Research of Hotspots and Emerging Trends in Chinese Logistics Research (2003-2013): A Visualization Analysis in CiteSpace

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Abstract. CiteSpace is visual document analysis software, by which performances and trends of certain disciplines can be displayed for a given period. Moreover, the evolution of a frontier research can be explored by such software as well. This research focuses on the visualization study in bibliographic databases by taking the logistics management studies as an example. Using the Chinese CNKI database, 864 publications were selected for analysis. With the frequency detection technology which is provided by CiteSpace, the hot research topics, frontiers and emerging trends can be explained visually in the logistics management field.

Introduction

1969, Pritchard first proposed that the terminology Statistical Bibliography should be replaced by Bibliometrics [1]. Since then the development of networks and computer technology has made visualization research of literatures possible [2]. Complicated phenomenon and analysis results can be obtained in the process of visualization research. Using the images generated by computer software, researchers can quickly understand the research status and be able to forecast the possible research directions in the future [3].

This paper tried to use CiteSpace to develop visualization study in bibliographic databases. Logistics management was selected to be the target area, because this field has become a hot issue in recent years. Effective global logistics management can reduce transaction cost while adding value to the overall economy and fostering business development [4-5].Previous studies have given lots of details of logistics management, but there is little concern for bibliometric analysis of the logistics management studies. Although several studies have emphasized the importance of literature analysis on logistics management [6] to our knowledge, a more quantitative and graphical approach based on bibliometric techniques has yet to be undertaken.

The rest of the paper is organized as follows. Section 2 describes the source selection and methodology of the study. Section 3 presents visualization analysis of research hotspots, which has three subsections presenting the co-occurrence analysis on topic terms, fronts time-zone view of keywords,and analysis of burst cited keywords. Section 4 presents the emerging trends. Section 5 is the last section devoted to conclusions.

Methodology

Source and Search Settings. The CNKI (China National Knowledge Infrastructure) has been selected as the source of information. This is the largest Chinese abstract and citation multidisciplinary database of peer-reviewed literature, which collected over 90% of China knowledge resources, comprehensive coverage of journals, dissertations, newspapers, proceedings, yearbooks, reference works, encyclopedia, patents, standards and laws & regulations. It also features smart tools to track, analyze and visualize research. All these characteristics show it to be an adequate selection to obtain relevant information. For bibliometric analysis, the online version of CNKI was searched with keywords (logistics management) and time slicing was limited to"2003~2013" to compile a bibliography of all articles related to the research in the field of logistics management. Altogether 864

original articles were used for further analysis, including authors, titles, abstracts, and cited references.

Selection of Visualization Software. Taking in consideration the accessibility and adequacy of the programs to the goals, the software CiteSpace was selected. CiteSpace is a Java-based program for co-citation analysis, especially for visualizing co-citation networks which can analyze connections between authors, institutions, countries, keywords, journals or references in the scientific literature [3]. It is regarded as the most characteristic and influential application software in the field of visualization analysis, which can visualize and analyze the trends and patterns in a field or domain within a designated period of time [7]. Scholars in different fields have attempted studies with the help of CiteSpace including the ones in logistics and supply chain management [6, 8-9]. All the researches indicate that Citespace is a useful tool for discovering trends and emerging topics in the development of a field or domain.

Visualization Analysis of Research Hotspots

Table 1 Research hotspots

Topic terms	Frequency	Centrality	First appearance year
Logistics management	285	0.09	2003
Electronic commerce	268	0.13	2003
Reverse logistics	67	0.15	2004
Supply chain	53	0.14	2003
Third party logistics	47	0.12	2003
Logistics distribution	39	0.09	2003

Co-Occurrence Analysis on Topic Terms. In this article, we detect the key words and take the high frequency of vocabulary to study the hotspots of research. With the scientific knowledge map and co-occurrence analysis on keywords, the research hotspots are displayed. After importing data into CiteSpace, we present the specific option values that were selected in CiteSpace. (a) Time interval of analysis: 2003- 2013 inclusive; (b) The unit of analysis: 1 year per time slice; (c) The nodes of the network: keywords; (d) The range of one slice: the top30; (e) Threshold : (2, 2, 20), (4, 3, 2), (4, 3, 20); (f) Visualization: a hybrid network time spectrum line generated by the topic terms and noun phrases has been selected. Then top 10 large clustering blocks are selected as the research object. After removal of similar words related to service economy and trade economy, five key nodes of the label subject words are explored (as shown in table 1).

