Current research hotspots and frontiers in cross-border e-commerce
——Based on CiteSpace visual knowledge graph data analysis

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Abstract. The emergence and outbreak of the new corona-virus directly aggravated the turbulence of world trade, and had a huge impact on the global economic development for a long time. Therefore, modern advanced science and technologies such as block-chain technology, artificial intelligence, digital economy, and cloud computing have begun to participate in the development and progress of cross-border e-commerce more and more frequently. In this context, the healthy development of the cross-border e-commerce industry is not only of great benefit to my country's recovery of stable import and export trade, but also of great practical significance to the gradual development of international trade. This paper uses CiteSpace to analyze the data of 401 cross-border e-commerce related documents on CNKI, and draws relevant keyword tables and maps. It focuses on the current research hotspots and frontiers in the field of cross-border e-commerce. E-commerce scholars carry out research and exchange and cooperation to provide certain help and reference.

Keywords: cross-border e-commerce; visual analysis; research hotspots

1 Introduction

Cross-border e-commerce refers to the international business activities in which transaction entities from different countries complete transaction activities through Internet e-commerce platforms and complete goods delivery through cross-border logistics [1]. With the development of globalization and Internet technology, more and more consumers

Cross-border consumption through the Internet and participation in international trade have made cross-border e-commerce, an emerging foreign trade format, develop by leaps and bounds [2]. Its main means are Internet technology and cross-border logistics, taking commerce as the core, and effectively using Internet big data to replace some traditional offline sales methods and shopping channels. The development of cross-border e-commerce has broken the barriers between various countries and regions to a certain extent, greatly reduced the cost of intermediate links, and has

achieved rapid development on a global scale. Looking back, after the budding stage from 1999 to 2007 and the development stage from 2008 to 2013, my country's cross-border e-commerce industry is experiencing an explosive stage from 2014 to the present. According to relevant data analysis, the scale of China's cross-border e-commerce market in 2021 is 14.2 trillion yuan, a year-on-year increase of 13.6% compared with 12.5 trillion yuan in 2020; 36.32% of 39.1 trillion yuan. In 2022, my country's cross-border e-commerce will still maintain rapid growth. In the context of the new crown epidemic sweeping the world, cross-border e-commerce has become an important engine supporting the "external circulation". In February 2022, the sixth batch of cross-border e-commerce comprehensive pilot zones was released. So far, 132 cross-border e-commerce comprehensive pilot zones have been established in six batches across the country. At present, it is the golden age of Internet big data development. The development and application of modern science and technology such as blockchain technology, artificial intelligence, digital economy, and cloud computing meet the needs of profound changes and innovations in all aspects of world trade. An important part of the digital economy is cross-border e-commerce, which can help consumers break through the limitations of certain time and space, meet the increasingly personalized and diversified consumer needs to a great extent, and effectively promote international trade. Form breakthrough and transformation. Looking at the literature in the field of cross-border e-commerce, it is found that there is a lack of objective quantitative analysis. Therefore, we imported 1,225 related literature results in CNKI literature database into CiteSpace software, transformed the literature content into a visual map through big data processing, and accurately analyzed its research hotspots and cutting-edge trends.

2 Research methods and data sources

2.1 Research methods

CiteSpace is a software that is mainly used in scientific literature, can quickly identify keywords and other information in the literature, and more accurately display the new development trends and current trends of research content in a specific time period through images and tables. This software was developed with the support of Professor Chen Chaomei of Drexel University in the United States, using a series of quantitative science and data visualization techniques. At present, thousands of domestic literates in different fields have used CiteSpace for data analysis, and CiteSpace has also become an important tool for researching progress, real-time hotspots and current trends in various disciplines. This software mainly processes and draws a visual map of some of the information in the literature, and is mainly used in the fields of library and information science, information science, technical science, and education [3]. This paper uses CiteSpace 5.7.R1 for data visualization analysis, focusing on research hotspots and frontiers in the field of cross-border e-commerce in the era of big data. In this paper, the software is scientifically used to map the co-occurrence, clustering, and emergence of keywords.

