Analysis on the Development of International Logistics Management Based on Bibliometrics

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Abstract—**This paper explores 20,555 papers embodied by SCI-EXPANDED, SSCI, A&HCI, CPCI-S and CPCI-SSH in the past 10 years. We compared and analyzed the increasing trend, research institutions, research field, and subject distributions. The global logistics management research papers are fluctuating up; Chinese logistics research is in the forefront of the papers published while the United States have the highest citation frequency and have the highest overall research level and institutional level; All the paper are concentrated in several disciplines such as operation and optimization. Based on the analysis of word frequency, the key words are extracted more than 1000 times, it identifies that logistics research is formed into four knowledge groups: logistics, supply chain, management, logistics technology.**

Keywords—*Logistics; Logistics Research; Knowledge Groups; Bibliometric Analysis*

I. INTRODUCTION

Modern logistics is the foundation of the national economy, the level of a country's logistics development has become an important benchmark to measure the level of its economic development [1]. At present, logistics management related research has received extensive attention, the majority of scholars and practitioners use different methods to study the formation of many research results. From a different point of view, these studies reflect the focus of current research and the focus of logistics management. These studies have different direction of application fields and different research methods. In order to further understand the current situation of logistics management research and scientifically analyze the current situation of logistics management research, and benefit the future research, this paper will use the method of bibliometric analysis to study and analyze the above problems.

II. DATA SOURCES AND RESEARCH METHODS

A. Data sources

Data source: Web of Science platform. Web of Science information retrieval platform can search for high quality documents on natural Sciences, social sciences, arts and humanities. Search strategy: "logistics" for the theme of retrieval. Time range: from 2007 to 2016 (deadline December 31, 2016) a total of 10 years. Because of the rapid development of research in the field of logistics, in order to

spread the latest research faster, there is a lot of high-quality literatures published in the form of conference papers. Therefore, the scope of the search is defined as the following 5 databases: SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, and the document type are article, review, proceedings papers. We retrieved a total of 20,555 papers on the logistics field. We downloaded all papers bibliographic data and characterized by merging and cleaning.

B. Research methods and analytical tools

Bibliometric analysis is a way to understand the present situation and development trend of research from the macro point of view [2]. From the literature point of view, it summarizes the development trend of the research field, the core institutions, research hot spots, etc., which can make people quickly have a general understanding of the whole picture in the field of research and provide macro reference for the relevant departments to carry out the research work in the future. The analysis tools used in this study: WOS platform, Thomson Data Analyzer (TDA) software, UCINET software.

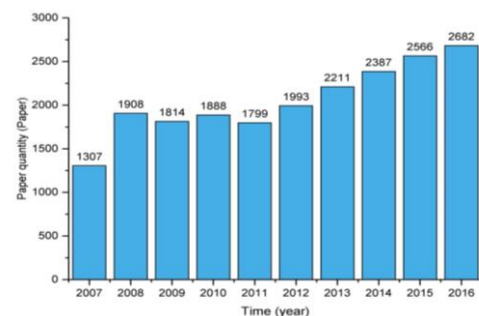### C. Analysis of posting quantity of Logistics Management

Fig. 1. The Change of the Number of Research Papers on Logistics Management

The general trend of the paper can be observed from the time and number of papers distribution. From figure 1, during the period of 2007-2016, the world's research papers on Logistics Management show fluctuating upward trend. Among them, the number of 2007 papers is relatively small, accounting for 1307. In 2008, the number of maximum growth relative to the previous year, rose 45.98%.The number of papers remained stable from 2008 to 2011, and since 2012, the

number of papers has been increasing year by year, reaching 2686 by the highest peak in 2016

III. RESEARCH CAPACITY DISTRIBUTION AND COMPARATIVE ANALYSIS OF LOGISTICS MANAGEMENT

A. Research Capacity Distribution

1) Analysis of distribution of research countries and regions

The number of papers published in a country (or region) could indicate to some extent the degree of attention to the field of research of the country (or region).The more the number of academic papers published, the more attention is paid to the study of the subject. According to all the authors of their corresponding countries and regions for analysis, the main countries and regions which research logistics management in the global are China, the United States, Germany, Britain, Canada, Italy, France, New Zealand, China Taiwan, Spain and so on. From Table 1, over the past 10 years (2007-2016) China's research in this field is becoming more and more active, the number of papers is 6853, and accounting for 41.99% of all national papers, which is about 2 times the United State ranked second. As can be seen from Table 1, the citation frequency of the United States published papers is the highest, followed by the United Kingdom. China published papers total citation frequency is ranked third, but the average citation frequency is low.

