



# Visualized Analysis of Science and Technology Translation in China Based on VOSviewer (1998-2022)

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## Abstract

Science and technology translation and related research have achieved milestones both in China and the West, but conditions in China have not drawn attention, especially regarding translation activities and analyzing relevant research. To provide a reference for the future development of science and technology translation worldwide, this study reviews the history of science and technology translation in China and presents an overview of the development of related research in various aspects using VOSviewer to investigate the researchers, research topics, themes and trends of science and technology translation in China.

**Keywords:** science and technology translation, translation history, translation studies, VOSviewer

## 1. Introduction

Science and technology translation both in the West and in China has progressed gradually with translation practice and achieved milestones. In reviewing Chinese translation history, many efforts have been made across a variety of countries and regions. Some notable examples include Rachel Lung (2008; 2016), who introduced translation officials in the Tang dynasty and put the Jiangnan Arsenal's translation department as a microcosm to introduce translation and ideological transformation in 19<sup>th</sup>-century China. Martha Cheung (2011) introduced some Chinese endeavors in reconceptualizing translation, and Rachel Lung (2011) also has a monograph sharing the history of interpretation in early imperial China. However, the majority of scholars worldwide have not paid much attention to the history of Chinese translation, especially regarding science and technology translation activities and analyzing relevant studies. Therefore, in an attempt to add the Chinese piece to the puzzle of translation history, this study will review the development of science and technology translation that falls into two parts: the history of Chinese science and technology translation activities and the advance in related research.

## 2. History of Chinese Science and Technology Translation

The history of science and technology translation practice in China can be divided into four periods: before the Ming Dynasty (-1368), during the Ming Dynasty and the Qing Dynasty (1368-1912), during the Republic of China (1912-1949), and from the founding of the PRC (1949) until the present day.

### 2.1 The Early Period

Translation in China before the Ming essentially consisted of translating religious documents, but a small number of foreign books on philosophy, astronomy, mathematics, medicine, and other sciences, such as *Jiuzhi Calendar*, *Brahmin Prescription* (Li et al., 1999), and so on, were also translated into Chinese.

### 2.2 The Middle Period

China's science and technology began to fall behind the West in the 16<sup>th</sup> century and continued to fall during the late Ming Dynasty and the early Qing Dynasty. Meanwhile, to do missionary work in China, Western missionaries began to cooperate with Chinese scholars to translate scientific documents, thus introducing Western science and technology and marking the first science translation climax in China. According to Ma Zuyi (2004), the ancient classics translated during this period mainly involved physics, medicine, astronomy, and arithmetic, with a small number of social science texts regarding linguistics, literature, philosophy, theology, etc. being translated. Although it was not yet systematic, the introduction of Western sciences and technology gave the Chinese people a basic understanding of the development behind Western innovations, providing the relevant knowledge for dramatic political changes in Chinese society. However, after over seventy famous missionaries came to China and translated or edited about 120 scientific works (Xu, 2005), Qing Dynasty expelled Western missionaries in 1723. Thus, there was little translation of scientific works over the next 100 years.

This changed in the late Qing Dynasty, however, when translation institutions and translation centers were set up to train translators and offer translation courses to realize "national salvation." The second science and technology translation climax

in China began with the emergence of Xu Shou, Yan Fu, and even Kang Youwei, the leader of the Reformists, who was not satisfied with only translating military technology, chemical, and electrical knowledge. He advocated for the translation of political, legal books, and various academic documents, thus expanding the scope of science and technology translation in China (She et al., 2001). In the late Qing Dynasty, the number of scientific and technological translations in China increased significantly with over 2,000 works translated, a much higher number than that in the late Ming and the early Qing (Li et al., 1999:44). This difference is epitomized by Jiangnan Arsenal's translation department, the largest translation institution of scientific and technological works during the Westernization Movement, which published 185 scientific and technological translations and over 49 translated but not published works from 1868-1912 (Wang, 1988).