2.2   Data sources

We collected data through the China National Knowledge Infrastructure (CNKI) database, entered the subject word "cross-border e-commerce", and obtained 9,406 pieces of data (search date: July 28, 2022, the same below). Since the database contains a large number of documents of varying quality, the research object of this paper is limited to: documents with the theme of "cross-border e-commerce" and "big data" published in highly academic journals, that is, in "core journals" ", "CSSCI", etc. After a precise search, a total of 410 high-quality literates were obtained, and then the articles that did not meet the requirements, such as dissertations, were manually deleted, leaving 401 articles. Export the article in RefWorks format, and use CiteSpace to convert the corresponding data format into analyzable data.

3   Study the energy distribution

3.1   Literature topic frequency statistics

According to 9406 Chinese documents in CNKI database (including documents, journals, doctoral and master theses, newspapers, conferences, etc.), the attention in the field of cross-border e-commerce is shown in Figure 1, showing a trend from growth to sharp growth (image The decrease in 2022 is due to the fact that the data statistics are in July 2022, and the literature volume statistics for this year are incomplete). In 2014, as the first year of cross-border e-commerce, the attention has risen from zero. From 2019 to 2019, the frequency of cross-border e-commerce topics has grown steadily at an annual rate of nearly 20%. In 2020, the topic frequency attention has risen sharply, from 1,211 articles in 2019 to 3,255 articles, an increase of nearly 270%; in 2021, it will maintain a high-speed growth to 3,897 articles. The high-frequency attention of the topic greatly reflects the popularity of cross-border e-commerce topics, and it also fully shows that scholars' enthusiasm for research and analysis in this field has a good trend and maintains a high degree of attention.

The number of citations and downloads of cross-border e-commerce literature was searched in the CNKI database. At present, "New Ways of International Trade: The Latest Research on Cross-border E-commerce" has the most citations, reaching 719 times. Published in 2014; "China's Cross-border E-commerce Logistics Dilemma and Countermeasures" has the highest number of downloads, reaching 31,743 times. The article was written by Zhang Xiaheng and Ma Tianshan in 2015. From this analysis, it can be seen that although contemporary scholars have high research enthusiasm in the field of cross-border e-commerce, the research direction mainly focuses on solving some problems and pain points faced by cross-border e-commerce in actual trade and proposes corresponding solutions.
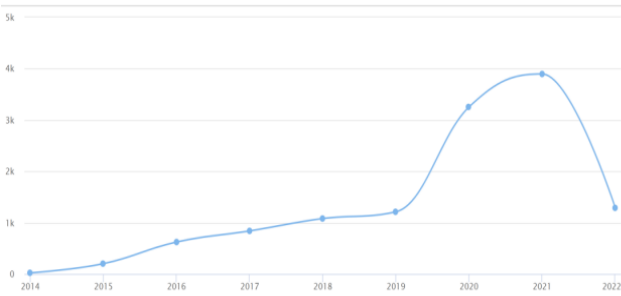
Fig. 1. Analysis of cross-border e-commerce attention index

3.2   The map of the author of the article

Use CiteSpace to perform data visualization processing analysis on the authors of cross-border e-commerce related documents, set the time zone as "1999-2022", check "author" as the drawing condition, and finally generate Node=251, Link=46 and Density= The author network map of 0.0015. The author's name with a larger font in the map corresponds to a larger volume of publications, and the names connected by lines indicate that the volume of collaborative publications between authors at both ends is greater than or equal to two. According to statistics, the author with the largest number of published papers is He Yandong, with 21 papers, accounting for 5.1% of the 410 core papers; followed by Du Zhiping and Ou Yuxian, both of whom published 18 papers, accounting for 4.3%. On the whole, research scholars have less cooperation and lack of contact with each other. But at the same time, according to the map, it can be found that there are more connections between authors with higher published articles. It can be seen that the authors of high-frequency publications are willing to maintain high-quality attention and cooperation in the research field for cross-border e-commerce, compared with other authors. Being able to have better communication and insights is conducive to timely grasping the hot spots and development trends in the cross-border e-commerce field in the era of big data.

