

A Visual Analysis of Higher Education Cost Sharing Based on Knowledge Graph

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ABSTRACT

In recent years, the country has intensively introduced education cost sharing guarantee measures, which not only reflects the country's high attention to the development of education, but also fully demonstrates that the education cost sharing system is not perfect and theoretical research does not support practical activities. Using CNKI database literature as the data source, using Citespace tools, and using the main evaluation indicators of the knowledge map, it is found that China's higher education cost sharing theory has fewer researchers, fewer institutions, fewer results, narrow theoretical research areas, narrow sources of research teams, and research results. The adoption rate of practice activities and government decisions is low.

KEYWORDS

Higher education; Education cost sharing; Knowledge graph; Visual analysis

1 Introduction

If education is prosperous, the country will be prosperous, and if education is strong, the country will be strong; Education determines the present and future of humanity. For any country or ethnic group, the importance of education is self-evident, so it is often given a strategic priority for development. However, the development of various levels and types of education needs to be based on necessary material foundations. In recent years, China's fiscal expenditure on education has reached and maintained a proportion of over 4% of its gross domestic product.

In order to support and regulate the development of education from an economic perspective, the country has intensively issued institutional measures such as the "Notice on Issuing the Reform Plan for the Division of Central and Local Financial Powers and Expenditure Responsibilities in the Education Field" (Guo Ban Fa [2019] No. 27) and the "Opinions on Further Adjusting and Optimizing the Structure to Improve the Efficiency of Education Fund Utilization" (Guo Ban Fa [2018] No. 82) in recent years, which not only reflects the high importance that the country attaches to the development of education, It also fully proves that China's education cost sharing system is not yet perfect, and it is necessary to increase construction efforts. The research on educational cost sharing theory promotes the development of educational cost sharing practice, and educational cost practice activities test the scientific nature of educational cost sharing theory. Only by strengthening both practical exploration and theoretical research can we accelerate the maturity of the education cost sharing system.

The reasonable sharing of educational costs directly determines the speed of educational development and affects the quality of education. Higher education, as an important component of the education system, is at the top of the education system and is related to the ultimate quality of talent cultivation. The theory of cost sharing in higher education serves as a support for practice, and the breadth and depth of research affect the quality of higher education by influencing the implementation of practical activities related to cost sharing in higher education. To ensure and promote the high-quality development of higher education, it is necessary to have a clear understanding and understanding of the current status and progress of the theoretical research on cost sharing in higher education, and what needs to be further strengthened and improved. As a graph showing the relationship between the development process and structure of scientific knowledge, the Knowledge graph will be able to more intuitively present the research status of higher education cost sharing.

2 Data Sources and Research Tools

CNKI is a more complete and functional platform in the three major Document retrieval databases in China, which will be more credible and convincing as a data source. By searching the CNKI database for literature with content on higher education cost sharing in the title, we selected all research literature on higher education cost sharing in China from the first publication of higher education cost sharing in 1996 to July 31, 2020 as the data source for this study. Citespace, Knowledge graph research and analysis tool developed by Dr. Chen Chaomei, a distinguished professor of Changjiang Scholars at Dalian University of Technology, is currently recognized as a literature research tool in the industry. So in the research process, this article will mainly rely on Citespace to complete.

3 Statistical Analysis

Through searching and statistics in the CNKI database under the title of higher education cost sharing, a total of 282 research papers on higher education cost sharing have been searched until the end of July this year. Among them, 237 were journal articles, 34 were doctoral Thesis articles, and 11 were conference papers. The basic information about the collected research literature is as follows.

(1) Number of documents issued in each year

The annual publication volume is a representative of the development history, maturity, and trend of a certain research field. The earliest research literature on cost sharing in higher education in China was Jiang Wenli's article "On Cost Sharing in Higher Education" published in Shandong Education Research on October 1, 1996, marking the beginning of the research on cost sharing in higher education. Since then, research literature has appeared in newspapers every year, and the number of publications continued to rise irregularly until 2007. The number of publications in that year was 37, which was the highest year so far. The following years, the number of publications showed an irregular downward trend. The number of publications in each year is shown in Table 1.