### 2.3 The Modern Period

In this period, the practice of science and technology translation in China became even more ambitious and extensive. The quantity of translated scientific works in this period reached nearly 10,000, far outnumbering the quantity translated during the last seventy years of the Qing Dynasty (Li et al., 1999:45). The government established book compilation and translation departments, while non-governmental publishing, such as The China Publishing and The Commercial Press, also developed rapidly, and scholars and experts who had returned from overseas became the main force of science and technology translators.

This period also witnessed the endeavors of the Communist Party of China. The Central Committee of the CPC started to foster translators and interpreters, and in 1940, the Foreign Languages School was established in Yan'an, Shanxi. Communist Party of China also set up publishing houses, where they translated many books about Marxism-Leninism and other scientific works.

### 2.4 The Contemporary Period

With the founding of the People's Republic of China in 1949, especially owing to the implementation of the Reform and Opening-up Policy in 1978, Chinese science and technology translation has reached a new climax. With a larger number of translators and a wide range of channels and forms of communication, many more subjects can be translated. Therefore, the practice of science and technology translation in China has brought new vitality and opportunities to the developing Chinese science and technology.

## 3. History of Chinese Science and Technology Translation Studies

### 3.1 Before the Implementation of the Reform and Opening-up Policy

Before the Ming Dynasty, translation studies in China centered on religious documents, such as Shi Daoan's (312-385) "Five Adaptations and Three Difficulties" from the Jin Dynasties, Yan Zong's (557-610) "Eight Requirements for Translators" from the Sui Dynasty, and Xuan Zang's (about 600-662) "Five Non-translatable Categories" from the Tang Dynasty.

In the late Ming Dynasty and the early Qing Dynasty, Western missionaries, as well as far-sighted personages among the Chinese dignitaries at that time such as Xu Guangqi and Li Zhizao, mentioned their opinions on science and technology translation in the preface and synopsis of their translations, opening up the study of science and technology translation in China. Over a hundred years later, in the Republic of China, as the different types and the overall number of scientific and technological translations increased, the research on science and technology translation also became more prosperous.

After the founding of the People's Republic of China in 1949, there was an urgent need to utilize translated works and introduce foreign scientific and technological resources, especially those from the former Soviet Union, to develop China in its reconstruction period. Therefore, science and technology translation research in this stage centered on Russian texts. Journals such as *Русский Язык* (*Russian Learning*) and *Fan Yi Tong Bao* (*Chinese Translation Bulletin*) were witnessed in this stage.

### 3.2 A Bibliographic Analysis of Related Researches (1978-2022)

Chinese science and technology translation research was rejuvenated after China implemented the Reform and Opening-up Policy in 1978. A large number of foreign language and translation journals, such as *Chinese Translators Journal* (formerly: *Translators' Notes*), opened a column on "science and technology translation," while professional journals such as *Shanghai Journal of Translators* (formerly: *Shanghai Journal of Translators for Science and Technology*) and *Chinese Science & Technology Translators Journal* were founded. The number of papers on science and technology translation gradually increased to over a thousand, and many papers, monographs, and textbooks discussing theories and techniques of science and technology translation also became increasingly published.

Influenced by globalization and informatization, science and technology translation research has varied contents, diverse research methods, and broadened research perspectives after analyzing relevant papers in three high-impact Chinese

translation journals (Shan Yu et al., 2017). Science and technology translation research is gradually becoming prosperous. Based on the quantitative analysis and mapping analysis of related papers, this study examined the last 25 years (1998-2022) of science and technology translation research in China.

### 3.2.1 Data collection and analysis

#### (a) Data source

The data for this study were obtained from the Chinese Social Science Citation Index (CSSCI), a database developed by the Institute for Chinese Social Sciences Research and Assessment of Nanjing University. CSSCI has been used by Tsinghua University, the National Library of China, the Chinese Academy of Sciences, and more than 100 other institutions as a basis for academic evaluation and assessment. The CSSCI database covers important research articles on Chinese science and technology translation.