(1) Electronic commerce. In the logistics process, the electronic commerce has been standardized and simplified the logistics process, but its tangible physical transport cannot be separated from the traditional logistics. Besides, there is a gap between the actual logistics management and information, modernization, socialization of the new logistics distribution.

(2) Reverse logistics. The term "reverse logistics" first appeared in 2004 in China. Reverse logistics emphasize the recycling of waste materials and effective control of environmental pollution. In recent years, as public awareness of environmental protection, community resources, the increasing importance of reverse logistics has become the focus of academic and business circles.

(3) Supply chain. Supply chain is the connection between the various relevant persons or the business of the connection before the arrival of the goods to the consumer, as a complex chain of producers, consumers, suppliers. Nowadays, the cost control of enterprises has already made the transition from the internal cost reduction to the enterprise external collaborative cost reduction.

(4) Third party logistics. The third party logistics means that the logistics services are completed not by supplier and demander but the third party in the process of logistics services, when the first and second party logistics organization and management mode has been unable to meet the society needs. Any business that refuses to consider the third party logistics is at the risk of losing its competitive advantages or the opportunity to create a competitive advantage offered by third-party logistics providers.

(5) Logistics distribution. Logistics distribution means integrating scattered logistics resources to achieve the highest utilization efficiency. How to achieve the logistics distribution path optimization is an important step in the design of the logistics system. The efficiency of it has a great influence on improving whole efficiency of logistics system and reducing transport cost.

Fronts Time-Zone View. The frequency detection technology provided by CiteSpace helps to detect the high frequency of the words from a large number of subject words by plotting the frequency time distribution. The determination of frontier areas and developing trend of logistics management is based on the change trend of frequency as well as the frequency of the terms [10]. As shown in Fig.1, the resultant number of nodes and links are 280 and 446. Each node is surrounded with citation rings, and the ring thickness corresponds to the cited times in the time slice, and sizes of the nodes represent frequencies of keywords. With exclusion of the several terms of the selected data range, the main research topics can be got. In 2003, "reverse logistics" emerged. "Logistics distribution" appeared in 2004. "Chain enterprise" and "cost" respectively appeared in next two years. In 2008, "electronic commerce environment" emerged.
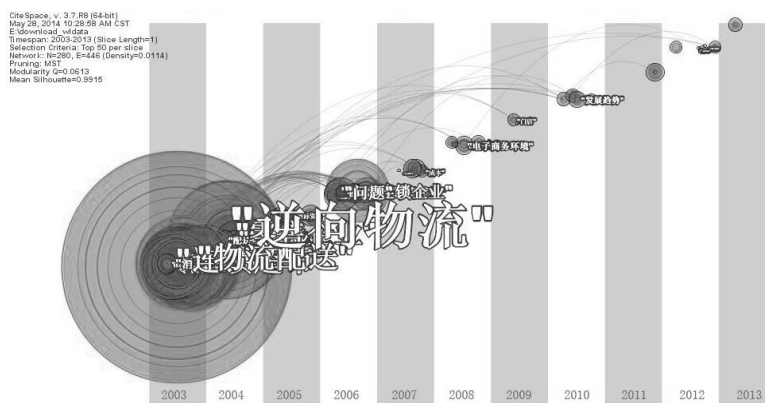

Figure 1. Fronts time-zone view

Analysis of Burst Cited Keywords. With the map of frequency time distribution, those burst terms with high frequency change rate and fast growth rate are detected from a large number of common words. Analyses of fronts and the development trend of science depend on both the frequency and the change trend of the word frequency [11]. Select keywords as the Node Types, terms burst as the Type Term and then run the software to find the keywords burst knowledge map. Table 2 lists the burst cited keywords.

Table 2 Table of burst cited keywords

Keywords	Burst	Frequency	Centrality	Year
Reverse logistics	5.18	67	0.15	2004
DC(distribution center)	4.14	51	0.19	2003
Modern logistics	4.06	26	0.10	2003
Retail	3.78	25	0.05	2004
Retailer	3.36	13	0.04	2003
Logistics system	2.97	28	0.04	2003
Logistics enterprises	2.93	38	0.02	2003
Supplier	2.87	43	0.06	2003
Return logistics	2.85	7	0.01	2012
Retail enterprises	2.84	35	0.06	2004
Management information system	2.64	12	0.01	2003

As shown in the table, the effective terms with burst value more than 3 are "reverse logistics", "distribution center" and "modern logistics". Among them, the highest ranked keyword is "reverse logistics", whose burst value reaches as high as 5.18.The burst value of "distribution center" is 4.14, ranking second. "Modern logistics" is the keyword with the burst value of 3.78, followed by "retail", "retailer", "logistics system", "logistics enterprises", "suppliers", "return logistics", "retail enterprises" and "management information system".

