

Visualization Research on Synergistic Evolution of S&T Finance and Technology-based SMEs

Xi Wu

Tongji Zhejiang College, Jiaxing Zhejiang, 314001, China

Keywords: S&T finance; technology-based SMEs; visualization research; synergistic evolution

Abstract: For studying the rules of the synergistic evolution of Chinese S&T finance and technology-based SMEs in China, this paper conducts analysis through more than a thousand scientific and financial related literature documents and related literature of scientific and technology-based SMEs. Through numerous literature and statistics, by combining software analysis of visualized literature with the "number-form" analysis method, this paper conducts discussion and research from cross-disciplined professional perspective to construct a visualized operating mechanism for S&T financial service technology SMEs, hoping to provide reference for researches on the future direction of China's S&T finance and the direction of financing.

1. Significance of Visualization Development of Synergistic Evolution of S&T Finance and Technology-based SMEs

Scientific and technological innovation has become an important guarantee for the synergistic development of finance with science and technology, as well as the driving force and necessary guarantee for the long-term stable development of China's economy at the same time. The technology-based SMEs as the most active group of enterprises in science and technology innovation in China also play a key role in promoting the development and progress of science and technology and transforming scientific and technological achievements into industrial upgrading. To promote the development of science and technology innovation in our country and promote the continuous growth of the social economy, it is necessary to vigorously support the technological innovation in technology-based SMEs since the development of science and technology innovation is of great significance to the society and positive development. At the same time of the in-depth reform of theory and practice of S&T finance under process, China's science and technology-based SMEs have continued to optimize and improve their financing channels, making the coordinated development of S&T finance and technology-based SMEs as hot research topic among experts and scholars in nowadays society.

Currently, through the combination of literature, description systems and visualization tools, it can be seen that there are numerous researches of the field of S&T finance and technology-based SMEs in China. However, in the huge research system, the research on the synergistic development of S&T finance and the areas of SMEs has not yet obtained corresponding conclusion. For the purpose of studying the development of S&T finance in China and related fields in technology-based SMEs, researches in the field of S&T finance and technology SMEs in China in recent years will be selected a hotspot for analysis and study to analyze the core research groups in China, summarize the current laws of the coordinated development of cross-sectoral development of S&T finance and ad technology SMEs in China, and build the relevant operational mechanisms for S&T financial service technology-based SMEs in China. We use literature as the beginning of research, with the rules of synergistic development as the core, with the establishment of a co-occurrence network in the field of research as the focus and the search literature and "CiteExperss" management tool and "NoteSpaceIII" visualization scientific knowledge and graphing software as tools to deeply analyze these hot research topics.

2. Sources of Related Data and Data Processing Mode

2.1 Method of data acquisition

CNKI periodical database with strong timeliness was used as a research sample so as to better analyze and research the dynamics and development direction of China's S&T finance and technology-based SMEs. With the support of professional software, we conducted relevant document retrieval in the field of S&T finance and technology-based SMEs. To ensure the integrity and accuracy of the research literature and fully consider the "Planning Standards Regulations for SMEs" and the development cycle of enterprises, we have specifically adopted "S&T Finance" and "Technology-based Small and Medium-sized "Enterprises" and "S&T Small and Medium-sized Enterprises" and "Science and Technology Entrepreneurial Enterprises" as keywords for searching.

2.2 Relevant data processing

Through the analysis of the variables in the literature, such as keywords, article titles, author names, and publication year, we also conducted in-depth study of the number of documents, institutions, hot spots, and frontiers was conducted, combined the research methods for data processing and analysis through "NoteSpaceIII" visualization scientific knowledge atlas software.

3. Analysis of Relevant Research Results and Contents

3.1 Analysis of literature quantity

Time-series method will be used to sort out the research and development content of China's S&T finance and technology-based SMEs. Through the date deadline in the database of CNKI journals on the day of the search, we can find more than 3,000 articles and research literature in the fields of S&T finance and technology-based SMEs. Among these articles, more than 900 articles were collected in the core journals. Through data analysis, it can be known that research in the field of science, technology and finance in China began in the 1980s. "Decision of the Central Committee of the Communist Party on the Reform of the Science and Technology System" concerning the combination of science, technology and finance in the field of science in 1985 without attracting too much attention was found, which involved the establishment of venture capital and the start-up of science and technology loans. At the time, it also promoted the integration of S&T finance in China. But for a long time, the relevant literature in the field of S&T finance in China has not obtained great improvement. Although the research of technology-based SMEs in our country is decade later than science and technology finance, there exist great advantages in the literature quantity. On the other hand, it can also be seen that China's technology-based SMEs have become the focus of research for experts and scholars.