#### (b) Analysis tools

The analysis tool used by the authors was VOSviewer, developed by Nees Jan van Eck and Ludo Waltman of Leiden University's Centre for Science and Technology Studies (CWTS), based on the computing platform Java released by Sun Microsystems, as a software tool for constructing and visualizing bibliometric networks. VOSviewer is capable of systematically exploring the research process of a discipline and determining its development trends, providing research institutions and research funders with a comprehensive view of their scientific activities to support strategic decision-making. The version of the VOSviewer used in this study was 1.6.18.

In addition, the authors used Office Excel, a data processing software developed by Microsoft, for plotting line graphs. The version of Office Excel used in this study was 16.43.

### 3.2.2 Visualization analysis

The authors used “科技翻译” as a search term and obtained 343 scholarly essays related to science and technology translation from CSSCI source journals. Using the paper-by-paper examining method, 271 valid articles were kept manually based on their titles and abstracts after excluding articles such as book reviews and conference reviews. The information of valid articles, including title, author, institute, keywords, source, and year of publication, was saved in text files and imported into the software tool VOSviewer. Combining with traditional bibliometric methods for data statistics, the authors analyzed the status of Chinese science and technology translation research in the past 25 years.

#### (a) Analysis of papers published annually

The chart of annual publications can visually show the development of a subject. The data collected were processed using Microsoft Office Excel to produce a chart of annual publications in Chinese science and technology translation research during 1998-2022, as detailed in Figure 1.

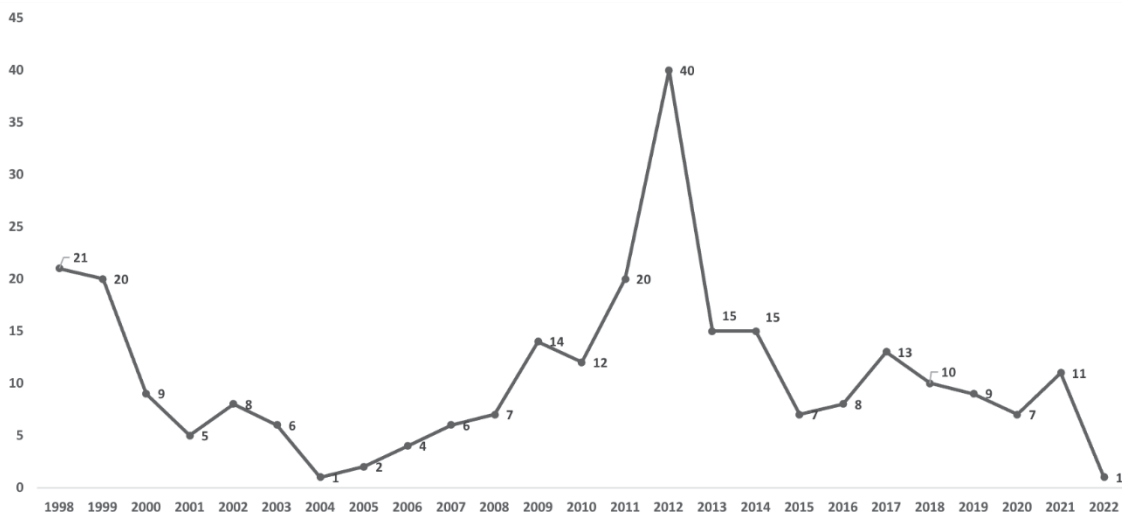


Figure 1. Papers published annually in Chinese science and technology translation study during 1998-2022

