

Knowledge Graphs Analysis of New Retail Research Based on Citespace*

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Abstract—This article uses the CNKI database as the data source. Taking the "new retail" as the theme, it collects all the research results of the new retail in the database since 2016. The number of effective data is 2202, which is analyzed and displayed in knowledge graph by Citespace5.3.R4 scientific measurement analysis tool. The results show that the research rate in this field is higher, the cooperation between authors is less and the cooperation level is low. The research community is not formed. The cooperation between research institutions is even lower. The high frequency keywords are more. However, there are not many keywords with prominence and centrality. There are few topics formed after cluster analysis, and the research frontier is not obvious enough.

Keywords—new retail; knowledge graph; author cooperation; institutional cooperation; keyword co-occurrence analysis

I. INTRODUCTION

New Retailing is a new mode of retail that individuals and enterprises rely on the internet to upgrade and reshape the production, distribution and sales of goods through the use of advanced technologies such as big data and artificial intelligence and the use of psychological knowledge, and then to reshape the business structure and ecosystem, and deeply integrate online services, offline experience and modern logistics [1]. The future e-commerce platform is about to disappear, and online and offline and logistics will combine to generate new retail. Online refers to the cloud platform, and offline refers to the sales of stores or manufacturers. The new logistics is to eliminate inventory and reduce the amount of stockpile. The disappearance of e-commerce platform means that the existing e-commerce platform will be scattered, and everyone has their own e-commerce platform, which is no longer in the large e-commerce platform of Tmall, Jingdong and Amazon [2]. In response to the tremendous changes in this industry, this study collected all the articles about the previous research on new retail and published results indexed by CNKI since 2016. Using Citespace's bibliometric analysis function, the knowledge maps of these results are analyzed, and the cooperation between authors and institutions is discussed.

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The theme changes and development directions of the research are analyzed.

II. RESEARCH METHODS AND RESEARCH TOOL

A. Research Methods

This study uses the author's cooperation network, institutional cooperation network, keyword co-occurrence analysis and other methods to conduct scientific quantitative analysis of new retail 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, and cooperative network analysis is an effective analysis method for clarifying the cooperation between authors and institutions. Keyword co-occurrence analysis is one of the scientific methods for exploring the basic knowledge, hot topics and research frontiers in this field.

B. Data Collection

On August 10, 2019, the study used the CNKI database as the data source to search for the search strategy with the theme of "new retail" and the time span from January 1, 2016 to August 10, 2019. Data is exported to 2616 samples and archived in RIS format download.txt for subsequent analysis. In order to ensure the quality of the data, this article examines all the data one by one, removes no authors, journal copyright pages, report articles, and removes duplicate data, obtaining a total of 2202 valid samples.

C. Research Tool

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 5.2.R2. Considering the stability of the program, this study used 5.3R4. version. The analysis tool can perform scientific measurement analysis on the data and draw a visual knowledge map to provide readers with a good visualization effect.

III. RESEARCH RESULTS

A. Research Output

Since the concept of new retail in 2016, the research results have grown rapidly (see "Fig. 1"). In 2016, there were

only 29 articles, with 758 articles in 2017, 1,204 in 2018, and 593 articles by August 10th, 2019. The number is very large. It can be seen that this topic has become a research topic of great interest in e-commerce and even in the commercial field.

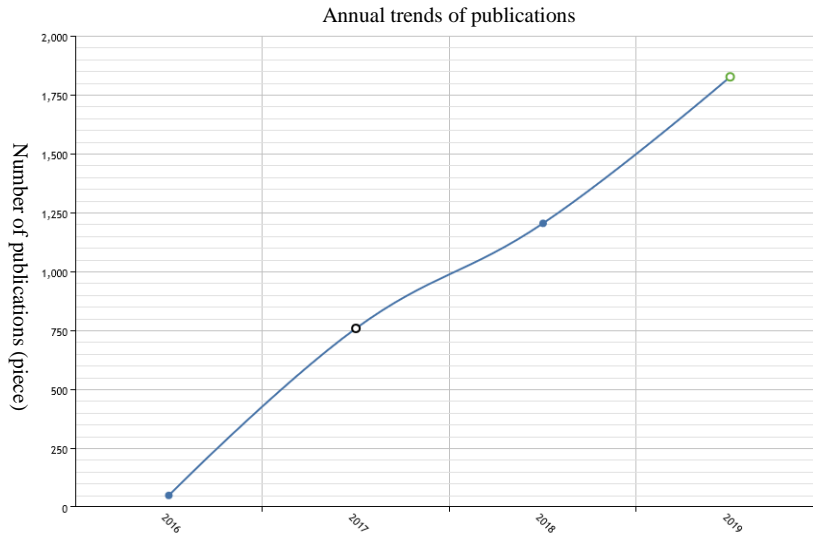


Fig. 1. Cumulative output of research results.