3.2 Content distribution of disciplines and core journals

Research of literature was performed through scientific distribution statistics involving literature related to S&T finance and technology-based SMEs and covering more than 40 professional disciplines, with great similarities of disciplines. This can to a large extent reflect the great similarities between the two major areas in the study of topics. Science and technology finance is the main analysis and research of financial disciplines. Also, it is the study of disciplines of enterprise economic and scientific research management, which has fully reflected that characteristics of science and technology finance is that financial activities are the driving force of technological innovation.

Core journals with certain academic influence in the literature are the version of a relatively high level among many academic-related journals. The published literature represents, to a large extent, reflected the highest level of research in related fields. The analysis of the publication rate of the core journals can help to more accurately grasp the current state of the highest level of development in the relevant areas of the research. Through retrieval, we can obtain totally 311 core documents related to

the field of science and technology finance, accounting for 1/5 of all documents, totally 574 core literatures about technology-based SMEs, accounting for 3/10 of the total. This is enough to indicate that a core group for literature research has not yet formed in the field of S&T finance and technology-based SMEs in China.

“CiteExpress” management tool was used to analyze the core journals in the research field of S&T finance and technology-based innovation companies. For visualization research of core journals, we have constructed a co-occurrence knowledge graph for analysis, as shown in Figure 1. In the entire knowledge graph, the relevant nodes represent the high-yield authors and research institutions, node color and size, represent the time and document quantity. We can analyze the research authors and their institution distribution in the field of S&T technology and technology SMEs by comparing the knowledge graph, corresponding knowledge co-occurrence graph as shown in Figure 2. Considering the low degree of cooperation between authors and related institutions, no large-scale cooperation network has showed up. The scientific and technological research departments and colleges and universities are currently the most important research institutions, which have become the main driving force for the development of China's S&T finance and important scientific and technological enterprises. However, on the whole, no core group for researching China's S&T finance and technology-based SMEs has appeared yet.

