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Research Article

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Research on the Construction of Scientific and Technological Innovation Evaluation System in Local Universities Based on SPSS

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Abstract This paper examines the research data of science and technology statistics in colleges and universities, and uses factor analysis to conduct empirical research on the scientific and technological innovation ability of local universities. The research results have certain practical significance for the evaluation of the scientific and technological innovation ability of local college teachers and the innovation mechanism of local college teachers' scientific research ability.

How to establish an effective and reasonable comprehensive index evaluation system to better reflect the scientific and technological innovation ability of local universities is an extremely important theoretical and practical issue. Based on the characteristics of local college teachers, this paper obtains relevant research data by consulting the Compilation of Science and Technology Statistics of Colleges and Universities, and uses factor analysis to empirically study the research and innovation ability of local college teachers.

Keywords factor analysis, local colleges, technological innovation

1. Introduction

Factor analysis is a multivariate statistical analysis method that converts primitive variables into several integrated variables. Since the evaluation object has many influencing factors, and there may be a correlation between the factors, this increases the difficulty of data processing and the complexity of evaluation. Factor analysis can solve the above problem well by studying the information relationship between many variable data and using several comprehensive variables to represent the structure between the original variable data. These comprehensive variables are called "factors". And can fully reflect most of the information of the original variables, thus effectively reducing the workload of the evaluation.

In this paper, the factor analysis module in SPSS software is used to analyze the scientific and technological innovation ability of colleges and universities. The solution steps are as follows:

(1) Input raw data

Set n Samples, each sample p Variables $n \times p$ The sample data matrix of the order:

$$X = \begin{pmatrix} x_{11} & x_{12} & \cdots & x_{1p} \\ x_{21} & x_{22} & \cdots & x_{2p} \\ \vdots & \vdots & \vdots & \vdots \\ x_{n1} & x_{n2} & \cdots & x_{np} \end{pmatrix}$$

Calculate the sample data matrix X Mean and variance, standardized processing;

(2) Find the sample correlation coefficient matrix

$$R=\begin{pmatrix} r_{11} & r_{12} & \cdots & r_{1p} \\ r_{21} & r_{22} & \cdots & r_{2p} \\ \vdots & \vdots & \vdots & \vdots \\ r_{p1} & r_{p2} & \cdots & r_{pp} \end{pmatrix};$$

(3) KMO test and Bartlett spherical test;
(4) the commonality of variables;
(5) Find the eigenvalue of the correlation coefficient matrix λ_i Unit eigenvector

$e_i=(e_{i1},e_{i2},\cdots e_{ip}),(i=1,2\cdots p)$,and find the variance contribution rate;

(6) determining the number of principal factors, usually selecting the main factor corresponding to the eigenvalue whose cumulative contribution rate is above 80%;
(7) Solving the load matrix;
(8) Rotating the load matrix to better explain the main factor;
(9) Find the main factor score coefficient matrix and the main factor score;
(10) Further statistical analysis of the main factor scores to obtain the final comprehensive score.

2. Evaluation Indicators

The key to measuring the scientific and technological innovation ability of local universities lies in the construction of scientific and technological innovation evaluation system, and the evaluation system depends on the selection of evaluation indicators. Therefore, selecting appropriate evaluation indicators has become the basis and key to construct local university innovation ability evaluation system. Based on the principles of science, rationality and system, according to the characteristics and process of innovation ability of colleges and universities, this paper decomposes five secondary indicators and 15 indicators around the first-level indicators of local university science and technology innovation ability. The three-level indicator is set to C1—C15, which is convenient for follow-up work. The specific evaluation index system is shown in Table 1. The secondary indicators are from resource input capacity, innovation operation capability, international cooperation innovation capability, and performance. Five dimensions, such as output capacity and ability to transform results, measure innovation ability. The decomposition of these five dimensions is based on the process of local university science and technology innovation, so it can evaluate science and technology innovation activities from the perspective of process management.

3. Statistical Analysis

The data in this paper comes from the Science and Technology Department of the Ministry of Education of the People's Republic of China, "Collection of Science and Technology Statistics of Higher Education in 2015". When using SPSS software to analyze the above sample data, KMO test is needed. KMO test is generally used to examine the correlation between variables. The correlation is between 0 and 1. The closer the KMO is to 1, the stronger the partial correlation between the variables is, and the better the factor analysis is. Generally speaking, the KMO statistic is above 0.7, which can be considered as a factor. The analysis results are better. The sample data analysis results in this paper are shown in Table 1. The results show that the KMO test value of 0.841 indicates that the factor analysis works well.

