



Analysis of Multi-level Collaborative Relationships in Bibliometrics

Based on Cross-Author, Cross-Region and Cross-Discipline

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Abstract. Bibliometrics studies the distribution structure, quantitative relationship, and change the rule of information of different disciplines, and then obtains the development status and research level of the research field. Based on a total of 1959 pieces of bibliometrics literature in China National Knowledge Infrastructure (CNKI) from 1992 to 2020, this paper analyzes the interdisciplinary and regional cooperation between research institutions and authors in the field of bibliometrics, aiming to illustrate the research status and interdisciplinary exchanges in the field of library and information science in China in the past 30 years. Providing reference and decision-making basis for the domestic scientific community to carry out cooperation and research.

Keywords: Bibliometric · scientific research cooperation · VOSviewer · Cluster analysis · Interdisciplinary communication

1 Introduction

Bibliometrics is an important branch discipline of library and information science and information management, and also one of the active professional fields in the current international library and information academia. As scientific research issues tend to be complicated, the research modes of various disciplines also develop towards the method of collaboration, and the knowledge production mode driven by a single discipline has been transformed into the knowledge production mode driven by interdisciplinary interaction [1]. Therefore, it is particularly important to analyze the cooperative relationship and research status in various fields. Bibliometrics can effectively reflect the connections and differences between regions, disciplines, and researchers, objectively analyze the cooperation between different disciplines, and put forward suggestions for strengthening the influence of library and information science, improving output capacity, and subject development.

2 Study Methods

In this paper, academic journals in CNKI (General Database of Chinese Academic Literature Online Publication) were selected as an object. Bibliometric analysis and bibliometric analysis were used as subject search terms, and “SCI source journals”, “EI source journals”, “Peking University Core”, “CSSCI”, and “CSCD” were set as source categories. The period was from 2010 to 2020, and the retrieval time was July 15, 2021, with a total of 1959 retrieval results.

$SU = ('bibliometric')$ or $SU = ('metrological\ analysis')$.

In this study, VOSviewer was used as the main visualization software to draw the scientific knowledge map, and the knowledge system in the field of metrology was further displayed by analyzing and aggregating knowledge units. Make a visual effect chart with Pyechart.

3 Research Results and Analysis

3.1 Trends Analysis

According to Fig. 1, the number of articles published in metrology research generally keeps rising. Since 2010, the number of articles published has seen a significant increase, reflecting that bibliometrics analysis has attracted the attention of many scholars during this period, resulting in more research results. From 2010 to 2020, the literature growth rate showed an alternating state of positive and negative, indicating that there were difficulties and corresponding breakthroughs in the field of metrology during this decade, showing intermittent growth.

3.2 Source Analysis

According to Bradford’s law, journals are divided into three regions: the core region is the journals with more than 9 articles (a total of 28 journals and 665 articles). The

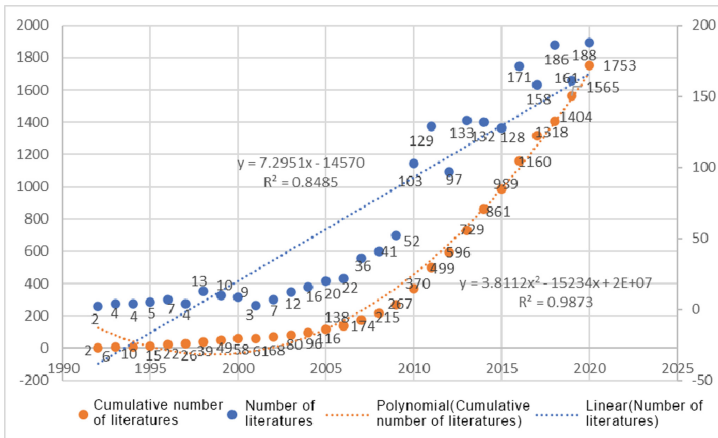


Fig. 1. Publication volume and growth trend

Table 1. Literature sources on bibliometric (top 10)

