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Abstract. Speeding up university transformation of scientific and technological achievements is a new requirement put forward by the state in the new era. It is a key link for achieving close combination between science and technology and economy. By sorting out the literature related to university transformation of scientific and technological achievements from 2012 to 2017 on CNKI, we extracted 17 factors that affected university transformation of scientific and technological achievements and used questionnaires to investigate the university scientific research personnel in Sichuan Province. Factor analysis was used to identify five key factors affecting university transformation of scientific and technological achievements, and to provide countermeasures and suggestions for promoting the capitalization and industrialization of scientific and technological achievements in universities.

Introduction

As an important source of scientific and technological achievements, universities have become the main force of China's basic research, the new force of technology transfer and high-tech industrialization. Although the quantity and quality of the scientific and technological achievements in Sichuan universities have been greatly improved in recent years, the application rate and the transformation of their achievements have always been in a relatively awkward predicament, and the scientific and technological achievements can be truly transformed are still very few in mass production, which should play a greater role in the innovation system of the state and society. Whether it is colleges or enterprises, there is an urgent need to find out the key factors that affect the transformation of scientific and technological achievements in universities. Therefore, it is an urgent problem to explore which factors affect the speed and efficiency of the transformation of scientific and technological achievements in universities.

The existing research on the transformation of scientific and technological achievements mainly focuses on collaborative innovation cooperation mode, scientific and technological achievements transformation ability, efficiency evaluation and policy analysis[1-3], and the related research on the influencing factors of university scientific and technological achievements transformation is still rare. This study sorts out the main factors affecting the transformation of scientific and technological achievements in universities by consulting related literatures. It uses factor analysis to identify the key factors and attempts to provide corresponding countermeasures and suggestions for promoting the capitalization and industrialization of scientific and technological achievements in universities.

Research Review

Literature Statistics and Analysis

In this study, the traditional literature statistics method is used to search for literature on “the transformation of University + scientific and technological achievements” and “transformation of scientific research results” on “CNKI” and search for relevant articles on the transformation of
Influencing Factors Screening and Extraction

A total of 250 influencing factors of scientific and technological achievements were extracted from 79 papers. By analyzing the meanings of these influencing factors, the influencing factors expressing the same or similar connotations were merged and renamed. Through this principle, the 250 factors are divided into 26 categories, and the frequency statistics of the two influence factors included in each category are calculated, the frequency in the 79 literature is calculated and the frequency is sorted according to the frequency. The main factors that affect the transformation of the scientific and technological achievements of colleges and universities can be obtained.

Research Design

Data Source and Processing

This study designed a preliminary questionnaire based on the influencing factors selected by the literature research method, and the questionnaire is mainly measured by the five point score scale of Likte.

After the completion of the questionnaire design, a questionnaire survey was conducted among Sichuan University, University of Electronic Science and Technology, Southwest Jiaotong University, Chengdu University of Technology and other scientific researchers in Sichuan Province. A total of 110 questionnaires were distributed and 96 valid questionnaires were retrieved. The effective recovery rate was 87%. Using SPSS21.0 test questionnaire reliability, the internal consistency Cronbach's α value was 0.87, greater than 0.7, indicating that the questionnaire had good reliability.

Research Methods

In this paper, SPSS23.0 software is used as a statistical analysis tool, 17 influencing factors extracted through the literature are selected as the evaluation indicators for the transformation of scientific and technological achievements in universities. For the convenience of analysis, these influencing factors are numbered as X1, X2, ..., X17.

Factor analysis process and results

Applicability Test of Factor Analysis

Before performing factor analysis, it is first necessary to prove whether the original variables to be analyzed are suitable for factor analysis, and the KMO value and Bartlett's spherical test value are the main observed index values. In this study, the sample data was tested for applicability by SPSS 23.0. The KMO value of this study is 0.889, which is in accordance with the judgment criteria. In addition, Bartlett's sphericity test value has a P value of 0.000 and is less than the significance level of 0.05, which can reject the null hypothesis. The above two test results prove that the 17 variables in the questionnaire are suitable for factor analysis.