Table 1: Tests by KMO and Bartlett

Tests by KMO and Bartlett

KMO sampling suitability.		0.841
Bartlett sphericity test	Approximate chi square	571.712
	Degree of freedom	105
	Significant	0.000

According to the main factor score coefficient matrix and the rotated main factor contribution rate as the weight to calculate the comprehensive score of the university's scientific and technological innovation ability, the results are shown in the table.

This paper uses the "score" function in SPSS19.0 software to automatically calculate the total score of the factor, and based on this, gives the total ranking based on this indicator, see Table 2.

Table 2: Comprehensive score ranking table

Area	First principal factor score	Second principal factor score	Overall ratings	Overall ranking
Jiangsu Province	4.28875	0.80235	2.079288426	1
Guangdong Province	-0.48282	2.42475	0.717647683	2
Shandong Province	0.82058	0.49806	0.528215622	3
Liaoning Province	-1.25848	2.69771	0.499791967	4
Zhejiang Province	1.72054	-0.70076	0.447180585	5
Hunan Province	-0.16787	1.13731	0.360866261	6
Henan Province	0.75957	0.11635	0.358512771	7
Anhui Province	0.32902	0.51121	0.329671127	8
Sichuan Province	-0.54397	1.3533	0.286882354	9
Beijing	0.24436	0.15026	0.158032257	10
Shanghai	0.58425	-0.26392	0.14202706	11
Heilongjiang Province	-0.10317	0.36587	0.095733392	12
Hebei Province	0.29136	-0.10713	0.080092718	13
Jiangxi Province	-0.45359	0.50759	0.004277264	14
Shaanxi Province	0.56321	-0.60783	0.003176886	15
Hubei Province	0.05394	-0.08217	-0.008761172	16
Fujian Province	0.25923	-0.33706	-0.020217878	17
Guangxi Zhuang Autonomous Region	-0.51113	0.27756	-0.106591674	18
Jilin Province	-0.86152	0.57024	-0.140910607	19
Tianjin	-0.51095	0.14215	-0.157757647	20
Chongqing	0.09587	-0.65507	-0.208191983	21
Yunnan Province	-0.52837	-0.05387	-0.239145978	22
Shanxi Province	-0.38628	-0.3718	-0.300624346	23
Guizhou Province	-0.54833	-0.53015	-0.427639131	24
Inner Mongolia Autonomous Region	-0.86267	-0.34473	-0.487620539	25
Xinjiang Uygur Autonomous Region	-0.45501	-0.9618	-0.552342528	26
Gansu province	-0.5401	-0.94586	-0.581540486	27
Ningxia Hui Autonomous Region	-0.44109	-1.27729	-0.665963802	28
Hainan	-0.50627	-1.32416	-0.710686354	29
Qinghai Province	-0.43254	-1.44712	-0.726689215	30
Tibet Autonomous Region	-0.41654	-1.544	-0.756725096	31

Through the processing of sample data of 31 provinces across the country, the above statistical results are obtained by using spss19.0 software. From the above table data, we can find that the local university's scientific and technological innovation ability has obvious regional tendency. The top ranked provinces such as Jiangsu, Guangdong and other developed coastal areas in the east, these regions have strong economic foundation, concentrated in universities and research institutes, and a large number of scientific and technological workers, providing a solid material foundation and reliable intellectual support for scientific and technological

innovation. The eastern region is economic development. The highland and talent innovation highland, and the empirical results also verify this point; Shandong is also ranked in the top of the education province. Beijing is the tenth, Beijing has 40 colleges and universities, including 21 universities directly under the Ministry of Education and ministries, 17 universities in Shanghai There are 6 subordinate colleges and universities, and the local colleges and universities are not very advanced in science and technology innovation. Ranked provinces in the middle, such as Anhui, Hebei, and Shanxi, are the central regions. The economic base of the central region is weaker than that in the eastern region. Supporting the development of science and technology and attracting talents for science and technology innovation needs to be strengthened. Therefore, the technological innovation ability of local universities has also improved. The technological innovation ability of western remote areas such as Gansu, Ningxia and Qinghai is relatively backward. On the one hand, the geographical location and natural environment of the western region are not conducive to economic development, and the weak economic foundation is also difficult to support the development of local universities' scientific and technological innovation. On the other hand, it is difficult to attract outstanding scientific and technological talents in the western region, and local universities have relatively low technological innovation capabilities.

Therefore, we propose to strengthen the scientific research management and functional supervision of local colleges and universities, actively increase investment in education, introduce international and private capital in a timely manner, optimize the layout of colleges and disciplines, and enable local colleges to serve local social economy more efficiently. Develop and minimize the gap between provinces. Promote the synchronization of economic development and education development, and promote the balanced development of regional higher education

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