TABLE I.   PUBLISHED PAPERS AND CITATION FREQUENCY

Country / Region	Papers	Citation Frequency	Average Quoting Rate
PEOPLES R CHINA	6853	10835	1.58
USA	3551	37570	10.58
GERMANY	1464	9695	6.62
ENGLAND	922	10975	11.90
CANADA	642	8826	13.75
ITALY	625	4663	7.46
FRANCE	583	5650	9.69
NETHERLANDS	574	6883	11.99
TAIWAN	571	4541	7.95
SPAIN	535	4191	7.83

2) Distribution of Core Research Institutions

Important research institutions which have a strong representation of scientific research, they play a leading role in the direction of discipline development. The published papers and citations of research institutions are counted with standardization of all research institutions names and merging repetitive institutions, and ranked according to the number and frequency of citation respectively. Table 2 lists the number of papers and the cited frequency of 20 research institutions with largest number of published papers and rank them according to the number of papers and citations. In the top 20 institutions, 6 belong to China, 8 belong to the United States, 2 belong to

Singapore, and the other 4 belong to Germany, France, Canada and the United Kingdom. In the top 20 institutions, Beijing Jiaotong University and Wuhan University of Technology have more than 200 papers, Hong Kong Polytech University have about 200 papers, California university system, University of Georgia system and the University of Florida system have papers between 150 and 200.Judging from the past 10 years，Beijing Jiaotong University, Wuhan University of Technology, Hong Kong Polytech University, California university system, University of Georgia system and University of Florida system have very active research performance in this field, and the papers are accounted for 15.31%, 9.51%, 6.82%, 6.08%, 5.69% and 5.37% respectively, the remaining 14 institutions accounted for 51.22% of papers.

TABLE II.   THE NUMBER OF PUBLISHED PAPERS AND CITATION FREQUENCY OF THE MAIN INSTITUTIONS

Institution	Papers	Citation Frequency	Country
Beijing Jiaotong University	433	379	CHINA MAINLAND
Wuhan University of Technology	269	79	CHINA MAINLAND
Hong Kong Polytechnic University	193	2537	CHINA HONG KONG
University of California System	172	1901	USA
University System of Georgia	161	2599	USA
State University System of Florida	152	1480	USA
University of Bremen	130	533	GERMANY
South China University of Technology	123	94	CHINA MAINLAND
Pennsylvania Commonwealth System of Higher Education (PCSHE)	116	1098	USA
United States Department of Defense	116	917	USA
Centre National de la Recherche Scientifique (CNRS)	112	905	FRANCE
Shanghai Maritime University	109	121	CHINA MAINLAND
Huazhong University of Science & Technology	107	343	CHINA MAINLAND
University of Montreal	104	1609	CANADA
Georgia Institute of Technology	91	1629	USA
University of Tennessee System	91	1568	USA
Nanyang Technological University	88	1161	SINGAPORE
Nanyang Technological University & National Institute of Education (NIE) Singapore	88	1161	SINGAPORE

TABLE 2, cont.			
University of Tennessee Knoxville	87	1539	USA
University of London	87	1311	ENGLAND

B. *Comparative Analysis of Research Capacity*

All the time, the number of papers and citation frequency are two important aspects of the analysis of the quality of the research results, which can reflect the strength and influence of researchers to a large extent [3]. Figure 2 and Figure 3 are the relative positions of the quadrant of the point of view, which compare the research power of major countries/regions and institutions respectively. The paper number of major countries/regions or institutions is shown on horizontal axis and the vertical axis is the citation frequency of the papers issued by each of them, the origin of the coordinates is the average value of papers and citation frequency. When the country/region or institution is located in the first quadrant, it shows that the number of papers and citations are higher than average, which can illustrate that the research has a high quality and quantity, while the third quadrant is the opposite; When the country/regional or institution is located in second quadrant, which can illustrate that the number of papers is lower than the average, but the citation frequency is higher than the average, while the fourth quadrant is the opposite.