The total number of articles published during 1998-2022 was 271, with an annual average of about 10.8 articles. As shown in Figure 1, the research on science and technology translations by Chinese scholars at the end of the 20<sup>th</sup> century was at a

climax, and the number of articles published in 1998 and 1999 both reached 20. However, in 2000, the number of publications dropped sharply to single-digits, which is believed to be influenced by the fact that Chinese scholars focused more on literary translations because of a debate on the scientific and artistic aspects of translation between the translation theory of the Chinese linguistic school and the traditional translation theory of the artistic school at this time. From 2001-2011, the number of publications began to stabilize and even surged in 2009 and 2011. That was owing to the expanded enrollment of postgraduate students in China especially due to the establishment of the Master of Translation and Interpreting, which focuses on the cultivation of application-oriented talents. The number of articles increased significantly to 40 in 2012 because of the rise of computer-aided translation tools and the review of all research in the 10 years since the Millennium. The number was stable again from 2013-2021 at an annual number of publications of around 10. That was owing to the in-depth research on the use of machine translation, the expansion of the spatial and temporal span of data analysis, the exploration of the history of Chinese science and technology translation, and innovations within the training mode of science and technology translation talents in institutions of higher learning.

(b) Analysis of articles' authors

Using VOSviewer, the raw data were pre-processed by converting the format. Then, the authors set the options: Type of analysis: Co-authorship; Counting method: Full counting; Unit of analysis: Authors; Minimum number of documents of an author: 1. All other settings were default. As a result, 309 eligible authors met the threshold, and a network view of co-authorship was generated, as shown in Figure 2.

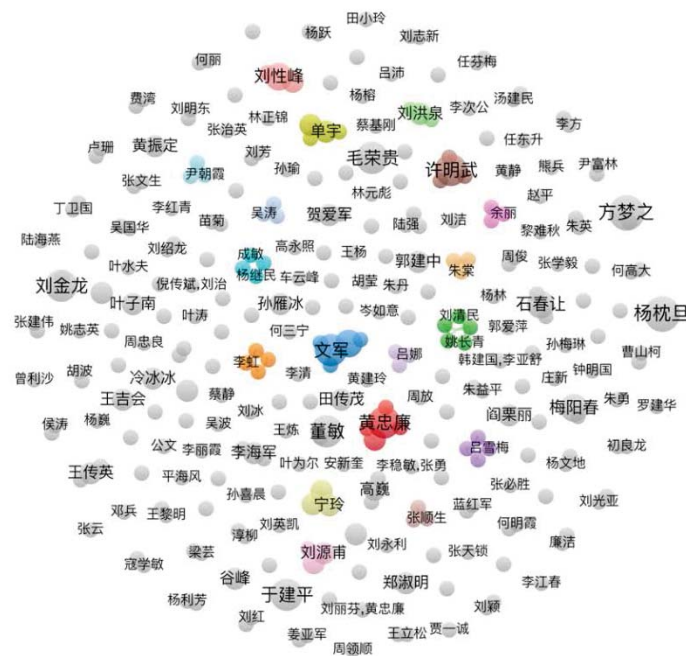


Figure 2. Network view of co-authorship in Chinese science and technology translation study during 1998-2022

Among them, the top five authors in terms of the number of publications are shown in Table 1. All of these authors were highly productive authors in the field of Chinese science and technology translation research and published four or more science and technology translation papers in CSSCI source journals between 1998 and 2022.

Table 1. Top five productive science and technology translation research scholars in Chinese CSSCI source journals during 1998-2022

No.	Author	Documents
1	Fang Mengzhi	5
2	Yang Zhendan	5
3	Huang Zhonglian	4
4	Wen Jun	4
5	Xu Mingwu	4

At the top of the list is Fang Mengzhi, former chief editor of *Shanghai Journal of Translators*. He published five articles about science and technology translation in CSSCI source journals in the last 25 years and has an abundance of other achievements. He is a pioneer in theoretical research on science and technology translation (Guo, 2014) and has made remarkable contributions to the development of this field in China. Also with five articles is Yang Zhendan, former senior editor of The Commercial Press, who has published a series of articles exploring the translation of scientific and technological terms in *Foreign Language Teaching and Research* and has made significant contributions to the relevant study. Yang is followed by Huang Zhonglian, Director of the Institute of Translation Science at Heilongjiang University, who has researched applied translation and translation thinking, etc.; Wen Jun, from the School of Foreign Languages, Beihang University; and Xu Mingwu, Dean of the School of Foreign Languages, Huazhong University of Science and Technology, all with 4 articles, highlighting the importance that both experts and their institutions place on the study of science and technology translation.