Emerging Trends Analysis

Dynamic development mechanisms of academic research will be revealed effectively by analyzing research front domains and development trends according to distribution of time and changing trends of frequency. Keywords are extracted and classified according to the following classification standard. Keywords whose cited frequency of more than 30 times are defined as high frequency terms, less than or equal to 30 are lower high frequency terms. Burst values more than 3 are defined as high burst terms, less than or equal to 3 are lower high burst terms. As the table 3 shows, there are four categories of term.

Table 3 Table of keywords bust frequency

Classification	Keywords	Burst	Frequency
high frequency、high burst （frequency >30，burst>3）	Reverse logistics	5.18	67
	Distribution Centre	4.14	51
lower high frequency、high burst （frequency≤30，burst>3）	Modern logistics	4.06	26
	Retail	3.78	25
	Retailer	3.36	13
	Retail enterprises	2.84	35
high frequency、lower high burst （frequency >30，burst≤3）	Logistics enterprise	2.93	38
	Suppliers	2.87	43
	Electronic commerce	——	268
	Supply chain	——	53
	Third party logistics	——	47
lower high frequency、lower high burst （frequency≤>30，burst≤3）	Return logistics	2.85	7
	Logistics system	2.97	28
	Management information system	2.64	12

(1) Terms with high frequency and high Burst value: "reverse logistics" and "distribution center." Reverse Logistics is more important, which is an integral part of the logistics management field. On the one hand, it conveys the business situation and the credibility of the image to the end-user groups; on the other hand, it raises enormous demands on internal logistics cooperation. The main function of distribution centers is to provide distribution services. Making good use of distribution facilities and information systems platform to flip, classify, distribute, process, support goods and design transport routes, modes of transport for the sake of saving transportation costs and the guarantee of customer satisfaction.

(2) Terms with lower high frequency and high burst keywords: "modern logistics", "retail, retail" and "retail enterprises". Modern logistics is a new type of management style. Goods and materials are transferred from supply to demand at the lowest cost according to customer's requirements. It is a drive to promote the development of huge logistics market in China. The problems of "modern logistics", "retail" and "retail logistics" are still and will grow as the logistics management develops, with more specific questions emerging. These issues may set off a new wave of research in the future and become a research priority in the company practice field.

(3) Terms with high frequency and lower high burst value of the terms: "logistics enterprises", "suppliers", "e-commerce", "supply chain" and "third party logistics". These terms are the research

hotspots in recent 10 years. From 2003 to now, many scholars have studied it as a basic research topic in the field of logistics.

(4) Terms with lower high frequency and lower high burst value technology: "the logistics system", "return logistics" and "management information system". The research continues, but the study is not very high heat and the breakthrough is not very obvious.

Conclusions

In this article, we detect the research hotspots and frontiers of Chinese logistics research by statistical profiles and visualize various temporal patterns. Based on the co-occurrence analysis on keywords, fronts time-zone view and analysis of burst cited keywords, the following conclusions can be drawn. Firstly, with the co-occurrence analysis on keywords provided by CiteSpace, it can be concluded that "logistics management", "e-commerce", "reverse logistics", "supply chain", "third party logistics" and "logistics distribution" are the hot topics of logistics management. Secondly, the research frontiers in the field of logistics management are "reverse logistics", "logistics distribution", "electronic business environment", "cost" and "chain enterprise "as shown in the fronts time-zone view. At last, the research hotspots and frontiers are classified and the trend of the research in the future is predicted.

It may be noted that there are some shortcomings in our research. Firstly, the dataset was not comprehensive and many important journals were excluded. Besides, figures made by CiteSpace II cannot contain all data because of its computational capability, so some minor details could be ignored. Meanwhile, in order to make the visualization in the field of subject knowledge fully display, it is needed to develop and utilize algorithm function of visualization software better.

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