

Analysis of Cooperation Network on International E-commerce Research in Recent Ten Years*

Yiping Hong

School of Economics & Management
Liming Vocational University
Quanzhou, China 362000

Abstract—With the rapid development of Internet and e-commerce technology, e-commerce has become an important part of people's daily life, and e-commerce is gradually changing human business activities. This research uses Web of Science database as the data source, adopts the method of scientific measurement analysis, and uses Citespace analysis tool to conduct cooperative network analysis of international e-commerce research in the past ten years. The research results show that: First, the output of international e-commerce research is high in the past ten years, and it is very scattered. Second, there are few prolific authors or academic community, and it is not stable. Third, high-output institutions are few. The top five institutions are in China. Fourth, the countries that have important influence in the field of e-commerce research mainly include the United States, China, the United Kingdom, and other countries. Fifth, the countries with developed e-commerce industries have more e-commerce research, and the two have strong consistency.

Keywords—e-commerce; cooperation network; Citespace

I. INTRODUCTION

With the continuous development of Internet technology, the ability of e-commerce serving consumers has been continuously strengthened [1]. In 2017, the global online retail transactions reached 2.304 trillion US dollars, an increase of 24.8% compared with that of 2016. In 2017, total global retail sales approximately reached 22.640 trillion US dollars, an increase of 5.8% from that of 2016. The proportion of online retail transactions to global retail sales increased from 8.6% in 2016 to 10.2% [2]. Among the top 20 countries with most attractive online markets in the world, the United States ranked first, China and the United Kingdom ranked the second and the third. China, Russia, Mexico, and Chile are developing countries and emerging markets listed in the list. Currently, the world has entered the era of mobile e-commerce [3]. In 2017, there were approximately 1.66 billion consumers' worldwide using mobile phones for online shopping. Among them, consumers in China using mobile phones for online shopping accounted for 88%, and the number of consumers using mobile online shopping ranked first in the world [4]. Mobile sales in China, Japan and the UK have surpassed that of the PC, and Brazil is the country with the largest

increase in mobile trading share [5].

The growth rate of the global e-commerce market has been declining year by year since 2016. The slowdown in growth has also occurred in developed countries such as the United States and emerging countries such as China [6]. The development of global e-commerce is in changeable period. The main reason for the slowdown in growth is the emergence of new changes in the environment for e-commerce development. The space and potential for industrial growth are limited. The development of e-commerce will move from extensive growth to refined and intensive growth [7]. It can be seen that e-commerce has become one of the hot spots of economic development in the 21st century.

In academia, e-commerce research has also become one of the hot topics. Taking Web of Science data as an example, the first article relating e-commerce published in 1996. By July 2018, there are 1912 articles titled by e-commerce and 7164 articles with the theme of e-commerce. It can be seen that research output of e-commerce is very rich. In order to understand the status quo of e-commerce research, this study uses the articles of Web of Science in the past decade as data sources to conduct scientific and quantitative analysis and explores the cooperation network relationship of international e-commerce research.

II. RESEARCH METHODS AND TOOLS

A. Research Methods

This study uses the author's cooperation network, institutional cooperation network and national (regional) cooperation network analysis to conduct scientific quantitative analysis of international e-commerce research. Scientific research cooperation refers to one of the important ways for different researchers and research institutions to overcome key and major issues in this field. Cooperation network analysis is an effective analytical method for clarifying the cooperative relationship between authors and institutions [8].

B. Data Collection

On July 8th, 2018, this study used the web of science core database as the data source. With the search strategy of

*Fund Project: Research Project for Young and Middle-aged Teachers of the Education Department of Fujian Province (JAS171073)

Title="e-commerce", Time span=2008~2018, Paper type="Article", the author has collected 715 papers. In order to ensure the quality of the data, this paper has checked all the data one by one. All the documents are valid, and the data is exported and archived in download.txt of RIS format for subsequent analysis.

