A Review of Industrial Collaboration Research

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Abstract. Based on CNKI and WOS source documents, this paper uses scientific metrological methods to conduct a visual analysis of domestic and foreign industrial collaboration research from 2014 to 2023. It also uses the keyword co-occurrence in Citespace visualization software to explore the hot changes and development trends in the field of industrial collaboration at home and abroad, and provide direction for China's future industrial collaboration research. The study shows that: (1) The overall development of foreign industrial collaboration shows a rapid upward trend, while domestic research is growing at a slower pace. (2) The hot spots in industrial collaboration development research are concentrated in the Beijing-Tianjin-Hebei region, the Yellow River Basin and other regions. The hot topics mainly focus on three aspects: collaborative innovation, collaborative agglomeration, and collaborative influencing factors.

Keywords: Industry collaboration, visualization, bibliometrics.

1 Introduction

With the continuous development of economic globalization, the demand for optimizing and upgrading the domestic industrial structure and integrating the industrial chain and the industrial collaboration between multinational companies have become increasingly prominent. As an advanced industrial development concept and model, industrial collaboration has become a key driving force for promoting high-quality development of regional economy. With the trend of economic globalization[1], the focus of cooperation has shifted from internal cooperation within enterprises to regional cooperation[2], and regional cooperation has been used to improve the external adaptability of the globalization trend. Therefore, a more comprehensive and flexible strategy has been proposed to deal with unstable cross-regional cooperation[3]. The global positive attitude towards regional cooperation and the implementation of China's "Belt and Road" policy require the promotion of regional coordinated development. Economic globalization is achieved in this context[4]. The closed development model cannot meet the requirements of sustainable development[5], and the coordinated development of cross-regional industries is still an important driving force for improving the quality and efficiency of economic development[6].

In recent years, the academic community has conducted more in-depth and extensive research on industrial collaboration, involving multiple disciplines such as strategic

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management, economics, regional science, and systems engineering. This paper aims to systematically sort out and summarize the existing theoretical research and practical exploration of industrial collaboration, and to review the development trend, number of publications, hot topics, and hot areas of industrial collaboration research, revealing the inherent laws of industrial collaboration, and providing theoretical basis and practical reference for relevant policy makers and corporate decision makers. At the same time, through comparative analysis of relevant research results at home and abroad, we explore new trends and directions in future industrial collaboration research, and further enrich and improve the theoretical system of industrial collaboration.

2 Data Resource and Research Methods

2.1 Data Rescource

In order to expand the breadth of research as much as possible while ensuring the accuracy of research, this paper selects CNKI to analyze domestic industrial synergy research. CNKI index journals can show the highest and most cutting-edge research results in China's scientific research level. In this paper, the search conditions in the CNKI journal search are set as "title or keyword or abstract is industry synergy", the time span is 2014-2023, and the source category is "core journals, CSSCI source journals, Science Citation Index (SCI) source journals, Engineering Index (EI) source journals", and the content irrelevant to the subject is removed. Finally, 1124 relevant documents are screened out. In this paper, the search condition in the WOS journal is "Industry synergy", and the content irrelevant to the subject is removed. Finally, 1559 relevant documents are screened out.

3 Characteristics

3.1 Analysis of the Quantitative Characteristics of Literature

Figure 1 shows the number of papers published by CNKI and WOS on industrial collaboration each year from 2014 to 2023. Overall, the number of papers published by CNKI and WOS in the past decade has shown a rapid upward trend, and the growth rate of WOS is higher than that of CNKI. Among them, CNKI published the least in 2014, with only 50 papers. The largest number of papers was published in 2022, reaching 161, indicating that in recent years, research on industrial collaboration has gradually attracted the attention of a large number of domestic scholars. From 2014 to 2023, the number of studies increased rapidly, from 50 to 152, with an average annual growth rate of 14.83%. Among them, WOS published the least in 2014, with only 42 papers. The largest number of papers was published in 2023, reaching 339, indicating that current research on industrial collaboration has attracted a lot of attention from domestic and foreign scholars.