(c) Analysis of the frequency and co-occurrence of keywords

Set the options in VOSviewer: Type of analysis: Co-occurrence; Counting method: Full counting; Unit of analysis: Keywords; Minimum number of occurrences of a keyword: 2. All other settings were default. 122 keywords met the threshold. After further processing keywords by manual merging, 98 valid keywords and their frequencies were obtained. Then, by arranging the results in descending order, the top 10 keywords are shown in Table 2. The occurrence of these high-frequency keywords is more than five times, which to some extent represents the hot issues that are of concern in Chinese science and technology translation research from 1998 to 2022.

Table 2. High-frequency keywords of science and technology translation research in CSSCI source journals during 1998-2022

No.	Keyword	Occurrences	No.	Keyword	Occurrences
1	science and technology translation	58	6	science and technology papers	8
2	translation	29	7	scientific and technological terminology translation	8
3	science and technology English	23	8	applied translation studies	7
4	translation strategies	11	9	applied translation	7
5	translation techniques	10	10	curriculum setting	6

As shown in Table 2, the keyword “science and technology English” is at the top of the list, indicating that Chinese science and technology translation research has mainly focused on English to Chinese texts in the last 25 years. The fourth and fifth rankings are “translation strategies” and “translation techniques” respectively, indicating that Chinese scholars attached importance to the analysis and summary of science and technology translation activities. The Chinese scholars’ emphasis on techniques is, to a certain extent, also reflected in “science and technology papers” and “scientific and technological terminology translation,” which are ranked 6<sup>th</sup> and 7<sup>th</sup>, respectively, and involve word choice and Chinese Pinyin spelling in translated texts. The occurrences of the keywords “applied translation studies” and “applied translation” are both 7, which indicates that with the implementation of the Reform and Opening-up Policy, applied translation, such as the translation of

advertisements, has emerged rapidly. Likewise, applied translation research, which started from science and technology translation research, has also gradually developed. Finally, “curriculum setting” has also received much attention from Chinese scholars, reflecting the gradual attention to cultivating science and technology translation talents in China in the past 25 years.

The authors further selected all valid keywords for co-occurrence analysis, and a network view was generated, as shown in Figure 3.

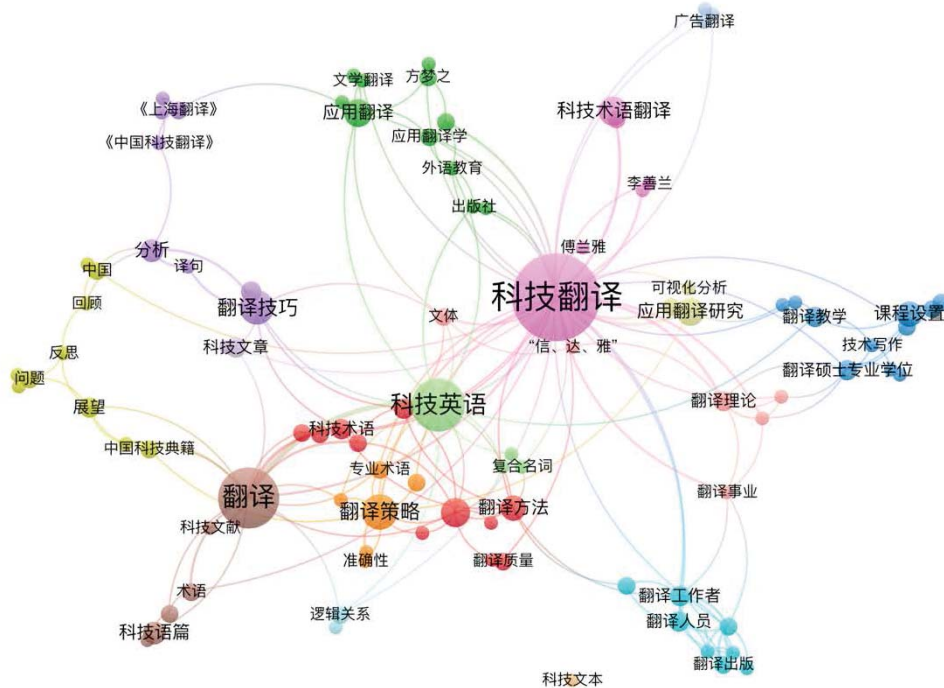


Figure 3. Network view of keywords co-occurrence in Chinese science and technology translation study during 1998-2022