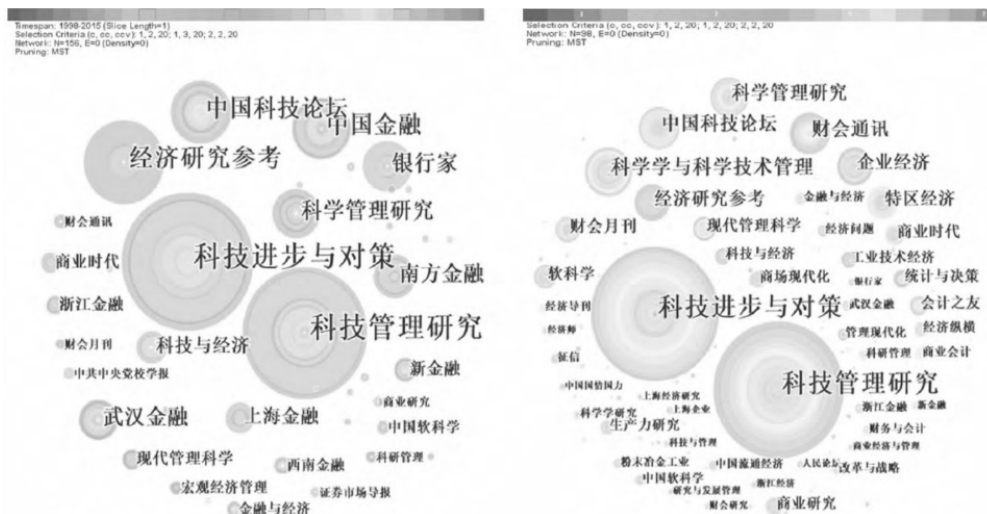


Figure 1. Core journal co-occurrence knowledge graph

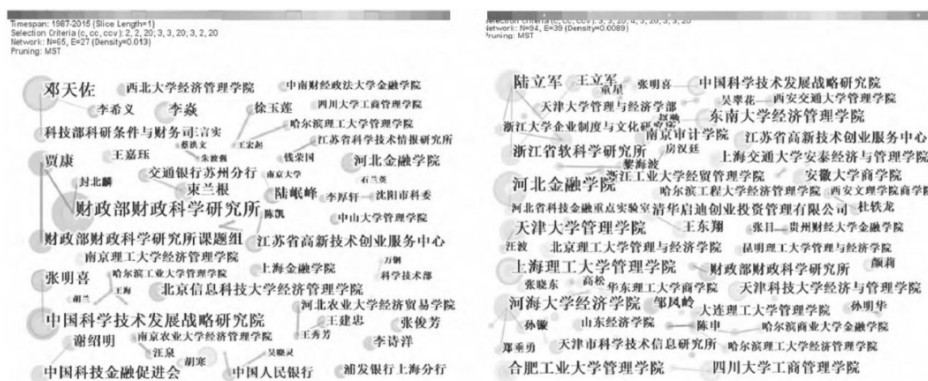


Figure 2. Author institution co-occurrence knowledge graph

“CiteSpace III” management tool was used to research and summarize the hot spots in the field of S&T finance and technology-based SMEs, and to construct knowledge graph for the entire development of literature and testing. For the keyword distribution, we can split the attributes and threshold value, and use the relevant intermediate-center measure to find the belongings of the study in the relevant catalog, and search through keywords to serve as the preface of the research. The

keyword co-occurrence knowledge graph is shown in Figure 3. In the whole graph, the nodes that form the keywords are mutation keywords. The chromatogram and size of the nodes show the existence period and keywords frequency. The connection lines between the nodes show different occurrence times. For the dynamic concept and potential research issue in frontier research, “CiteSpace III” management tool will be used to monitor the mutation history for the analysis of the keyword mutation phenomenon in the situation and the trend interpretation of preface in the whole field.

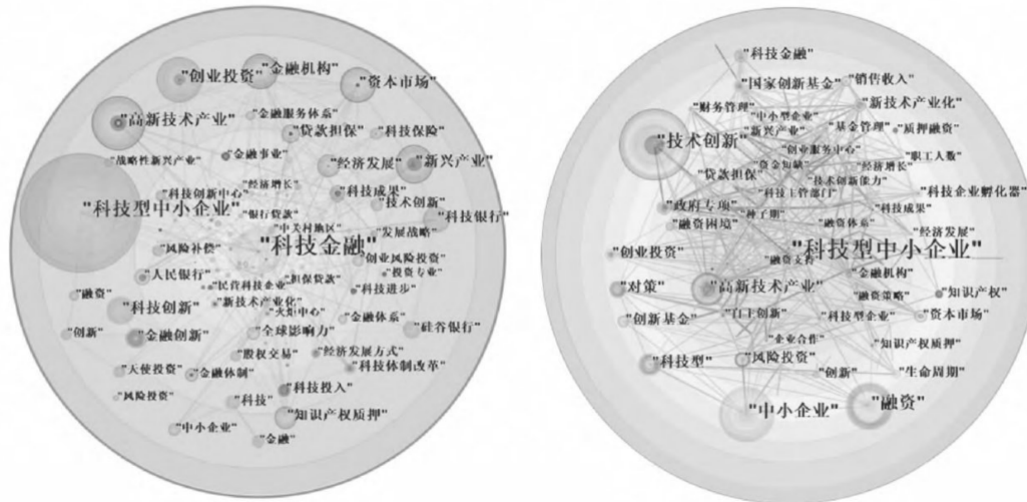


Figure 3. Keyword co-occurrence knowledge graph

For the entire context of the development of S&T finance and the development of technology-based SMEs can be achieved through the synergic evolution trend graph. At the beginning of the entire S&T finance research, the research related to the innovation of financial credit market is the most notable, which proves that, the related fields of S&T finance during this time period are the key research objects for the innovation and development of the entire science and technology system, and also indicate the target of scientific and technological progress and development. With the continuous development of scientific and technological progress in China, and improving synergic development of S&T finance and technology-based SMEs, financial innovation has become the direction of the direction of the development of S&T finance, and also provide professional financial guarantees for technological development in SMEs. Therefore, discovering the most suitable financing channel based on the characteristics of technology-based SMEs is an effective way to solve the financing difficulties of SMEs. With the financing needs of technology-based SMEs as a starting point, we established the overall operating mechanism of S&T finance and technology SMEs as a financing solution by combining with the actual situation of S&T finance and the actual situation of financing for SMEs.