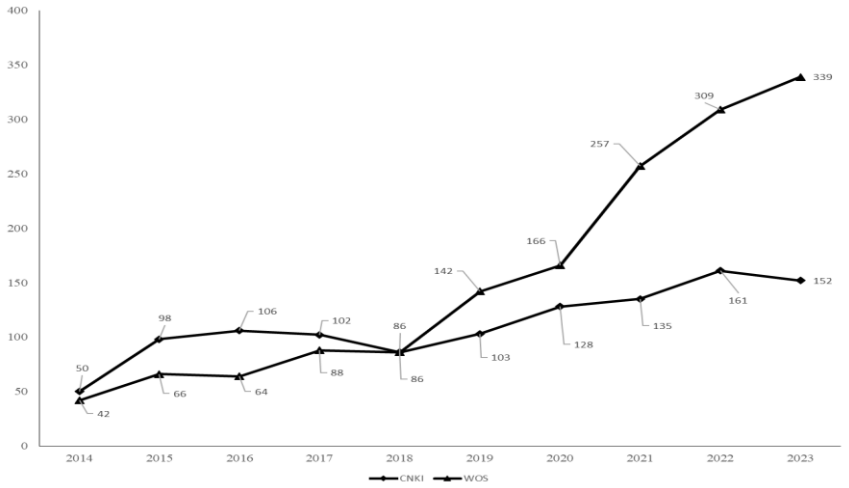

Fig. 1. Distribution of number of documents

3.2 Keyword Analysis

From the ranking of high-frequency keywords in Table 1 and Table 2 and the keyword co-occurrence maps in Figure 2 and Figure 3, it can be seen that the hot topics of domestic and foreign industrial collaboration research have both similarities and heterogeneity. They are both interconnected and different from each other. In order to better grasp the respective characteristics and research differences of domestic and foreign industrial collaboration research, this paper will compare and analyze the hot topics of domestic industrial collaboration research from the two aspects of similarity and heterogeneity.

Similarity: First, domestic and foreign research attaches importance to the relationship between industrial collaboration and innovation, and improves the level of economic development through collaborative innovation. Its common keywords include "collaborative innovation", "innovation", "evolution", etc. Second, domestic and foreign industrial collaboration attaches importance to the level of industrial collaborative development, and studies the level of industrial collaboration through the synergy model. Its keywords include "synergy", "model", "performance", etc. Third, domestic and foreign industrial collaboration attaches importance to the relationship between industrial collaborative development and the economy, and examines whether there is a certain correlation between the two. Its keywords include "digital economy", "circular economy", etc. Fourth, domestic and foreign research focuses on the study of influencing factors of collaborative development, and the keywords include "influencing factors" and "impact".

Heterogeneity: From the perspective of domestic research, first, the focus is on studying the industrial agglomeration of regional economic belts, and its keywords include "cooperative agglomeration" and "industrial agglomeration". Second, it pays more attention to the digital economy. This is because with the widespread application of

digital technology, the information industry, communication industry, Internet industry and various new industries based on digital technology have developed rapidly, and a large number of new business scenarios, new formats and new models have emerged. Its keywords include "digital economy". Third, it pays more attention to the exploration of the coordinated development of the industrial chain, and no longer stays on a single core enterprise, but pays attention to the coordinated development of the entire industrial chain. Its keywords include "industrial chain". From the perspective of foreign research: China's industrial collaboration research has become a hot topic in foreign research in this field. With the continuous deepening of economic globalization, the number of industrial collaboration research in China has increased year by year in recent years, and the quality has gradually improved. This rapid development trend has attracted the attention of global industrial collaboration researchers. Its keywords include "China" and so on.

In summary, except for synonymous keywords in domestic and foreign literature, the overall literature on industrial collaboration is mainly concentrated in three aspects: coordinated development, coordinated agglomeration and coordinated innovation. Among them, the research areas are mainly concentrated in Beijing-Tianjin-Hebei, the Yellow River Basin and other regions.

Table 1. Frequency distribution of industry collaboration keywords collected by CNKI

Keywords	Count	Centrality	Keywords	Count	Centrality
coordinated development	112	0.30	Sports industry	24	0.07
Industrial Collaboration	95	0.27	Digital economy	20	0.02
Beijing-Tianjin-Hebei	90	0.16	Industrial structure	18	0.01
coordinated innovation	71	0.21	Technological innovation	17	0.06
manufacturing	49	0.10	Industrial chain	15	0.03
Synergistic agglomeration	42	0.05	Urban agglomeration	15	0.04
Industrial agglomeration	26	0.04	Degree of Cooperatio	15	0.01

Table 2. Frequency distribution of industry collaboration keywords collected by WOS

Keywords	Count	Centrality	keywords	count	centrality
impact	57	0.23	energy	26	0.03
management	42	0.06	technology	25	0.04
Industrial symbiosis	41	0.10	china	25	0.12
system	40	0.11	growth	25	0.05
performance	39	0.11	model	23	0.04
Circular economy	31	0.02	perspective	22	0.05
innovation	30	0.09	evolution	21	0.07