3.3   Map of issuing institutions

Use CiteSpace to perform data visualization processing analysis on the issuing institutions of cross-border e-commerce related documents, set the time zone as "1999-2022", check "institution" as the drawing condition, and finally generate Node=252, Link=32 and Density= The network map of the issuing organization of 0.001. The co-occurrence map of issuing institutions can effectively reflect the publishing institutions and corresponding cooperative relationships of relevant documents in the field of cross-border e-commerce. On the whole, there is also less cooperation between the issuing agencies. Under the partial analysis, professional research departments of applied universities and professional vocational colleges have a high degree of enthusiasm for cross-border e-commerce research. In addition, such schools have a good research foundation and make great contributions to the literature related

to cross-border e-commerce. It is not difficult to see that most of the schools in the picture are located in the eastern coastal area, which is a place where import and export trade is prosperous or the radiation area of the cross-border e-commerce comprehensive pilot area, which lays a solid foundation for the actual research.

4   Research hotspots and frontier analysis

4.1   Keyword co-occurrence map analysis

Use CiteSpace to perform data visualization processing analysis on keywords in cross-border e-commerce related literature, set the time zone as "1999-2022", check "keywords" as the drawing conditions, and finally generate Node=425, Link=908 and the keyword co-occurrence map with Density=0.0101. The font size of a keyword in the map corresponds to the frequency of occurrence of the word, and the thickness of the line indicates the degree of closeness and co-occurrence frequency of the relationship between keywords. As can be seen from the figure, the subject word "cross-border e-commerce" (ie "cross-border e-commerce"), as the core of high-frequency words, appeared 811 times in total. In addition, the keywords with the highest frequency of occurrence of the subject words are "blockchain", "talent training", "cross-border logistics" and so on. The closeness and col-linearity with the high-frequency keyword "cross-border e-commerce" are "blockchain technology", "e-commerce", "small and medium-sized enterprises", etc.; the closeness and col-linearity with "cross-border logistics" The more frequent ones are "cross-border e-commerce platforms", "One Belt One Road", "overseas warehouses", etc. To a certain extent, these high-frequency keywords reflect the research hotspots in the cross-border e-commerce field in the 23 years from 1999 to this year and the connections between the hot keywords. For example, the high frequency of keywords such as "talent training" and "school-enterprise cooperation" reflects that contemporary scholars are gradually realizing the importance of scientifically cultivating e-commerce talents this morning; key words such as "cross-border logistics" and "overseas warehouse" The words are specific opinions on the feasibility of improving the infrastructure supporting facilities in the cross-border e-commerce field.

4.2   Keyword clustering map analysis

Use CiteSpace to perform data visualization processing analysis on keywords in cross-border e-commerce related literature, cluster keywords, and filter the top 10 categories with the highest number of keywords to present a keyword clustering map. The Modularity Q of the graph is 0.5086, indicating that the clustering has a significant network structure (value greater than 0.3). The serial number in the figure starts from 0, and in turn indicates the number of keywords in the category from more to less. The clustering ranking of keywords is cross-border e-commerce, talent training, innovation, cross-border logistics, cross-border e-commerce platform, small and medium-sized enterprises, smart contracts, digital economy, export logistics and e-commerce platform. In general, the digital economy such as cross-border trade and logistics relying on

Internet technology is in a state of rapid development, and there is corresponding talent training and infrastructure construction to develop together with it. Keyword clustering research reflects the current scholars' attention to certain problems existing in cross-border e-commerce.

4.3   Keyword Emergence Graph Analysis

Keyword emergence refers to the large change in the frequency of a certain keyword within a certain period of time. Therefore, CiteSpace is used to analyze the data visualization of keywords in cross-border e-commerce related literature, and the time zone is specially set as "2014- 2022" to generate a keyword emergence map with a sample size of 7, as shown in Figure 2. Emerging keywords have time continuity, which can effectively reflect the popularity and popularity of the keyword in a specific time period, which is convenient for scholars to conduct in-depth research. Not only that, but emerging keywords can help predict dying trends and emerging directions in the future. The figure shows that the earliest and longest-lasting keyword is "cross-border e-commerce". In its development stage, "existing problems" and "school-enterprise cooperation" followed, indicating that the development of cross-border e-commerce is also actively solving problems in specific transactions, and continuously strengthening the scientific training of talents. The emergence of "One Belt, One Road" in 2018 fully reflects that national policies and the world trade situation affect the development of cross-border e-commerce to a certain extent. Starting from 2020, the continuous development of "digital economy" and "digital trade" corresponds to the new trend of trade in the era of big data; "cross-border e-commerce platform" is a hot continuation of "cross-border e-commerce", indicating that such keywords remain received higher attention. On the overall trend, the intensity of emerging keywords in each stage has a trend of first decreasing and then increasing. According to the prediction function of emerging keywords, it is possible to imagine that in the future, "digital economy" and "cross-border e-commerce platform" will become the key directions for studying the development of the current cross-border e-commerce field.