C. Research Tools

This study uses Citespace, a scientific measurement analysis tool developed by Professor Chen Chaomei of Drexel University in the United States. The software was developed in 2004 and has been upgraded to version 5.3.R3. The analysis tool can scientifically analyze data, and draw visualization knowledge map, providing readers with good visualization. Based on stability, this study used the 5.2R2 version.

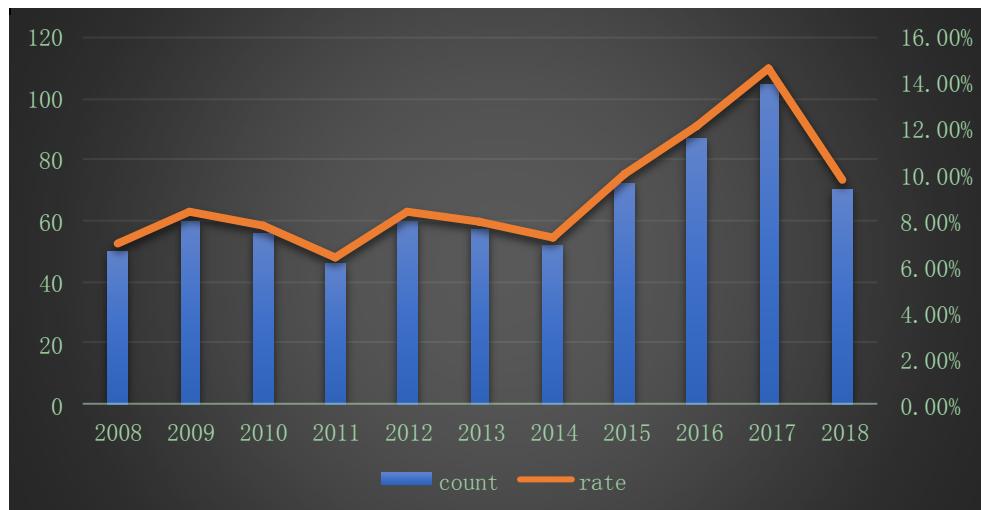


Fig. 1. International e-commerce research output in the past decade.

In view of the development of international e-commerce industry, the capital of the e-commerce industry has become hot since 2011, and more and more traditional enterprises have begun to actively enter the e-commerce market, hoping to leverage their resource advantages and industry experience in traditional industries to integrate with e-commerce to seize the commanding heights in future development[9]. However, at the same time, e-commerce

III. RESEARCH RESULTS

A. Research Output

By sorting out the collected data and plotting the output of international e-commerce research in the past decade (Fig. 1), it can be seen that from 2008 to 2014, the research output is relatively stable at 50 papers. From the beginning of 2015, the output of e-commerce research began to increase year by year. It is more than 100 articles in 2017, and it has exceeded 70 papers in 2018 by the search time. It can be seen that international e-commerce has gradually been valued by the academic community since 2014. The output is also increasing year by year.

enterprises start the transformation and upgrading. The first is to expand product categories, and the second is to increase logistics network construction [10]. Taking the UK, the country with most developed e-commerce in Europe as an example, the growth rate of e-commerce transactions has been declining year by year since 2009, which may be one of the factors that have attracted the attention of the academic community [11].