Although the research on cost sharing in higher education has been carried out in China for nearly 30 years, the number of research literature is not large in terms of both the total number of research literature and the number of literature in individual years. This also fully proves that China's current research on cost sharing in higher education lacks attention, and the investment of personnel and energy is still insufficient.

Table 1 Statistics of Annual Document Volume

Unit: Pieces		
Number	Year	Number of publications(pieces)
1	1996-2000	8
2	2001-2005	66
3	2006-2010	139
4	2011-2015	58
5	2016-2020	23

(2) Ranking of publication volume institutions

The number of publications issued by an institution is a measure of the distribution of research teams in a certain research field or direction. Through statistics, it was found that a total of 40 authors from institutional units across the country have published papers on the topic of cost sharing in higher education. Among them, Jiangxi Normal University, the institution with the largest number of papers, has 7 papers in total, 2 of the 40 institutions with the smallest number of papers, and 11 institutions have 2 papers in total. Institutions with a total publication volume of 4 or more are shown in Table 2.

Table 2 Statistics of institutions with a publication volume of 4 or more articles

Number	Issuing Unit	Number of publications(pieces)
1	Jiangxi Normal University	7
2	South Central University for Nationalities	6
3	Beijing Normal University	6
4	Hunan Agricultural University	6
5	Zhengzhou University	5
6	Huazhong University of Science and Technology	5
7	Zhejiang University	5
8	Hunan Normal University	5
9	Zhejiang University of Technology	4
10	Guangxi Institute of Technology	4
11	Guangzhou University	4

Both the number of publishing institutions and the number of institutions with the highest number of publications further indicate that China still lacks a research team that has made outstanding contributions to cost sharing in higher education. The reality of cost sharing research in higher education in China is that there are few research teams and research results.

(3) High yield author ranking

According to the calculation formula $M_p = 0.749 \sqrt{N_p \max}$ proposed by Price Law, the father of scientific Metrology, $M_p = 2$ is calculated, that is, the authors who have published two or more papers are all high-yield authors of this study. Among 282 research articles, 30 authors have published 2 or more articles, contributing a total of 73 articles, accounting for 25.89% of the total number of articles. This is far lower than the value proposed by Price Law that core authors in a certain research field should account for half of the total number of articles [6]. Due to space limitations, only authors with a publication volume of 3 or more are listed here, as shown in Table 3.

The number of individual posts to a certain extent represents the breadth, depth, and intensity of research conducted by researchers in a certain field. From Table 3, it can be seen that among the researchers on cost sharing in higher education in China, Cui Laiting, who has the highest total number of publications, currently only has 5, and only 2 publications can enter the high-yield author sequence, which is difficult to believe. This not only indicates that there are fewer personnel participating in the research on cost sharing in higher education in China, but also indicates that

Table 3 Statistics of High Yield Authors with 3 or More Published Articles

Number	Name	Unit	Number of publications(pieces)
1	Cui Laiting	Zhengzhou University	5
2	QinFuli	Guangxi i Institute of Technology	4
3	Zeng Xiaojun	Guangzhou University	3
4	SongJie	Zhengzhou University of Science and Technology	3
5	Zhang Jianying	Jiangxi University	3
6	Zeng Jianji Hunan	Huaihua Medical College	3
7	Yang Haiping,	Hunan Huaihua Medical College	3
8	ZengJianji	Hunan Normal University	3

there are fewer researchers with deep master level expertise.

(4) High frequency keywords

Keywords are an important basis for document management, text classification, text clustering, and information retrieval, and are also highly concentrated in a literature [7]. By using the Citespace tool to search and organize, in the study of cost sharing in higher education, the top three high-frequency keywords are higher education, cost sharing, and education cost, with a frequency of 157, 147, and 23, respectively. Especially, the frequency of the key words higher education and cost sharing is significantly higher than other keywords. In existing research literature, keywords with a frequency of 8 or more occurrences are shown in Table 4.