As can be seen from Figure 2 and Figure 3, the United States, the United Kingdom and Canada, are located in the first and second quadrants both at the national level and at the institutional level, indicating that the overall level of research and institutional level in these countries are very strong. For China and its research institutions that are very active in recent years, only appeared in the third quadrant and the fourth quadrant, which indicates that its future research should not only focus on the number of papers published, but also to pay attention to the influence of the paper, increase its world recognized degree.
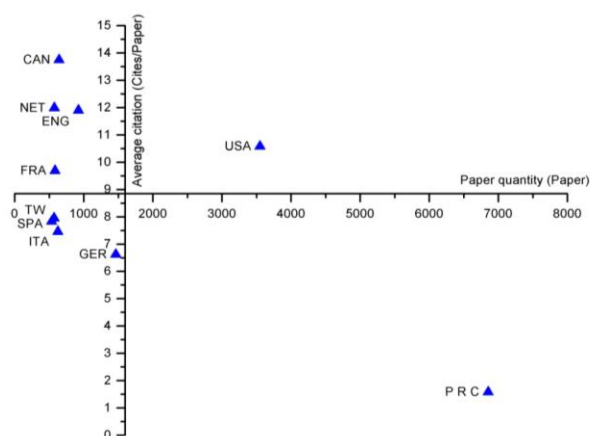

Fig. 2. Analysis of research results in major countries

IV. THE RESEARCH DIRECTION AND SUBJECT ANALYSIS

According to the classification of WOS database on a specific research field, table 3 lists the top 20 specific research directions of international logistics management research

papers in accordance with the number of papers. As can be seen from table 3, the top 5 research directions were: OPERATIONS RESEARCH MANAGEMENT SCIENCE (4944), MANAGEMENT (3924) ENGINEERING INDUSTRIAL (2573), ENGINEERING ELECTRICAL ELECTRONIC (2258), COMPUTER SCIENCE INFORMATION SYSTEMS (1807). The above 5 research directions, the first two directions are more biased with theoretical methods, and the latter three directions are more biased with engineering applications. This shows that the theoretical research is much more than the methods research in international logistics management area.
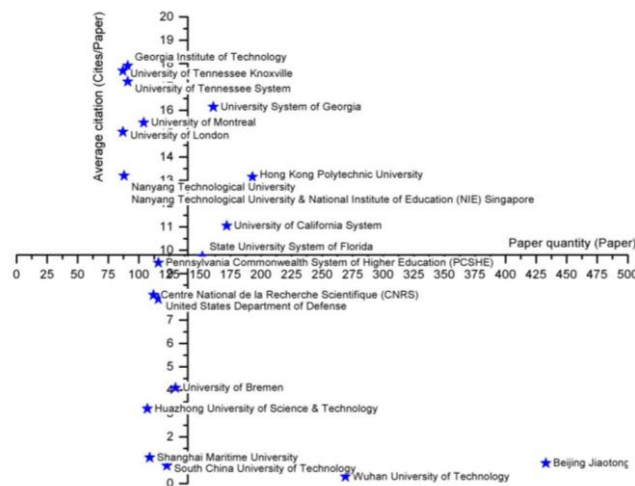

Fig. 3. Analysis of the research results of core institutions

TABLE III. INTERNATIONAL LOGISTICS MANAGEMENT RESEARCH FIELD AND RESEARCH DIRECTIONS

No.	Web of Science Research Directions	Number
1	OPERATIONS RESEARCH MANAGEMENT SCIENCE	4944
2	MANAGEMENT	3924
3	ENGINEERING INDUSTRIAL	2573
4	ENGINEERING ELECTRICAL ELECTRONIC	2258
5	COMPUTER SCIENCE INFORMATION SYSTEMS	1807
6	COMPUTER SCIENCE INTERDISCIPLINARY APPLICATIONS	1776
7	BUSINESS	1644
8	ENGINEERING MANUFACTURING	1600
9	COMPUTER SCIENCE THEORY METHODS	1508
10	ECONOMICS	1459
11	COMPUTER SCIENCE ARTIFICIAL INTELLIGENCE	1348
12	TRANSPORTATION	1222
13	TRANSPORTATION SCIENCE TECHNOLOGY	1163
14	AUTOMATION CONTROL SYSTEMS	1049
15	ENGINEERING MECHANICAL	821
16	ENGINEERING MULTIDISCIPLINARY	770
17	ENGINEERING CIVIL	675

TABLE 3, cont.		
18	MATERIALS SCIENCE MULTIDISCIPLINARY	654
19	ENVIRONMENTAL SCIENCES	650
20	TELECOMMUNICATIONS	600

Extracted the key words from the global 20555 papers published in 2007-2016 in the logistics management, a total of 7902 key words whose cumulative frequency of the occurrence is 672277 times. The keywords frequency is the total number of keywords in all the key words of the paper [4].

The maximum frequency of the keywords "logistic" is the occurrence frequency of 14850 times, which means that there are 14850 papers using the key words, others key words that appears more than 2000 times were "supply chain", "reverse logistics", "supply chain management", "city logistics", "optimization", "sustainability", "simulation", "humanitarian logistics". See table 4.