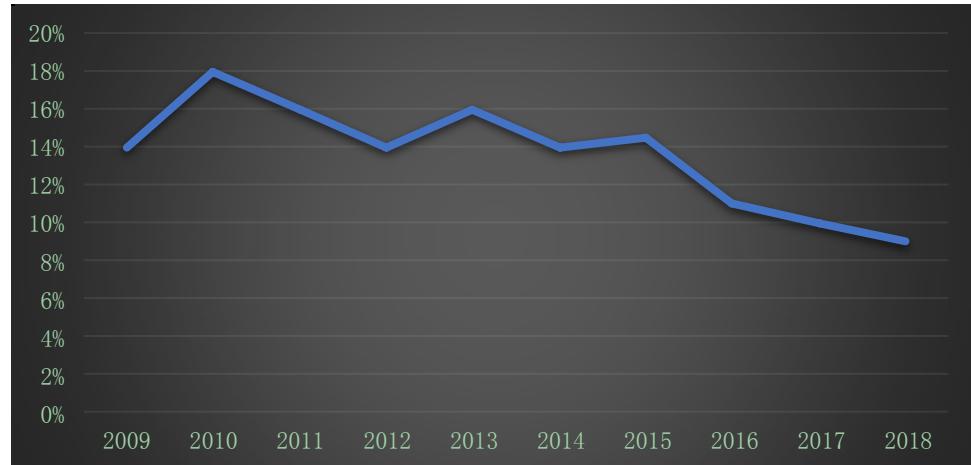


Fig. 2. Average growth rate of online retail transactions in the UK from 2009 to 2018.

B. Author Cooperation Network

The author cooperation network is the most basic way of scientific research cooperation analysis. This study uses author cooperation network analysis of Citespace. The parameters will take 1 year as the statistical unit. The articles published each year are highly cited in the first 50 articles. The authors have published more than two articles, and the authors have cooperated twice or more. The cooperative contribution rate is higher than 20%[12]. The author analyzes the international e-commerce research in the past decade and draws a social network map (Fig. 3). There are 58 nodes, 28 cables, and network density 0.0169 in the figure. The network is very loose. Each node represents an author. The node size represents the author's publication volume, and the cable represents the cooperative

relationship between the authors. It can be clearly seen from the figure that most of the nodes exist in isolation, forming a few academic groups. The author, Wang Y publishes most articles (9 articles), followed by Ramanathan R (5 articles). The remaining number of publications is no more than three. From the perspective of formed academic groups, there are 12 academic groups, including 5 groups of 2 authors, 6 groups of 3 authors, and 1 group of 4 authors. In general, the author cooperation rate is low. Combining with the author's published volume, all academic groups are very unstable. Through the sudden detection of Citespace literature, there are no authors with suddenness in the network. Further searching the intermediary intermediateity of the nodes in the network, the author finds that the intermediary intermediateity of all nodes is less than 0.1, which confirms the low cooperation of the authors in the previous analysis.

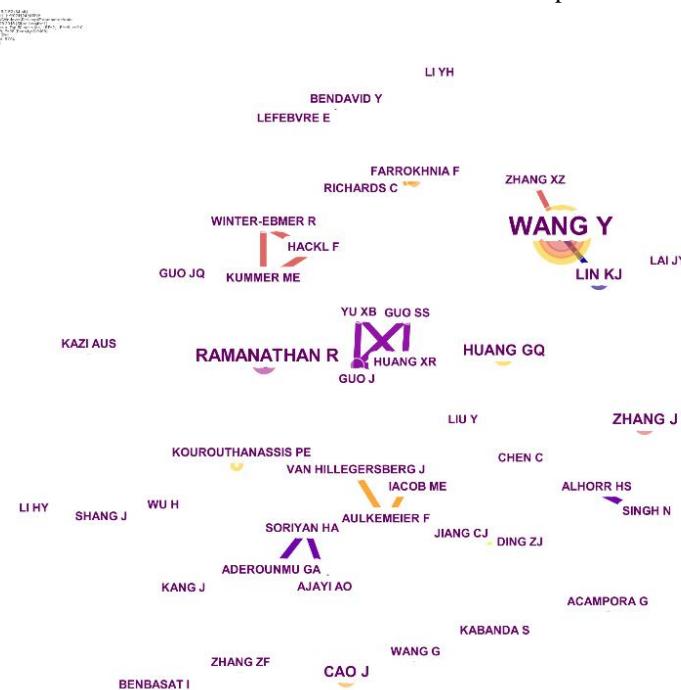


Fig. 3. Author cooperation network of international e-commerce research in the past ten years.