Top 7 Keywords with the Strongest Citation Bursts

Keywords	Year	Strength	Begin	End	2014 - 2022
cross-border e-commerce	2014	9.6855	2014	2017	
existing problems	2014	2.5711	2015	2017	
school-enterprise cooperation	2014	2.3804	2015	2018	
One Belt, One Road	2014	3.8187	2018	2019	
digital trade	2014	3.7785	2020	2022	
digital economy	2014	2.3986	2020	2022	
cross-border e-commerce platform	2014	2.4359	2020	2022	

Fig. 2. Keyword Emergence Map of Cross-border E-commerce Related Literature

4.4   Keyword time zone map analysis

Use CiteSpace to perform data visualization processing analysis on keywords in cross-border e-commerce related literature, set the time as "2014-2022", count the earliest time nodes of keywords and sort them in order, and generate a keyword time zone map. The time zone map analyzes high-frequency keywords in each year from 2014 to 2022, and combines keywords with similar meanings to clearly show the research hotspots in the field of cross-border e-commerce each year. Sorting is from left to right, and the farther to the right the keyword is, the more advanced it is. According to Figure 7 and related literature, cross-border research can be roughly divided into the following directions: (1) Explore the current new model of cross-border e-commerce logistics. These include analyzing and optimizing overseas warehouse models, and timely follow-up of commodity transactions along the "Belt and Road". For details, please refer to Zhang Xiaheng and Zhang Ronggang's "Research on the Construction and Application of Cross-border E-commerce and Cross-border Logistics Composite System Collaboration Model". (2) Make full use of big data to promote the development of cross-border e-commerce. Combined with the rapidly developing science and technology such as blockchain and digital economy, it actively drives small and medium-sized enterprises to catch up with the trend of cross-border e-commerce development. For details, please refer to the innovative policy recommendations on "blockchain + cross-border e-commerce" proposed by Ding Baogen et al. (3) Vigorously promote the transformation of cross-border e-commerce trade models. Promoting brand internationalization, improving the cross-border e-commerce platform system, and studying international trade rules are all important measures to help brands go overseas. For details, please refer to Zhang Xiaodong and He Pan's research on the formation mechanism of international cluster brands in the cross-border e-commerce industry. (4) Scientifically cultivate e-commerce talents. Focus on talent training courses in higher vocational colleges and improve school-enterprise cooperation. For details, please refer to Luo Jun's constructive opinions on the training of cross-border e-commerce talents in higher vocational colleges with modern apprenticeship. At the same time, it can be seen that agricultural products may also become a hot direction for future research.

5   Conclusion

Based on CNKI literature database, this paper scientifically uses CiteSpace software for visual data analysis. With reference to relevant literature publications, keywords, hotspots and other information, this paper systematically analyzes the research hotspots and frontiers in the field of cross-border e-commerce, which will provide some help and reference for cross-border e-commerce scholars to conduct research, exchanges and cooperation, and help cross-border e-commerce in my country. industry development.

The following conclusions are drawn:

(1) In the era of big data, cross-border e-commerce is developing at a steady rate, the annual publication volume is generally in the growth stage, and the research enthusiasm

has continued to maintain a high level [4]. Excellent literature has a very high number of citations and downloads, but there is also a lack of high-quality and high-level research results and weak links between authors.

(2) The research hotspots of cross-border e-commerce are mainly distributed in five areas: logistics warehouse research, enterprise development research, talent training research, foreign trade relationship research and science and technology research.

(3) The frontiers of cross-border e-commerce research can be divided into four directions: exploring new models of cross-border e-commerce logistics, making full use of big data to promote the development of cross-border e-commerce, vigorously promoting the transformation of cross-border e-commerce trade models, and scientifically cultivating e-commerce talents [5].

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