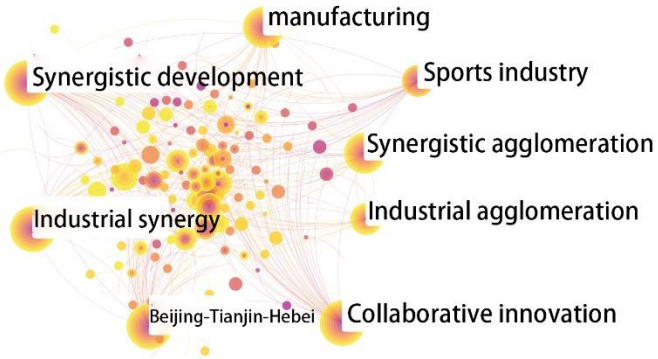

Fig. 2. Domestic industry collaboration keyword knowledge graph

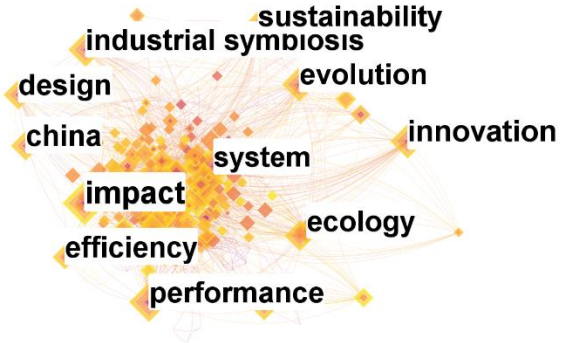

Fig. 3. Foreign industry collaboration keyword knowledge graph

4 Conclusion

Research trend: The overall development of foreign industrial collaboration shows a rapid upward trend, while domestic research is growing at a slower rate. From 2014 to 2023, the number of studies has increased rapidly, from 50 to 152, with an average annual growth rate of 14.83%. Among them, the number of articles published on WOS in 2014 was the least, with only 42 articles. The number of articles published in 2023 was the largest, reaching 339, indicating that the current industrial collaboration-related research has attracted a lot of attention from scholars at home and abroad.

Research hotspots: It can be seen from the research hotspot map that, except for synonymous keywords, the overall literature on industrial collaboration in domestic literature is mainly concentrated in three aspects: collaborative development, collaborative agglomeration, and collaborative innovation. The research areas are mainly concentrated in Beijing-Tianjin-Hebei, the Yellow River Basin and other regions. According to the co-occurrence of keywords and the frequency distribution of words, it can be seen that domestic and foreign industrial collaboration research has both similarities and heterogeneity. From the perspective of similarity, domestic and foreign research attaches importance to the relationship between industrial collaboration and innovation, improves the level of economic development through collaborative innovation, attaches importance to the level of industrial collaborative development, and studies the level of industrial collaboration through the synergy model. Pay attention to the relationship between industrial collaborative development and the economy, and examine whether there is a certain correlation between the two. From the perspective of heterogeneity, domestic research focuses on studying the industrial agglomeration of regional economic belts, emphasizing the impact of the digital economy on regional industrial development, and focusing on the exploration of the collaborative development of the industrial chain. It does not stay at a single core enterprise, but focuses on the collaborative development of the entire industrial chain. In terms of foreign research, China's industrial collaboration research has become a hot topic in foreign research in this field. With the continuous deepening of economic globalization, the number of industrial collaboration research in China has increased year by year in recent years, and the quality has gradually improved. This rapid development trend has attracted the attention of global industrial collaboration researchers.

Looking back over the past 10 years, research on industrial collaboration has made significant progress at home and abroad. However, after a comprehensive comparison of relevant domestic and foreign achievements, this article believes that there is still a lot of room for growth in China's industrial collaboration research. China can improve and learn from the following two aspects of related research: First, on the basis of continuing to develop empirical research methods, continuously improve the theoretical level of China's industrial collaboration research. At present, the theoretical basis of relevant research in China is relatively weak, which may lead to the lack of reliability and stability of empirical research. Only by deeply understanding the internal mechanism and mutual relationship of industrial collaboration research can we better expand empirical research; second, continue to improve the localization level of China's industrial collaboration research. At present, China's industrial collaboration research focuses on the development of the Yellow River Basin and the Beijing-Tianjin-Hebei Economic Belt. In the future, it should continue to focus on other economic belts, such as the Guangdong-Hong Kong-Macao Greater Bay Area and the Pearl River Delta. Promote the synchronous and coordinated development of industries across the country.

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