C. Institutional Cooperation Network

The analysis function of the research institution of Citespace is adopted, and the parameter setting is consistent with author cooperation network analysis. A map of e-commerce research cooperation network was drawn. It can be seen that the cooperation among e-commerce research institutions has been low for nearly ten years. From the

From the perspective of the formed community of scientific research institutions, five communities of scientific research institutions have been formed. The following "Table I" is compiled. As can be seen from the table, most of the research communities only include 2 to 3 units. However, the academic community with City University of Hong Kong as the core is particularly prominent. The sub-community consisted of City University

perspective of the number of documents issued by scientific research institutions, the largest number of documents is Zhejiang University. According to the data of the analysis, the top five scientific research institutions are: Zhejiang University (9 papers), Tongji University (7 papers), City University of Hong Kong (7 papers), Taiwan University (6 papers), and Dalian University of Technology (5 papers), all of which are from China.

of Hong Kong, Chinese Academy of Sciences, the University of Chinese Academy of Sciences, Guangdong University of Technology, Hong Kong Polytechnic University, and the sub-community consisted of University of California, Irvine, Macquarie University, and Royal Melbourne Institute of Technology have very prominent role.

TABLE I. COMMUNITY OF INTERNATIONAL E-COMMERCE RESEARCH INSTITUTIONS IN THE PAST TEN YEARS

Num	Institute
1	Jinan University; HongKong University; Auckland University
2	Dalian University of Technology; Huazhong University of Science and Technology
3	Zhejiang University; Taiwan University
4	Tongji University; New Jersey Institute of Technology; Cardiff University
5	City University of Hong Kong; Chinese Academy of Science; University of Chinese Academy of Sciences; The Hong Kong Polytechnic University; GuangDong University of Technology; Macquarie University; University of California, Irvine; RMIT University

It adopts Citespace sudden detection function to detect research institutions with the suddenness. The results show that there is no research institutions having the suddenness. Viewing the intermediary intermediateness of all nodes, City University of Hong Kong, Hong Kong Polytechnic University, Guangdong University of Technology has intermediary intermediateness. However, the value is quite low, only at 0.01.

D. National (Regional) Cooperation Network

Using Citespace national (regional) cooperation network analysis, keeping the parameter settings consistent with

author cooperation network analysis, the author draws a national (regional) cooperation network map of international e-commerce research for nearly ten years (Fig. 5). There are 42 nodes and 76 cables, and the network density is 0.883. The network structure is loose. Different from the author cooperation network map and scientific research institution cooperation network map, the node network in the national (regional) cooperation network map is complex, and the cooperation between countries (regions) is close. From the network map formed, all the nodes are intertwined. The cooperation is close, forming a community. And it is relatively stable.

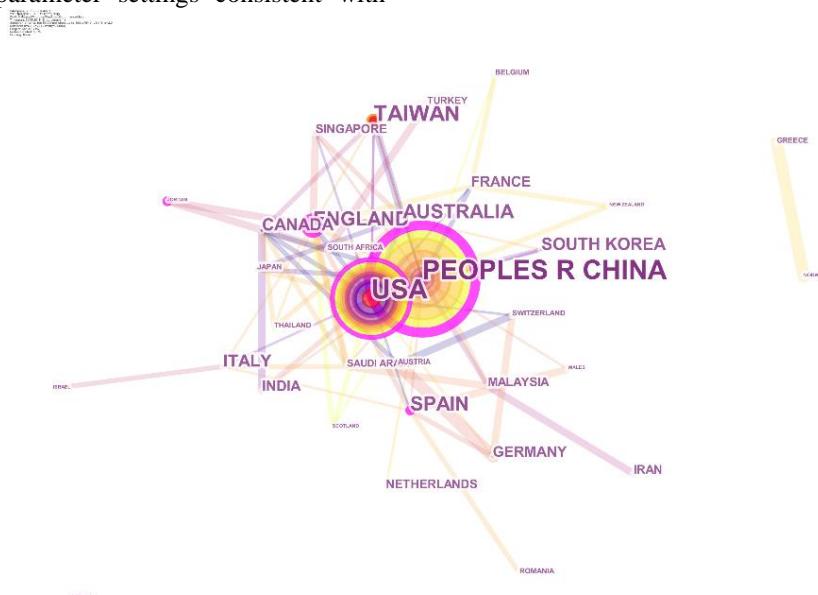


Fig. 4. National (regional) cooperation network for international e-commerce research in the past decade.