Table 4 High frequency keyword statistics

Number	Keywords	Frequency
1	High education	157
2	Cost share	147
3	Education cost	23
4	The cost of high education	18
5	Educational equality	18
6	The cost share of high education	15
7	Cost share and compensation	12
8	The private high education	10
9	tuition	10
10	Educational cost share	8
11	Cost compensation	8
12	subject	8

From keyword analysis, it can be seen that the research on cost sharing in higher education in China is relatively concentrated, which also indicates that there will be great potential for future research in this field, with a large space for expansion. The research on cost sharing in higher education still has a long way to go.

(5) Distribution of Achievements in Disciplines

The distribution of research results on cost sharing in higher education is shown in Table 5, with almost all research results concentrated in the discipline of education, accounting for 97.00% of all research results. However, many related disciplines such as management, economics, finance, sociology, etc. have not yet explored the issue of cost sharing in higher education, and there is still a large scope for research.

(6) Ranking of journal publication volume

Academic journals are one of the effective carriers for the disclosure and exchange of research results. Through statistics, it was found that "Heilongjiang Higher Education Research" is the journal with the highest publication volume of research results on cost sharing in higher education in China.

Table 5 Statistics of Subject Distribution of Research Achievements

								Unit:%
Discipline	Education	Business Man- agement	Finance	Math	Quantitative economy	Banking	Law	others
数量	97.00	0.70	0.70	0.35	0.35	0.35	0.35	0.20

Currently, a total of 10 such achievements have been published, followed by 7 published in "Higher Education Exploration". According to statistics, the research on cost sharing in higher education has resulted in journals with more than 4 articles, as shown in Table 6.

Table 6 Ranking Statistics of Publication Volume

Number	The name of the journal	Number of articles published
1	Heilongjiang Researches on Higher Education	10
2	Exploration of Higher Education	7
3	Coal Higher Education	5
4	Friends of Accounting	5
5	Research on Higher Education in Science and Engineering	4
6	Research on Education Finance and Accounting	4
7	Prices Monthly	4
8	Jiangsu Higher Education	4

It is not difficult to see that the publication of research results on cost sharing in higher education is not centralized, which may be related to the quantity and quality of literature, or may be due to information asymmetry between authors and journal publishers. From the perspective of the total number of publications, the lack of research results is insufficient to support the establishment of journals or the creation of columns, which should be the main reason.

(7) Fund funding situation

Government funding is a reflection of the government's emphasis on the project and the significance of the project itself. In the research literature on cost sharing in higher education, there are only 18 research results clearly marked as being funded by various government funds at all levels, including 4 papers from national level funding projects, 11 papers from provincial and ministerial level funding projects, and 3 papers from municipal level funding projects. Please refer to Table 7 for details.

Table 7 Statistics of Fund Support

Number	Name of Fund	Number of Subsidies (Ar- ticle)
1	National Natural Science Foundation of China	1
2	National Social Science Fund	3
3	Ministry of Education Humanities and Social Sciences Research Project	1
4	National Education Science Planning Project	4
5	Zhejiang Natural Science Foundation	1
6	Henan Soft Research Science Institute	5
7	Research Fund of Hunan Provincial Education Commission	1
8	Shanxi Provincial Department of Education Research Program Project	1
9	Jiangsu Provincial Department of Education Humanities and Social Sciences Project	1

Only 6.38% of published research on cost sharing in higher education received government funding. The low proportion of research results receiving funding is mainly due to three reasons: firstly, the governments insufficient attention; secondly, the research significance of the project itself is not significant; thirdly, the research team lacks sufficient strength. From the intensive measures

taken by the government to ensure educational financial investment in recent years, it can be completely ruled out that the first two situations are possible. The lack of awareness and ability of researchers and teams is the greatest possibility of receiving less funding.

(8) Analytic Hierarchy Process of Research Types

The hierarchical distribution of research types in the paper to a certain extent represents the maturity of theoretical research. The high proportion of basic research in achievements indicates that theoretical research is not yet mature and is still in its infancy or growth stage; A high proportion of applied research results often indicates that theoretical research is relatively mature. Among the 282 studies on cost sharing in higher education, there are 186 purely fundamental research papers, accounting for 66.43% of the total number of achievements. This proves that the research on cost sharing in higher education in China has not yet entered a mature stage, and there is still a lot of research work waiting to be carried out. The hierarchical distribution of research results on cost sharing in higher education is shown in Table 8.