B. Author Network Analysis

This paper used the function of authors' co-occurrence network analysis of Citespace. The parameters are set as: N=Top50% (the first 50% of each year), C=2 (frequency>2), CC=2 (co-occurrence frequency>2), CCV=2 (common rate > 15%) [3]. The analysis showed that there were 3,303 authors in the new retail research field. The network node N=207, that is, the author who meets the screening conditions is 207, and the connection E=59, that is, a total of 59 authors satisfy the condition of cooperation more than twice. The network density is 0.0028, and the structure is very loose, indicating the cooperation strength between authors is very weak. Judging from the generated report, China's new retail research has only formed two research teams, namely Fang Yixun, You Zheqi, Ma Chenming, Zhao Jianfeng, Ye Bingjie and Wei Qing team, Xi Chongbin, Ren Fang and Zhao Jiaoyun team.

This study compiled authors with more than 5 articles, the highest output was Fan Peng (13), followed by Meng Yonghui (11), and the rest were below 5 (see "Table I"). According to Plath's law, it can be seen that in a certain field, the core author's output accounts for almost half of all authors' output. The core author's formula is:

$M_p = 0.749 \sqrt{N_{pmax}}$, where M_p is the author of the core author and N_{pmax} is the author of the highest-output author [4].

The maximum number of articles in this paper is 13 articles. According to the formula, the M_p is 2.700, that is, the author, whose number of published articles is more than 3, is the core author of the field. According to statistics, there

are 50 authors who have published more than 3 articles in this study. It means that there are 50 core authors, and a total of 271 articles were published, accounting for 12.30% of the total. According to Plath's law, the core author's publication volume should reach about 50% of the total number of publications. In this research, the core authors only account for 12.30%, which is much lower than 50%. It can be seen that a real meaning core author group has not yet formed in this research field.

Through the sudden detection of Citespace's literature, there were no authors with suddenness in the network. Further finding the intermediary centrality of the nodes in the network, it was found that the mediating intermediacy of all nodes was 0, which confirmed the low degree of cooperation of the previous analysis.

TABLE I. LIST OF THE NUMBER OF AUTHORS' PUBLICATIONS

No	Count	Author	Year	No	Count	Author	Year
1	13	Fan Peng	2017	11	7	Wu Yongyi	2017
2	11	Meng Yonghui	2017	12	6	Lv Lizhe	2017
3	9	Li Xiang	2016	13	6	Liu Kuang	2017
4	8	Cai Yunlei	2016	14	6	Kang Yingqing	2017
5	8	Shu Shengxiang	2016	15	5	Bai Yang	2018
6	8	Sheng Yulei	2016	16	5	Shen Jie	2017
7	8	Wang Jin	2016	17	5	Li Bingyi	2018
8	8	Jiang Debin	2016	18	5	Zhu Dongmei	2018
9	8	Tangji Weide	2016	19	5	Xi Chongbin	2017
10	7	Bao Yuezhong	2017				

C. Institutional Cooperation Network Analysis

The cooperation of scientific research institutions is one of the common forms of scientific research cooperation. Through the cooperation of scientific research institutions, it can achieve complementary advantages and have a good help to overcome major scientific research topics. This analysis uses Citespace to analyze scientific research cooperation, and generates a cooperative network map of China's new retail research and research institutions. The parameter setting refers to the cooperative network analysis part of the scholars. There are 144 scientific research institutions, and the cooperation frequency is 11 times. The network density is 0.0011, and the net is very loose. Most institutions are isolated, indicating that the frequency of cooperation between institutions is very low. Further analysis

of the cooperative community of scientific research institutions reveals that a stable research cooperation community has not yet been formed in the new retail sector.