Source	Science Indicator		
	Percentage	Combined IF	Count
Information Science	3.22%	1.966	63
Journal of Modern Information	2.86%	1.868	56
Journal of Intelligence	2.4%	1.951	47
Chinese Nursing Research	2.1%	1.066	41
Science and Technology Management Research	1.84%	1.086	36
Chinese Journal of Scientific and Technical Periodicals	1.74%	2.172	34
Library and Information Service	1.63%	2.192	32
Journal of Anhui Agricultural Sciences	1.33%	0.351	26
Nursing Journal of Chinese People's Liberation Army	1.23%	1.137	24
The Chinese Journal of Clinical Pharmacology	1.12%	1.282	21

number of journals in this region is relatively small, but the volume of articles is high. For the whole literature collection, 33.95% of the literature was concentrated in 4.07% (28) journals and 66.46% in 25.6% (176) journals. This shows that metrology research has been concentrated in a few journals and formed its core journal group. Twenty-eight journals, including information science, modern information, information journal, and nursing research, constitute the core journals in the field of metrology and become the backbone of the development of the field.

In Table 1, it is shown that among all periodical sources, information science publishes the most literature (63 times), followed by modern information (56 times) and information journals (47 times), which mainly focus on the research of library information science and news media. Among the top 10 journals, the top three with the highest composite IF index are Library information Science, China Science and Technology Journal Research, and Information Science.

3.3 Author Analysis

The cooperative network is a hot research field in complex network analysis and a research direction in social network analysis and has become an important factor to improve the ability of scientific research institutions to produce results [2]. In addition, collaboration helps to expand the scope of disciplinary research, share scientific resources, reduce research risks and promote the production of high-quality research results [3]. There were 4955 authors in statistical literature from 1992 to 2020. Table 2 lists the top 10 authors with more than 8 publications, among which 7 authors are located in the same institution (PLA General Hospital), focusing on the research of pharmacy, clinical medicine, and other disciplines. At the same time, with the minimum number of 3 the author build the author cooperation network, it can be seen that the authors build a strong network of cooperation, and studies of scientific cooperation in the field of

Table 2. Authors on bibliometric (top 10)

Index	Author information			
	Name	Affiliation	Focus area (Top2)	Quantity
1	WANG Rui	The General Hospital of the People's Liberation Army	Pharmacy;Clinical Medicine	23
2	WANG Jin	The General Hospital of the People's Liberation Army	Pharmacy; Clinical medicine	22
3	LIANG Bei-bei	The General Hospital of the People's Liberation Army	Pharmacy;Clinical medicine	12
4	BAI Yan	The General Hospital of the People's Liberation Army	Pharmacy;Clinical medicine	11
5	Zhang Zhiqiang	Documentation and Information Center, Chinese Academy of Chengdu	Library information and Digital Library; Scientific Management Research	9
6	Zhou Ming-xin	Xinjiang Medical University	Chinese medicine;Science of Pharmacology	8
7	Lan Yuexin	China People's Police University	News and Media; Public security;	8
8	BAI Nan	The General Hospital of the People's Liberation Army	Pharmacy;Medical education and Medical fringe;	8
9	MEI He-kun	The General Hospital of the People's Liberation Army	Pharmacy;Library; Scientific Management	8
10	CAO jiang	The General Hospital of the People's Liberation Army	Pharmacy;Library; Scientific Management Research;	8

scientometrics, generally considered the most direct result of the scientific cooperation is co-authored papers [4], Fig. 2 shows in the related fields of medicine and clinical medicine, The PLA General Hospital has assembled a stable and high-level team of authors, whose research direction to a certain extent represents the latest research trends in pharmacy and related fields, and at the same time demonstrates the rich disciplinary exchanges between the library and information science and medicine.