Table 8 Hierarchical Statistics of Research Result Types (Unit :%)

type	hier- archy	fundamental research	Industry guidance	Policy Re- search	High educa- tion	vocational guidance	engineering technology	Basic and Secondary Vocational Education
占比		66.43	15.00	10.36	3.57	3.57	0.71	0.36

4 Issues and Suggestions

The cost sharing mechanism for higher education in China has been established for 30 years [8], and research on cost sharing in higher education has also been carried out for nearly 30 years. However, there is still a lack of convincing theoretical support at the practical level. According to the statistical analysis above, there is a situation of "three deficiencies, two narrows, and one low" in the theoretical research of cost sharing in higher education. Only by raising awareness, strengthening guidance, and continuously improving research methods can we gradually fill the gaps in current research work and better serve the practical activities of cost sharing in higher education.

4.1 Shortcomings in Research on Cost Sharing in Higher Education

(1) Three deficiencies: fewer personnel, fewer institutions, and fewer achievements

According to Citespace statistics, in the 25 years since the first study on cost sharing in higher education was published, only 239 researchers in China have published their research results, and on average, less than 10 researchers have published their research results publicly each year. Although the number of researchers whose research results have been publicly published does not necessarily represent the number of participants in research work, it indirectly reflects the limited number of researchers engaged in cost sharing in higher education to some extent. Of course, the number of researchers does not necessarily represent the quality of research results, but the level of quality is often based on quantity. It is an indisputable fact that there are fewer personnel engaged in research on cost sharing in higher education, and fewer personnel have publicly published costs.

At the same time, it was found that 239 researchers with publicly published results were distributed in 40 institutional units nationwide, and none of the 40 institutional units were professional institutions for cost sharing research in higher education. Researchers are only scattered among various institutional units, lacking rigorous organizational and systematic professionalism. It is a fact that there are few institutional units that assist in the research of cost

sharing in higher education, and there are no professional institutions for the research of cost sharing in higher education.

It is natural that the number of research results directly related to the small number of researchers and research institutions is small. In the 25 years since the publication of research results, only 282 papers have been published publicly. Among the vast and vast scientific research achievements, they can only be considered a drop in the ocean. The average number of research results per year is just over 11, and both the total number of research results and the average number per year can be described as pitiful.

(2) Two narrows: narrow research scope and narrow source of research team

Through the analysis of research topics related to cost sharing in higher education, the main content of cost sharing in higher education in China is focused on the construction of sharing mechanisms and systems, with research results accounting for about 60% of the total literature, followed by empirical research content, accounting for about 20% of the total literature. The coverage of theoretical research on cost sharing in higher education is still relatively limited, and a relatively systematic research theoretical system has not yet been formed. Although the focus of research is relatively concentrated, due to the limited number of literature, the research on the focus is still not thorough enough.

The previous statistics have made it clear that a total of 40 authors from institutional units across the country have published research results on cost sharing in higher education, but all of these 40 institutional units are higher education institutions. The administrative authorities in charge of higher education, educational industry associations, and related scientific research institutes are all closely related departments for research on cost sharing in higher education. However, since the publication of relevant research results, there has been no research result from the relevant departments for nearly 30 years. Whether authors from 40 universities participate in professional research teams or have personal research interests, researchers simply come from universities, and it is obvious that the source of the research team is too narrow.

(3) Low adoption rate at the practical level

Among the 282 publicly published research papers on cost sharing in higher education, 34 were sourced from CSSCI journals, accounting for 12.06% of the total publication volume; 59 articles are sourced from Peking University's Chinese core journals, accounting for 20.92% of the total publication volume. According to the standard that the proportion of core journals can generally be controlled between 10% -15% ^[9], whether judged by the proportion of CSSCI journals or the proportion of Peking University Chinese core journals, the overall quality of literature research that has been published is relatively high. Both from the level of innovation and the depth of research, full recognition should be given.