From the results report, China Securities Times, China Economic Weekly, and School of Business of Jiangnan University have more output, respectively 12 articles, 11 articles, and 9 articles (see "Table II"). Judging from the bursting degree of citations, only the Securities Times and the Dalian Municipal Bureau (Tobacco Bureau) have an explosive degree with intensity of 1.85. The time span is 2016-2017, and no other institutions have any explosiveness. From the point of view of node centrality, all nodes are not central, which confirms the previous conclusion that institutional cooperation is very weak in this field.

TABLE II. LIST OF THE NUMBER OF AGENCIES' PUBLICATIONS

No	Count	Burst	Institute	Year
1	12	1.85	Securities Times	2016
2	12	1.85	Dalian Municipal Bureau (Tobacco Bureau)	2016
3	11		"China Economic Weekly"	2017
4	9		School of Business, Jiangnan University	2018
5	9		China Electronic Commerce Research Center	2016
6	9		Jiangxi University of Finance and Economics	2017
7	9		Chinese Association of Market Development	2016
8	8		School of International Trade and Economics, Anhui University of Finance & Economics	2018
9	8		Tianyuan Finance	2016
10	6		Ali Research	2017
11	6		Beijing Wuzi University	2018
12	6		Business School, University of Shanghai for Science & Technology	2018
13	6		School of Management, Shanghai University	2017
14	5		School of Economics & Management, Southwest University of Science and Technology	2018
15	5		Hunan Modern Logistics College	2018
16	5		Shanxi University of Finance and Economics	2017

D. Keyword Co-occurrence Analysis

Using Citespace's noun terminology function, the noun terms are extracted from the collected document abstracts, and then the reference frequency N=top50 is selected. The path-finding network method is used to carry on the keyword co-occurrence analysis. The results show that there are 118 keywords forming a co-occurrence network. The network is connected with lines, and there are 386 co-occurrences. The network density is 0.0559, and the keyword network is closely connected. From the results of clustering, the Modularity value = 0.4413. According to the standard given by software developer Chen Chaomei, Modularity is ideally between 0.4 and 0.8.

1) High frequency keywords: Statistics on the high-frequency vocabulary obtained from the analysis can be found in "Table II". From the high-frequency vocabulary, it can be seen that "new retail", "online and offline", "consumer", "Alibaba" and "physical retail" have the highest frequency (frequency is greater than 100), ranking first in the echelon; reaching 806, 309, 172, 163 and 102 times. The following "retail industry", "physical store", "e-

commerce", "traditional retail", "supply chain", "e-commerce", "e-commerce platform", "retail business", "convenience store" and "business model" and other keywords are higher than 50 times, ranked in the second echelon. "Fresh e-commerce", "Retail Industry", "Retail Mode", "Consumption scene", "New Retail", "Omni-channel", "Shopping Experience", "New retail Model", "Logistics", "Consumption Upgrade" ", "Big Data", "Retailer", "Ma Yun", "Hema Fresh" and "Brand company" are the third echelon, which the frequency is higher than 30 times. After that, the high-frequency words are all below 30 times, which is classified as the fourth echelon. (See "Table III") The reason why "new retail" is the highest frequency may be the reason for the search term, indicating that the collected data is of good quality. The high-frequency words of the second echelon reflect that the researchers' focus is mainly on the company's own operating environment, such as e-commerce platforms, physical stores, and retail formats. The high-frequency words of the third echelon reflect the researcher's focus on the management technology level of e-commerce.