According to the number of keywords they contain, the Clusters ranked in the top five are as follows: Cluster 1 contains 11 keywords, which are: online translation, Chinese to English translation, Skopos theory, science and technology journals, science and technology terms, science and technology papers, editing, translation methods, translation quality, English translation, and English. The research topic can be summarized as machine translation of scientific and technological texts, and the main research content is in machine translation (e.g. Online translation) assisted, the guiding theory of English translation of Chinese scientific and technological discourses, translation method, and the evaluation method of translation quality. Cluster 2 contains 11 keywords, which are: Shanghai Science and Technology Translation Society, publishing house, foreign language education, discipline research, applied translation, applied translatology, literary translation, Fang Mengzhi, editing and processing, translation theory research, and the translatology system. The main contents can be summarized as applied translation studies and research on the translatology system, of which the primary promoter is Fang Mengzhi, former chief editor of *Shanghai Journal of Translators* sponsored by Shanghai Science and Technology Translation Society. Cluster 3 contains 11 keywords, namely: information technology, training mode, technology writing, summary, translation profession, translation criticism, translation teaching, Master of Translation and Interpreting, translation competence, curriculum setting, and curriculum design. The research theme can be summarized as a teaching and training model for translation majors led by MTI, and the main research is about designing curriculums for developing translation techniques in information technology, technical collaboration, and translation criticism. Cluster 4 contains 10 keywords, namely: China, Chinese scientific and technological classics, reflection, development, review, outlook, current situation, research method, translated texts, and problem. The theme of the study can be summarized as a review, reflection, and outlook on Chinese science and technology translation, with the main contents being the methods of Chinese science and technology translation research and its problems,

as well as the history of science and technology translation in China. Cluster 5 contains 8 keywords, namely: Shanghai Journal of Translators, Chinese Science & Technology Translators Journal, analysis, science and technology English translation, translation techniques, translation research, translation sentences, and article analysis. This research theme can be summarized as the analysis of science and technology translation papers in high-influence translation journals in China, such as *Shanghai Journal of Translators* and *Chinese Science & Technology Translators Journal*. It mainly analyzes the science and technology translation techniques, translation methods, and translation research involved in papers. Therefore, it is evident that the research scope of science and technology translation in China is relatively wide, not only involving translation methods and translation techniques, but also including translation theory research, reflecting on the pre-existing research, and looking forward to the future from various perspectives. All in all, the research on science and technology translation in China gradually shows prosperity.

#### 4. Conclusion

The translation of science and technology works and relevant studies both in the West and in China have progressed together with translation practice and achieved milestones. However, the related achievements in China have not received much attention. In this regard, this study divided and briefly introduced the history of Chinese science and technology translation from ancient to contemporary times, as well as the development of science and technology translation research. Furthermore, the study hopes to provide a reference for the development of science and technology translation worldwide by analyzing the studies between 1998 and 2022 from the perspective of China in three dimensions: the number of papers annually, authors, and keywords. Although the research on science and technology translation in China has made many achievements, compared with the practical and theoretical research on literary translation in China, the research on science and technology translation is still weak. Not only is there a lack of outstanding published practical and theoretical papers on science and technology translation, but there is also a need for more science and technology translators and translatology scholars to strengthen their research on the basic theory of science and technology translation while summarizing the experience of it, to promote the continuous development of science and technology translation research.

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## Notes

Note 1. The deadline for data collection is June 13, 2022.



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