Based on the word frequency statistics of the paper keywords in 2007-2016, we analyze the knowledge community in this field:

1) Logistics knowledge group: V1 logistics, V3 reverse logistics, V5 city logistics, V9 humanitarian logistics, V 16 green logistics, V 21urban logistics and V23 biomass logistics were included. These keywords cover the hot spot in the field of logistics, in addition to concern the very high degree of city logistics and reverse logistics, a new concern also reflects the new direction of the development of logistics, such as biomass derived from green logistics. The goal of biomass and green logistics is to reduce environmental pollution and reduce resource consumption, and it is not only an important part of circular economy, but also a part of protecting the ecological environment of the earth for the effective mode of realizing sustainable development [5]. Humanitarian logistics is caused by sudden natural disasters, local military conflicts and other unexpected factors of logistics activities; it has high demands on collaborative mechanism of lean and agile rescue process in the relief process, which belongs to the new comprehensive department of the cross between the logistics management and disaster management [6].

2) Supply Chain Management Group: including V2 supply chain, V4 supply chain management, V19 closed-loop supply chain, V27 facility location. Supply chain is the core research hotspot in logistics research, it constructs the supply chain network from the industrial level and combines the research method of model construction, analyzes the industrial development in specific areas and relies on the strategic alliance of contract. At the same time, it is also the most critical "bridge" that links to other knowledge points, for example, combination of closed-loop supply chain and reverse logistics is an important means which can solve the energy crisis and reduce environmental pollution, its economic value is more and more prominent [7].

3) Logistics management knowledge group: including V6 e-commerce, V12 internet of things, V13 management, V24 remanufacturing, V26 collaboration, V28 risk management.

With the progress of Internet and information technology, the whole process of logistics optimization and integration continue to accelerate, improving the level of logistics management is essential to enhance the competitiveness of enterprises. Risk management has also become an important guarantee to ensure the smooth operation of the logistics in a rapidly changing competitive environment.

4) Logistics technology knowledge group: including V6 optimization, V7 sustainability, V8 simulation, V10 genetic algorithm, V14 transportation, V15 model, V17 performance, V18 RFID, V22 vehicle routing. The knowledge group mainly uses the cybernetics method, simulation modeling method, mathematical programming and optimization method, uses radio frequency identification and other technical means to study how to achieve operational optimization and system stability in practical operation, with extremely high practical value.

TABLE IV. THE KEYWORDS IN INTERNATIONAL LOGISTICS MANAGEMENT RESEARCH FIELD WHICH FREQUENCY IS MORE THAN 1000 TIMES

No.	Keywords	Total Frequency
1	logistics	14850
2	supply chain	4950
3	reverse logistics	4345
4	supply chain management	4070
5	city logistics	3685
6	optimization	2750
7	sustainability	2695
8	simulation	2530
9	humanitarian logistics	2310
10	genetic algorithm	1980
11	e-commerce	1925
12	internet of things	1760
13	management	1650
14	transportation	1430
15	model	1265
16	green logistics	1210
17	performance	1210
18	rfid	1210
19	closed-loop supply chain	1155
20	logistics management	1155
21	urban logistics	1155
22	vehicle routing	1155
23	biomass	1100
24	remanufacturing	1100
25	uncertainty	1100
26	collaboration	1045
27	facility location	1045
28	risk management	1045

V. CONCLUSION

In connection with 20,555 papers of article, review, and proceeding papers which included from the database of SCI-EXPANDED, SSCI, A & HCI, CPCI-S and CPCI-SSH, the status and hotspot of logistics management are analyzed in this paper. The results of the study show that:

- The global logistics management research papers are fluctuating up.

- The countries and regions that concerned about the logistics research is mainly concentrated in China, the United States, Germany, Britain and so on. Chinese logistics research vitality is in the forefront of the world in recent years, papers published by the United States have the highest citation frequency.

- Beijing Jiaotong University, Wuhan University of Technology, Hong Kong Polytechnic University, University of California System, University of Georgia System and the University of Florida System is the active research unit in this field. However, observed from the average of the published and the average number of cited times, the overall research level and institutional level in the United States, the United Kingdom and Canada are at the forefront both at the national level and at the institutional level.

- The distribution of disciplines is mainly concentrated in the fields of operation and optimization, management, industrial engineering, electrical and electronic engineering, computer information system and so on.

- Logistics research presented as four knowledge groups which is logistics, supply chain, management and technology.

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