Due to the current lack of rich research topics and content on cost sharing in higher education, especially the theoretical research on cost sharing in higher education that closely integrates with national conditions, it has not yet achieved good development in China, and the targeted strategies and suggestions for solving practical problems are not strong. The government has clearly adopted theoretical research findings and suggestions in addressing the problems of local higher education investment mechanisms, and there are obvious traces of not adopting theoretical research findings in other decisions on cost sharing in higher education. The research results on cost sharing in higher education have a low adoption rate in government decisions and practices, and the localization effect of theoretical research on cost sharing in education is not yet obvious.

4.2 Suggestions for Research on Cost Sharing in Higher Education

The current status of research on cost sharing in higher education is clear, and the continuous

development of national policies on financial investment in higher education requires greater support from theoretical research. Only by raising awareness of the importance of theoretical research on cost sharing in higher education and increasing guidance for theoretical research, can theoretical research on cost sharing in higher education achieve significant development. While theoretical research continues to enrich and improve, it plays a greater reference role for practice and decision-making.

(1) Raise awareness

Cost sharing in higher education is related to the healthy development of higher education and directly affects the quality of talent cultivation in universities. Only by fully understanding the importance of cost sharing in higher education can we place it in its rightful position. Cost sharing in higher education consists of two parts: theoretical research and practical exploration. Theory originates from practice and can guide or predict practice. It also needs to be tested and improved in the process of practice, and the two complement each other. Both the improvement of practical activities for cost sharing in higher education and the improvement of theoretical research itself cannot be separated from the research work on cost sharing in higher education.

To enhance the understanding of the importance of theoretical research on cost sharing in higher education, it is not only necessary for researchers and their teams, but also for higher education administrative authorities, higher education related industry associations (associations), relevant research institutes, and other close stakeholders in higher education. Only when government functional departments, industries, professionals, and researchers reach a consensus can the research on cost sharing in higher education be truly strengthened. The shortcomings in current theoretical research can be improved and made up for as soon as possible, and theoretical achievements can better serve and promote practical activities of cost sharing in higher education.

(2) Strengthen guidance

Based on the reality of fewer researchers, institutions, and achievements in higher education cost sharing, in order to achieve greater breakthroughs in quantity and quality in higher education cost sharing research more quickly, government functional departments, industry associations (associations), research institutions, and existing higher education cost sharing researchers should increase their guidance work on higher education cost sharing research. Enable researchers, institutions, and achievements to first increase in quantity, and then gradually improve the quality of research achievements.

Strengthening research and guidance on cost sharing in higher education can be achieved through various methods such as setting up guideline projects in government funding projects and increasing rewards and funding for achievements. Firstly, it is necessary to increase guidance for existing researchers, so that they can invest more time and energy into their research work based on the existing foundation, and strive to achieve new breakthroughs in both quality and quantity of research results. Secondly, it is necessary to increase guidance for personnel with research potential and attract more outstanding researchers to the research team of cost sharing in higher education. But high-quality research results are not easy to achieve overnight. Whether it is research work or policy guidance work, there needs to be a persistent and long-term process of perseverance.

5 Conclusion

A reasonable cost sharing mechanism for higher education not only comes from continuous exploration and testing in practice, but also relies on the support and promotion of theoretical research. Although China has established a higher education cost sharing mechanism that includes government budget allocation, student payment of tuition and miscellaneous fees, encouragement

of social education donations, and enterprise payment of education surcharges, the proportion of government sharing of higher education costs is relatively low, the amount of education financial investment fluctuates greatly, and there are still significant differences in education financial investment between regions that are not conducive to the development of higher education, There is still a need for practical exploration and theoretical research to work together to continuously improve.

By using the Knowledge graph to analyze the theoretical research of higher education cost sharing, the research finds that there are few researchers, institutions, achievements, narrow research areas and research teams in China's higher education cost sharing theory, The adoption rate of research results in practical activities and government decision-making is low. Only by raising awareness of the importance of cost sharing mechanisms and theoretical research in higher education, strengthening work guidance, and through long-term and unremitting efforts, can close stakeholders in higher education, such as higher education administrative authorities, higher education related industry associations (associations), and relevant research institutes, make up for the shortcomings in research on cost sharing in higher education, To better promote the implementation of practical activities for cost sharing in higher education.

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