3.4 Institution Analysis

The regional characteristics of institutional cooperation show that the region is an important driving force of institutional cooperation [5]. Through the discussion of regional academic exchange and interdisciplinary academic cooperation, this study screened out the correspondence address of the first institution of 1959 pieces of literature, removed 12 literature with no correspondence address information, and drew a visual map with 1947 valid data.

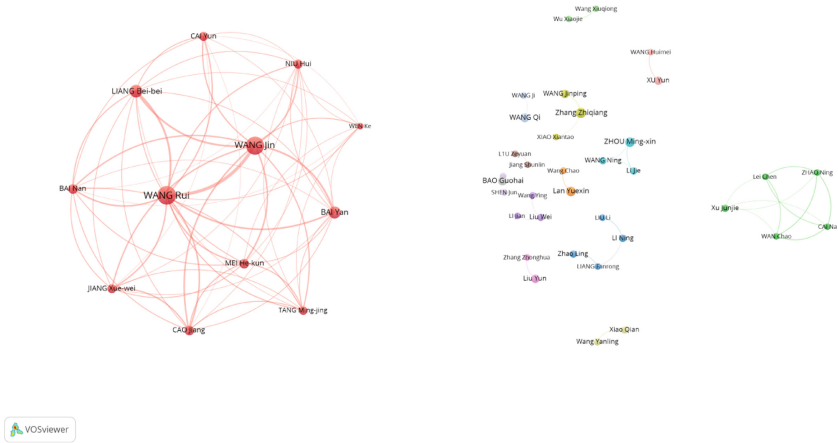


Fig. 2. Network diagram of Author cooperation analysis

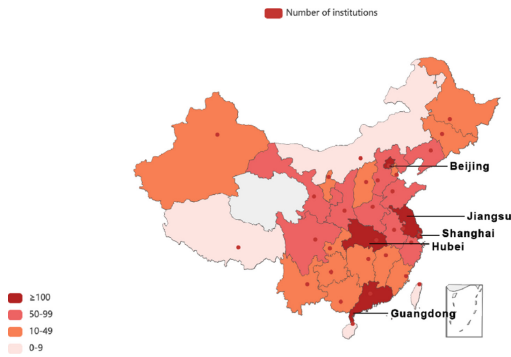


Fig. 3. 1992–2020 Literature distribution map

It can be seen from Table 3 that the top three institutions in the number of articles published are Wuhan University (49), Hua Zhong University of science and technology (31), and PLA hospital of traditional Chinese medicine (29), which have rich research in the field of bibliometrics. In terms of regions, the top 10 regions can be roughly divided into three echelons. The first echelon is Beijing, which has absolute basic advantages in bibliometrics research. The total number of articles published in This region is 319, accounting for about 20% of the national total, and 132 more than Jiangsu Province, which ranks second. The second tier is Jiangsu province, Guangdong Province, Hubei Province, and Shanghai, with the three regions Posting between 100 and 200 documents. The third tier consists of Liaoning, Shandong, Sichuan, Henan, and Zhejiang provinces, with an output between 50 and 100 (Fig. 3).

Through further analysis of provincial thermal maps (Fig. 4), it can be seen that the number of documents in many provinces has increased rapidly after 2010, including Jiangsu, Guangdong, Hubei, and Shanghai. Among them, Beijing is the most significant city. From 2019 to 2020, the growth rate of literature in Beijing reached 133%, and since

Table 3. Insituitions on bibliometric (top 10)

Rank	Institution	Number	Rank	Region	Number
1	Wuhan University	49	1	Beijing	370
2	Huazhong University of Science and Technology	31	2	Jiangsu Province	190
3	The General Hospital of the People’s Liberation Army	29	3	Guangdong Province	133
4	Nanjing University	27	4	Hubei Province	132
5	Nanjing University of Chinese Medicine	25	5	Shanghai	121
6	Peking University	24	6	Liaoning Province	83
7	Beijing University of Chinese Medicine	24	7	Shandong Province	77
8	Sichuan University	21	8	Sichuan Province	74
9	Beijing Normal University	19	9	Henan Province	67
10	Hebei Agricultural University	19	10	Zhejiang Province	62