4. Relevant content research and conclusion

In the article, visualization research of the synergistic evolution of S&T finance and technology-based SMEs was conducted by using the dossiers and descriptive statistics methods of the literature, and using the visualized literature as the main research tool. Through the database of CNKI journals, literatures about S&T finance and technology-based SMEs in the last 30 years were exported for analysis and research. In statistics and research, we can find out the status of research on S&T finance and technology-based SMEs in terms of literature quantity, hot research, and preface evolutionary research. Meanwhile, we also performed quantitative statistical analysis. The following conclusions are drawn: Firstly, we can learn that the research literature in the field of S&T finance has only received widespread attention since 2006 after the underestimated development period. Since 2006, research in the field of science and technology finance has remained as the research content

with high popularity. To a certain extent, this fully indicates the direction of demand for China's economic development. It also publicizes policy orientation and clarifies the overall development direction. Secondly, in the field of research for important science and technology enterprises, the growth trend also indicates that the science and technology-based SMEs are currently a new type of research area. Thirdly, as cross-convergence appears in China's S&T finance and technology-based SMEs in terms of discipline research, a wide range of papers on cross-study of key journals in the field of science and technology SMEs emerge. However, lack of a stable core journal group, it is necessary to improve the level of academic research for continuous research reform and innovation in the professional field. In the research fields of S&T finance and technology-based SMEs, because of the existence of cross-cutting studies, the overall number of literatures is relatively small. As the main body of research, higher-education institutions and distributed research institutions are scattered without no core research group with stronger cohesion formed. Fourthly, the new type of financial innovation industry has become the leading prelude to the entire development of the field of science and technology finance. Capital market and pledge financing have also become the main research objects in the field of technology-based SMEs. Internet finance, venture capital investment, and intellectual property pledge, technology-based SMEs research trend are worth further analysis and research.

We can know S&T finance and science and technology SMEs area analysis and research. Due to no in-depth cooperation, the main research body is also relatively single. The government's scientific and technological researchers and scholars of universities and colleges as the core force of research on China's S&T finance and technology-based SMEs, they have worked out more satisfactory results. Besides, with the continuous improvement of research capabilities, complementary advantages and cooperative innovation can be realized with government as the lead, universities and colleges as research bases for scientific and technological innovation, and small and medium-sized enterprises and financial institutions as pilot regions for collaborative networks. China's S&T finance and technology SMEs can be more closely integrated in theory and practice. At research nodes of S&T finance and technology-based SMEs, due to the theme diversity, we need to continue to explore. For better development and innovation of China's S&T finance and technology-based SMEs, we should sum up experience in practice, explore diversified development in the capital market, learn from successful cases, and actively control the trend of S&T finance and technology-based SMEs, and solve actual problems.

5. Conclusion

Without support from municipal government, most research of S&T finance, and technology-based SMEs are usually qualitative and few are empirical studies, which makes the practical application of the entire technology-based SMEs have obstacles to get suggestions and methods without obvious effectiveness. Therefore, we should strengthen the analysis and research in the empirical aspect and continuously improve the research system in this domain.

References

- [1] Duan Ru. Studies on Science, Technology and Finance Policy to Promote the Development of Science and Technology SMEs, *CO-Operative Economy & Science*, 2014,(7):58-59.
- [2] Yu Feng, Pan Yuxiang. Technology Financial Platform Promotes the Development of Scientific and Technological SMEs, *Times Finance (The end of month)*, 2016,(5):137,143.
- [3] Tang Zhen, Li Fang. Bibliometric Analysis of the Status Quo of China's Sci-tech Finance Research, *Journal of Information*, 2014,(2):81-85.