Intuitively, China is the country with the largest number of publications. The second is the United States. The number of publications far exceeds that of other countries and regions. By sorting the data, the top 10 countries

(regions) with the largest number of publications are listed in "Table II" below. From the table, it can be found that except for China and Taiwan, the top ten countries (regions) are developed countries.

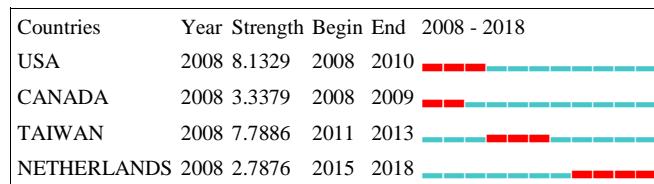
TABLE II. TOP TEN COUNTRIES WITH THE LARGEST NUMBER OF PUBLICATIONS ON INTERNATIONAL E-COMMERCE RESEARCH IN THE PAST 10 YEARS

Num	Country (Region)	Count	Num	Country (Region)	Count
1	China	211	6	Australia	36
2	USA	171	7	South Korea	30
3	Taiwan	72	8	Italy	27
4	Spain	47	9	Canada	23
5	England	44	10	Germany	14

The salience of a node means that the node is heavily referenced within a certain time span, indicating that the node has an important role in the network. Such a node usually represents the transformation of a research, and the node with salience is expressed with red color in the network map [13]. Using Citespace node prominence detection, four nodes are highlighted, which are USA,

Canada, Taiwan, and Netherlands. The following "Table III" can be obtained. From the table, it can be found that the average years of all the prominent nodes are in 2008. From the start and end time, it can be roughly divided into three time periods, namely 2008-2010 (USA, Canada), 2011-2013 (Taiwan), 2015-2018 (Netherlands). The time periods represent three different periods.

TABLE III. TOP 4 COUNTRIES WITH THE STRONGEST CITATION BURSTS



The mediation centrality of a node represents the number of shortest paths through a node in a network. In a network, the greater the mediation centrality of a node is, the greater its role in communication between other nodes will be. The value of the general mediation centrality is between 0-1. If the mediation centrality of a node is 0, it indicates that the node is at the edge of the network and is not associated with other nodes. If the mediation centrality of a node is 1, which means that the node is at the core of the network and can contact other nodes completely [14]. Using the compute centrality function in the metric function list of Citespace, the mediation centrality of the nodes in the network is calculated. After sorting, the following "Table IV" can be obtained. From the numerical value, it can be seen that "China" is at the core position in the network, and 33 % of the nodes are connected, followed by "British",

"United States", "Jordan", "Spain" and other countries. According to the combination of the number of published documents and the prominence of nodes, the consistency of the number of publications, prominence and mediation centrality of the network is not high. For example, "China" has a high volume of publications and high mediation centrality, but it is not prominent. The publications take much time. While the "Taiwan area" has a higher amount of publications, it also has a certain degree of prominence. The mediation centrality is zero, indicating that its volume is concentrated in a certain period. Of course, there are also nodes with higher consistency. For example, "United States" has a high volume of publications, strong prominence, and high mediation centrality, indicating that it plays a pivotal role in this field.

TABLE IV. NODE NETWORK MAP WITH MEDIATION CENTRALITY

Num	Centrality	Country (Region)	Year	Half-life
1	0.33	PEOPLES R CHINA	2008	8
2	0.26	ENGLAND	2008	7
3	0.19	USA	2008	4
4	0.13	JORDAN	2013	0
5	0.10	SPAIN	2008	5
6	0.07	ITALY	2008	6
7	0.07	CANADA	2008	2
8	0.07	MALAYSIA	2012	3
9	0.07	SOUTH AFRICA	2013	4
10	0.06	AUSTRALIA	2008	6
11	0.03	SAUDI ARABIA	2015	0
12	0.02	FRANCE	2008	4
13	0.01	GERMANY	2012	5

The half-life period refers to the time from the beginning of a node to the decrease. The longer the half-life period of the node is, the stronger the persistence of the node will be. If the node represents the literature, the more classical the document is. From the perspective of the half-life value, "China" has the longest half-life period, followed by that of "British", "United States", "Australia", "Italy" and other countries. This also cites the previous conclusion that China has a large amount of publications. The high intermediary centrality is due to the accumulation of time, which proves that China has an important position in e-commerce research.