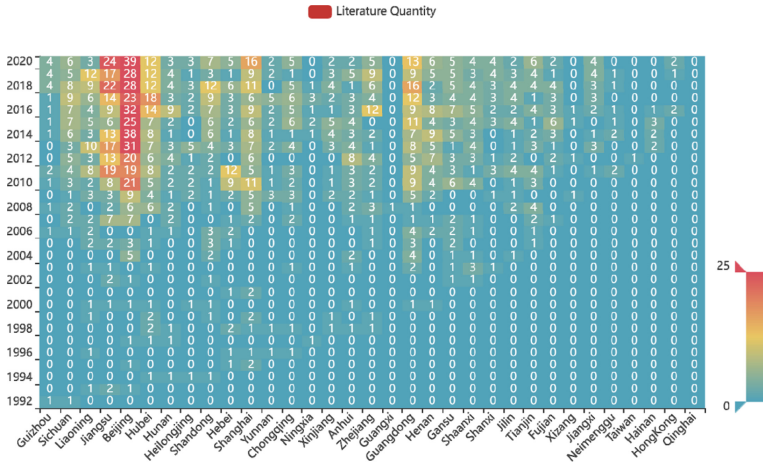


Fig. 4. Annual number of articles issued by each region

then, the number of articles published has been more than 20 every year. Guangdong province was late in publishing literature, but maintained a high growth rate after 2010, ranking third in the number of articles published, totaling 135.

3.5 Interdisciplinary Collaboration Analysis

Scientific cooperation can exist objectively through bibliometrics papers and is affected by the output capacity of partners, geographical proximity, disciplinary differences, fund input, and other relevant factors [6]. Among the 1959 retrieved articles, excluding the articles published by a single institution or single author (a total of 1025 articles), 934 articles were found to have multi-institution cooperation, accounting for about 48% of the total. Then, by obtaining and comparing the correspondence addresses of literature institutions, a total of 284 pieces of literature were screened out and 750 pieces of literature were published cooperatively with regional institutions (Fig. 7).

According to the statistics of 284 articles published in cooperation in different regions, (Fig. 5) among the top 10 regions, Beijing has a wide range of trans-regional cooperation and exchange relations, appearing 103 times in total, followed by Jiangsu (41), Guangdong (39), Shanghai (33) and Hubei (32). Among the Times of cooperation between different provinces, the number of cooperation papers between Beijing and Jiangsu, and Gansu is large, with the same number of 11. It was followed by Beijing and Guangdong (9) and Beijing and Anhui (7).

