders, accelerate the transformation and application of scientific and technological innovation results, promote the deep integration of industry, academia and research, and spread the benefits of scientific research results to society.

Finally, build a sound policy guarantee system. Talent is the key to scientific and technological innovation, and the quality of human resources affects the level of scientific and technological innovation. Therefore, local governments should find ways to ensure the proportion of high-level talents in the region, retain local high-level talents, absorb high-level talents from other places, and cultivate more high-quality scientific and technological innovation talents by formulating employment policies for scientific and technological innovation talents and incentive policies for talent training. On the one hand, local governments should provide institutional guarantees for the employment of scientific and technological innovation talents. From the aspects of evaluation system and living security, we should create a social atmosphere that is conducive to scientific and technological innovation talents to concentrate on scientific research and academic research, enhance the "pulling force" on innovative talents in universities, avoid the outflow of talents in the region, and at the same time attract more fresh and high-quality blood to the central and western regions to improve the vitality of scientific and technological innovation. On the other hand, formulate appropriate talent training incentive policies. For universities in the central and western regions, formulate a scientific scientific and technological innovation talent training quality assessment system, regularly conduct innovative talent training assessments on major universities, and carry out different degrees of rewards for universities based on the evaluation results. Spiritual incentives and material incentives coexist to stimulate the internal motivation of innovative talent training in universities.

8.2.2. Universities Should Rationally Set Scientific and Technological Innovation Goals and Strengthen Research Projects and Exchanges and Cooperation

Firstly, colleges and universities should rationally evaluate the results of scientific and technological innovation. Although the ultimate goal of scientific and technological innovation is to produce results, research shows that compared with the results of scientific and technological innovation, the input and process of scientific and technological innovation in colleges and universities have a greater positive effect on the level of high-quality economic development. Therefore, colleges and universities should establish a scientific evaluation concept, truly avoid the phenomenon of only focusing on papers and titles, do a good job in the basic work of ensuring human, material and financial resources, create a good environment for scientific and technological innovation for teachers and students, adhere to talent training as the primary goal, firmly establish the educational goal of cultivating high-end and top notch innovative talents, and continuously cultivate innovative talents and reserve resources at all levels in the process of education, teaching and scientific research, with high-quality talents as the foundation, serve the high-quality development of the regional economy, and achieve a win-win situation for scientific and technological innovation and regional economy.

Secondly, attach great importance to the process of scientific and technological innovation. As a channel for talent training and a prerequisite for the output of results, the process of scientific and technological innovation is crucial to improving the quality of economic development. As demonstrated above, the process of scientific and technological innovation has the greatest significant positive impact on the high-quality development of the economy. Therefore, the central and western regions should pay more attention to increasing the intensity of research projects, adopt dual incentives that emphasize both material rewards and spiritual rewards to encourage college teachers and students to apply for high-level projects, pay close attention to major research areas that the country urgently needs to solve, keep up with the forefront of scientific and technological innovation, attach importance to basic research and applied research in parallel, give scientific researchers sufficient research funds and personnel control autonomy, technical route decision-making power, and increase research efforts; at the same time, make good use of the platforms provided by the “The Belt and Road Initiative” and other opening-up policies, strengthen scientific research exchanges and cooperation with foreign universities and universities in the eastern region, encourage and provide financial support for scientific researchers

to actively participate in high level academic exchange activities at home and abroad, and broaden their scientific research horizons.

Finally, strengthen the awareness of serving the society. Although the geographical location cannot be changed, we can cultivate and tap our own advantages. Strengthening social services obviously has a positive impact on the high-quality development of the economy. Therefore, colleges and universities in central and western China should strengthen exchanges with the application parties of the results, pay attention to the needs of social development, actively cooperate with the government, enterprises and other parties, and continuously increase the intensity of industry-university-research cooperation, and create a three-dimensional innovation system of "military, government, school, enterprise and society" and other multi-party cooperation, improve the ability of collaborative innovation, promote the efficiency of transformation of scientific and technological achievements, better serve the market demand of the region, lead industrial development with scientific and technological innovation, improve the spillover effect and radiation driving effect of scientific and technological innovation achievements, and continuously narrow the gap with the development level of the eastern region.

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