TABLE III. LIST OF HIGH FREQUENCY KEYWORDS

No	Count	Key words	No	Count	Key words	No	Count	Key words	No	Count	Key words
1	806	New retail	20	41	"New retail"	39	23	Retail commerce	58	15	New retail era
2	309	Online and offline	21	40	Omni-channel	40	23	Shopping center	59	15	the People's Republic of China
3	172	Consumer	22	39	Shopping experience	41	22	E-commerce era	60	15	Suning
4	163	Alibaba	23	38	New retail model	42	21	Transformation and upgrading	61	15	RT-Mart
5	102	Physical retail	24	36	Logistics	43	21	Consumption experience	62	14	Consumer experience
6	95	Retail industry	25	36	Consumption upgrading	44	20	Tmall	63	14	Internet
7	91	Physical stores	26	35	Big data	45	20	Off-line	64	14	User experience
8	87	E-commerce	27	35	Retailer	46	20	JD.com	65	14	Entity
9	80	Traditional retail	28	32	Ma Yun	47	19	Commerce	66	13	Retail
10	76	Supply chain	29	32	Hema Fresh	48	19	Marketing strategy	67	13	Retail enterprises
11	71	E-commerce	30	32	Branding company	49	19	Retail revolution	68	12	Traditional retail industry
12	70	E-commerce platform	31	28	Artificial intelligence(AI)	50	18	o2o	69	11	Rural e-commerce
13	65	Retail format	32	28	Double Eleven	51	17	Amazon	70	11	Innovation
14	61	Convenience stores	33	27	Commodity	52	16	Retail stores	71	11	Concept
15	54	Business model	34	25	Internet +	53	16	Blockchain	72	11	Yintai
16	47	Fresh produce e-commerce	35	24	Enterprises	54	16	Yonghui Superstores	73	11	Form of thinking
17	44	Retail industry	36	24	Business management	55	15	Merchant	74	10	Eyewear industry
18	42	Retail model	37	24	Outlet	56	15	Superstores	75	10	Ali
19	41	Consumption scene	38	24	Dealers	57	15	Supermarkets	76	10	Retail strategy

2) *Keyword prominence*: Prominence refers to the surge in citation of a document, author, or concept over a time span. According to Kuhn's scientific revolutionary theory, high prominence often contains features and characteristics of important scientific discoveries. From the point of view of the keyword's prominence, there are 12 keywords in the new retail field that are prominent, as shown in "Table IV" below. It can be seen from the table that the prominence of

China's new retail research field is concentrated in 2016-2017, focusing on retail platforms (such as supermarkets, physical retail, Tmall, e-commerce, supermarkets, retail stores) and operations management (commerce, business management, and enterprises). It can be seen that in the research results of 2018-2019, there are few new research topics, which are based on the original themes.

TABLE IV. TOP 12 KEYWORDS WITH THE STRONGEST CITATION BURSTS

Keywords	Year	Strength	Begin	End	2016 - 2019
Commerce	2016	6.0901	2016	2017	
Superstores	2016	4.8011	2016	2017	
Physical retail	2016	4.8734	2016	2017	
Retail	2016	4.158	2016	2017	
Tmall	2016	6.413	2016	2017	
Business management	2016	7.7066	2016	2017	
E-commerce	2016	25.7161	2016	2017	
Ma Yun	2016	10.305	2016	2017	
Supermarkets	2016	4.8011	2016	2017	
Enterprises	2016	7.7066	2016	2017	
Merchant	2016	4.8011	2016	2017	
Retail stores	2016	5.123	2016	2017	

3) *Keyword centrality*: Centrality is the importance of measuring the position of nodes in the network. Generally, there are two situations that lead to high node centrality. First, the node is highly connected to other nodes and becomes a key node similar to the hub. Second, the node is located in two different clusters and is the key node for the connection between the two clusters. The central node is often the beginning of a new research trend. For this reason, the centrality of the observation node can intuitively understand the development trend of the research field. As can be seen from "Table III", the two terms "new retail" and

"e-commerce" have the highest centrality, indicating that the two keywords are most important in the network; The centrality of "traditional retail", "online and offline", "consumer", "physical store", "physical retail" and "retail mode" is higher than 0.1, indicating that these nodes are of great importance. Combined with "Table III" and "Table IV", most of the high-frequency vocabulary is not prominent, and many high-frequency vocabularies have no intermediateness, indicating that these high-frequency vocabularies, although widely mentioned, does not have sufficient influence. (See "Table V")

TABLE V. LIST OF KEY WORDS WITH CENTRALITY

No	Centrality	Key words	No	Centrality	Key words	No	Centrality	Key words	No	Centrality	Key words
1	0.31	New retail	15	0.07	Ma Yun	29	0.03	Internet +	43	0.02	E-commerce platform
2	0.3	E-commerce	16	0.07	Consumption scene	30	0.03	Hema Fresh	44	0.02	Supply chain
3	0.23	Traditional retail	17	0.06	Commerce	31	0.03	Business model	45	0.01	Business management
4	0.23	Online and offline	18	0.06	User experience	32	0.02	Retail stores	46	0.01	Enterprises
5	0.19	Consumer	19	0.06	Retail format	33	0.02	Supermarkets	47	0.01	Tmall
6	0.14	Physical stores	20	0.05	Retail industry	34	0.02	Superstores	48	0.01	Ali
7	0.13	Physical retail	21	0.05	Convenience stores	35	0.02	Merchant	49	0.01	JD.com
8	0.11	Retail model	22	0.05	Retail industry	36	0.02	RT-Mart	50	0.01	Transformation and upgrading
9	0.1	Alibaba	23	0.04	E-commerce	37	0.02	Suning	51	0.01	E-commerce era