IV. CONCLUSION

This study uses Citespace 5.2.R2 as a research tool, and takes Web of Science database as a data source to conduct cooperation network analysis and visualization of international e-commerce research results. Through analysis, first, there are few high-output authors, only a few academic communities, and the degree of cooperation is not tight. Second, the institutions with high output are in China, and the cooperation between research institutions is very low. There are several academic communities that are very unfavorable for overcoming major issues in this area. Third, the country (region) with the largest output is China, followed by the United States, and then, Taiwan. The cooperation between countries (regions) is very high. It is worth noting that the United States plays an important role in the field of e-commerce research. China's contribution in this field is very prominent and has played an important role. On the whole, the output of international e-commerce research in the past decade is very large, but it is very scattered. This coincides with the trend of e-commerce globalization. In countries and regions where e-commerce industry is developed, there are more and more in-depth researches on e-commerce.

REFERENCES

- [1] Lim S, Jin X, Srai J S. Consumer-Driven E-Commerce: A Literature Review, Design Framework and Research Agenda on Last-Mile Logistics Models[J]. Social Science Electronic Publishing, 2017, Accepted(1).
- [2] Idris A, Edwards H M, McDonald S. E-COMMERCE READINESS OF SMEs IN DEVELOPING COUNTRIES: A MODEL-DRIVEN SYSTEMATIC LITERATURE REVIEW: Proceeding of the Uk Academy for Information Systems Conference, 2017[C].
- [3] Martinelli E M, Tunisini A, Guercini S. Customer-driven Supply Chains under IMP lens: a systematic literature review and conceptual framework[J]. 2017, 11(2).
- [4] You Jing. Sustainable Marketing Research of SMEs Based on E-commerce Ecosystem—Taking Alibaba E-commerce Ecosystem as an Example[J]. Journal of Business Economics, 2017(19): 84-87.
- [5] Xiao H M, Zhu X M. Research and Empirical Analysis of User Satisfaction in Mobile E-commerce Vision[J]. Mathematics in Practice & Theory, 2018.
- [6] Sullivan Y W, Dan J K. Assessing the effects of consumers' product evaluations and trust on repurchase intention in e-commerce environments[J]. International Journal of Information Management, 2018, 39:199-219.
- [7] Couture V, Faber B, Gu Y, et al. E-Commerce Integration and Economic Development: Evidence from China[J]. Social Science Electronic Publishing, 2018.
- [8] Chen Chaomei. Visualization exploration of scientific frontier map knowledge [M]. (Second edition). Background: Science Press, 2018.
- [9] Yu Yimin, Chen Taowei, Zhao Kun. Development of China-ASEAN Cross-border E-commerce and Countermeasures—Based on the Single Window of Trade Facilitation and International Trade [J]. Exploration of Economic Issues, 2018(4).
- [10] Yu Fumao, Sun Xiaoli. Case Study on Supply Chain Collaboration Mechanism of E-Commerce Driven Industrial Clusters[J]. Science and Technology Management Research, 2018(2): 179-186.
- [11] Li Ying. Network Ecology Characteristics and Innovation Development of E-commerce Format—Based on the New Trend of Global E-Commerce Development[J]. Journal of Business Economics, 2017(4): 59-61.
- [12] Chen C. CiteSpace II: Detecting and visualizing emerging trends and transient patterns in scientific literature[J]. Journal of the Association for Information Science and Technology, 2006, 3(57):359-377.
- [13] Chen Yue, Chen Chaomei, Hu Zhigang, et al. Principle and application of citation space analysis [M]. Beijing: Science Press, 2014.
- [14] Li Jie. Scientometrics and Knowledge Network Analysis [M]. Beijing: Capital University of Economics and Business Press, 2018.