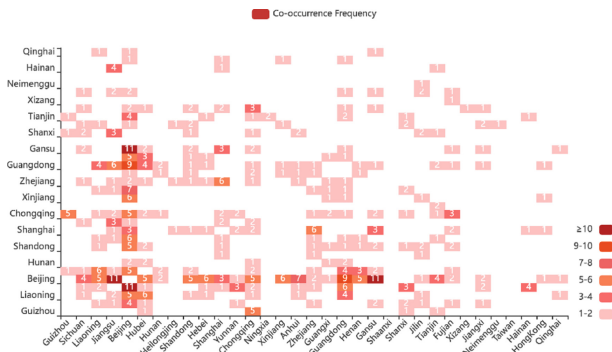


Fig. 5. Analysis of trans-regional cooperation

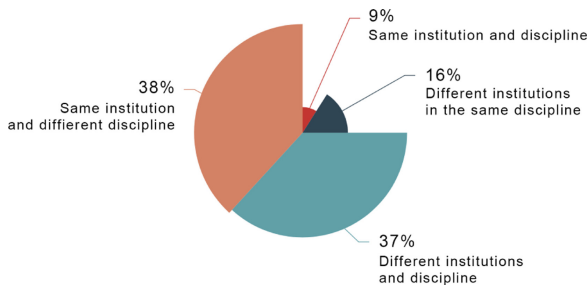


Fig. 6. Cross-regional and disciplinary analysis

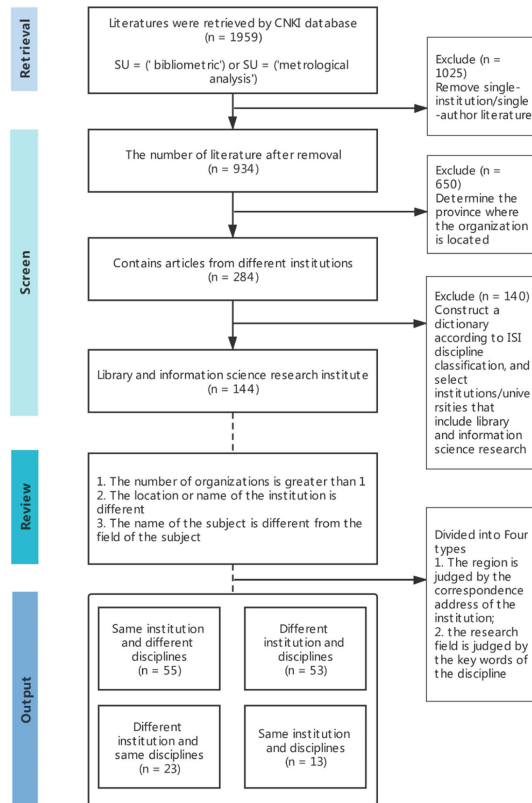


Fig. 7. Flowchart of the literature search

3.6 Discipline Cooperation Analysis

Among the literature produced by multi-institution cooperation, a discipline dictionary was constructed according to ISI discipline classification (Contains keywords: statistics, library, information management, information research, archives, library and information, archives management), and 144 pieces of literature were selected and statistically corresponding to the sources including libraries and information science institutions through word matching. As an interdisciplinary subject, library and information science, due to the complexity of its research objects, the development of its core institutions to a large extent represents the current development direction of the library and information science. Communication and cooperation with core institutions are of great significance to promote the development of their institutions. Therefore, the intersection between the library and information science and other subjects is further discussed [8]. As can be seen from Fig. 6, interdisciplinary exchanges account for a large proportion of both internal and inter-university cooperation, among which the interdisciplinary cooperation of the same institution is the largest, with 55 articles in total, accounting for about 38%. This was followed by inter-institutional and interdisciplinary cooperation (53, accounting for 37%), cooperation in the same field between different institutions (23, accounting

for 16%), and cooperation in the same field within the same institution (13, accounting for 9%). This shows that interdisciplinary communication has become a common phenomenon in the field of library and information science.

4 Conclusion

Through the above analysis, cross-institutional and interdisciplinary scientific research cooperation is universal in the field of library and information science. In the analysis of authors and journals, excluding the library and information science itself, medicine, pharmacy, and other related fields will mostly adopt bibliometrics to analyze the development of this field. Combined with 144 articles and books intelligence cooperation in the field of literature, the research and development of photocatalytic bibliometrics analysis with the Chinese e-government research literature measurement analysis, etc. There are cited articles in quantity, to some extent instructions in related disciplines such as medicine, chemistry, and the social sciences have a higher recognition on the method of literature metrology, At the same time, it reflects that interdisciplinary communication can promote both disciplines.

However, there are still some drawbacks in the current situation of scientific research cooperation. For example, most provinces that participate in trans-regional cooperation are concentrated in the eastern coastal areas and developed regions, while the cooperation frequency of neighboring institutions is relatively frequent. The overall lack of a close cooperation network will hinder the knowledge exchange between different units to a certain extent. Bibliometrics research methods have provided a scientific basis for international cooperation in macro decision-making, [7] and more regional and disciplinary research in China should also make new attempts.

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