Factor Analysis Process

When the factor is extracted, the number of common factors is determined according to the principle that the feature value is greater than 1, and five common factors are obtained. The factor load, eigenvalue and variance contribution rate of each factor are shown in Table 1. Factor 1 has higher load on index X4, X5, X6, X8, X10 and X13, reflecting the system mechanism of the transformation of scientific and technological achievements and named it as a mechanism factor; factor 2 has higher load on X9, X11 and X12, reflecting the strength of universities and the factors of researchers themselves and named as the level factors of colleges and researchers; factor 3 has higher load on X3, X14 and X15, which reflects the market power of the transformation of
scientific and technological achievements, and named it as the market power factor; factor 4 has higher load on X 16 and X 17, which reflects the information of the transformation of scientific and technological achievements, and named it as information sharing factor; factor 5 has high load on X1 and X2, reflecting the policy and institutional support needed for the transformation of scientific and technological achievements, which will be a policy support factor.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Evaluation index and factor</th>
<th>Factor load</th>
<th>Characteristic value</th>
<th>Variance contribution rate</th>
<th>Cumulative variance contribution rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>X4 Scientific research management system and mechanism</td>
<td>0.763</td>
<td>3.413</td>
<td>20.078%</td>
<td>20.078%</td>
</tr>
<tr>
<td></td>
<td>X5 Research and transformation of funds</td>
<td>0.793</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>X6 Excitation mechanism</td>
<td>0.689</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>X8 Distribution of interests</td>
<td>0.621</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>X10 Scientific research evaluation system</td>
<td>0.555</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>X13 Intellectual property protection mechanism</td>
<td>0.722</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>X9 The level of scientific research personnel</td>
<td>0.736</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>X11 The strength and importance of colleges and Universities</td>
<td>0.717</td>
<td>2.296</td>
<td>13.506%</td>
<td>33.584%</td>
</tr>
<tr>
<td></td>
<td>X12 The transformation consciousness of scientific research personnel</td>
<td>0.694</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F2</td>
<td>X3 The combination of supply and demand</td>
<td>0.770</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>X14 Technology market</td>
<td>0.629</td>
<td>2.072</td>
<td>12.186%</td>
<td>45.770%</td>
</tr>
<tr>
<td></td>
<td>X15 Scientific and technological innovation dynamic force</td>
<td>0.585</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F3</td>
<td>X7 The degree of cooperation between industry-university-research</td>
<td>0.653</td>
<td>1.812</td>
<td>10.661%</td>
<td>56.431%</td>
</tr>
<tr>
<td></td>
<td>X16 Knowledge sharing among team members</td>
<td>0.664</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>X17 The degree of information circulation</td>
<td>0.751</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F4</td>
<td>X2 Science and technology intermediary service agency</td>
<td>0.644</td>
<td>1.299</td>
<td>7.643%</td>
<td>64.074%</td>
</tr>
</tbody>
</table>

Factor Score Calculation

After determining the factor variable, the score of the factor variable can be calculated to obtain the specific value of each sample data on different factors. Calculate the model based on the factor score:

\[ F_j = \beta_{j1}X_1 + \cdots + \beta_{jp}X_p, \quad j=1,2,\cdots,m \]  

(1)

Among them, \( F_j \) is a common factor, and \( \beta_{j1} \sim \beta_{jp} \) is the scoring coefficient of each factor. After determining the factor variable, the score of the factor variable can be calculated to obtain the specific value of each sample data on different factors. Finally, the scores of the factors are calculated as: \( F1=0.59, F2=0.60, F3=0.52, F4=0.52, F5=0.76. \) Based on the results of the factor analysis, the weight of each evaluation indicator on its principal factor can be determined.

The weight of the institutional mechanism factor is 0.3134, followed by the level factor of university and scientific research personnel, market dynamics factor, information sharing factor and policy support factor. The weights are 0.2108, 0.1902, 0.1664, and 0.1193, respectively.

Research Conclusions and Recommendations

Conclusions

(1) Factors influencing the transformation of scientific and technological achievements in universities. From the results of factor analysis, it is found that institutional mechanisms, the level of colleges and researchers, market dynamics, information sharing and policy support are important
factors influencing the transformation of scientific and technological achievements in universities. Among them, institutional and institutional factors account for the most weight, which has become a key factor affecting the transformation of scientific and technological achievements in universities.

(2) Ranking of the impact of evaluation indicators on the transformation of scientific and technological achievements in universities. By sorting the weights of the evaluation indicators among the common factors, the influence of institutional mechanism factors on the transformation of scientific and technological achievements in universities is the research and transformation funds; the factors affecting the transformation of scientific and technological achievements in universities and colleges is the level of scientific research personnel; the influence of market dynamic factors on the transformation of scientific and technological achievements in universities is the combination of output supply and market demand; among the information sharing factor, the degree of information circulation has a greater impact on the transformation of scientific and technological achievements in universities; the relevant laws, regulations and policies have great influence on the transformation of scientific and technological achievements in the policy support.

Recommendation

(1) Improving scientific research management systems and mechanisms. The institutional mechanism factors have the greatest impact on the transformation of scientific and technological achievements in universities but the scores are low. To promote the capitalization and industrialization of scientific and technological achievements in universities, it is necessary to improve and improve the existing scientific research management system and mechanism, and establish a new type of university technology mode that adapts to the socialist market economic system. Adequate funding is one of the necessary conditions for the realization of the transformation of scientific and technological achievements. Increasing investment in research and development and transformation funds is an urgent response for the government, universities and enterprises.

(2) Enhancing the importance attached by universities and researchers to the transformation of scientific and technological achievements. Scientific research personnel are the source of scientific and technological achievements. The level of scientific research personnel directly determines the quality and value of scientific and technological achievements. Therefore, it is the key to improve the scientific research level and ability of researchers. At present, many university scientific research management departments pay less attention to the transformation of scientific and technological achievements, and focus on education and scientific research, while ignoring the importance of the transformation of scientific and technological achievements. Universities should adapt to the new requirements of the transformation of current scientific and technological achievements, pay attention to the achievements transformation and benefit, create a good atmosphere for the transformation of scientific and technological achievements in universities.

(3) Improving market power and achieving close integration of results supply and demand. University scientific research personnel should improve their own innovation power and identify market demand and trends through government consultation and market research and consider the integration of results supply with enterprises and market demand and strengthen the integration of universities and markets. We should encourage the major scientific research personnel with major scientific research and industrialization projects, and the scientific and technical personnel with practical experience to work in Colleges and universities. At the same time, the relevant scientific and technical personnel of the enterprises will be allowed to work part-time in the enterprises to work in the transformation of scientific and technological achievements, and to further enhance the consciousness of the scientific research personnel in the city field so as to achieve the precise connection between scientific and technological achievements and market demand, and to improve the practical value of scientific and technological achievements.
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References