No	Centrality	Key words	No	Centrality	Key words	No	Centrality	Key words	No	Centrality	Key words
10	0.09	Traditional retail industry	24	0.03	Innovation	38	0.02	Retail revolution	52	0.01	Shopping center
11	0.09	Fresh produce e-commerce	25	0.03	Internet	39	0.02	Double Eleven	53	0.01	Retail commerce
12	0.08	Consumption experience	26	0.03	Yonghui Superstores	40	0.02	Branding company	54	0.01	Outlet
13	0.08	Logistics	27	0.03	o2o	41	0.02	Shopping experience	55	0.01	Commodity
14	0.08	"New retail"	28	0.03	Marketing strategy	42	0.02	Omni-channel	56	0.01	Big data

4) *Keyword clustering*: Using the clustering function of Citespace, the clustering strategy of "keyword+LLR" is adopted to display in the timeline. The clustering results show that there are 6 clusters in the field, and "mean silhouette"=0.3766. The maximum clustering value is 114, the clustering rate is 96%, and the clustering effect is good, as shown in "Fig. 2". It can be seen from the "Fig. 2" that the new retail is a concept compared to the traditional retail

industry. The reason it came into being is that with the coverage of computer networks and the improvement of mobile phone functions, the fast and rapid development of e-commerce has prompted changes in people's consumption patterns, as it shown in the keywords appearing in the "Fig. 2": Double Eleven, consumption scene, business model and traditional retail. Further analysis of each cluster is performed below.

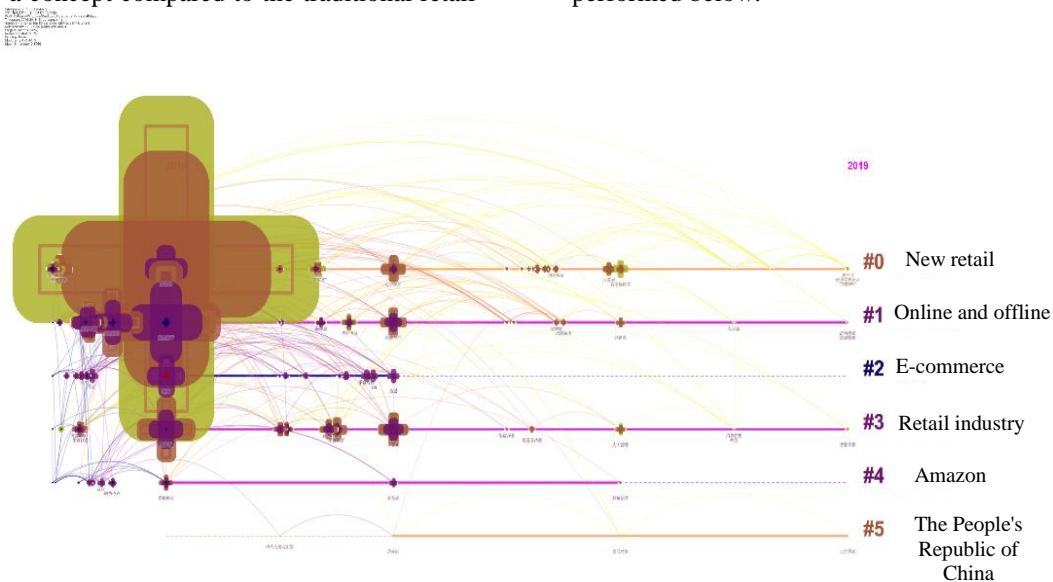


Fig. 2. Timeline display map of keyword clustering.

According to the clustering result of "Fig. 2", the "Table VI" can be obtained. As can be seen from the "Table VI", the data volume of Cluster0 is the largest, reaching 36, accounting for 31.58% of the total. As the clustering tag number increases, the clustering data continuously reduced, and the amount of Cluster5 data is only 4. From the value of

the silhouette, the silhouette values of all clusters are greater than 0.4, which basically meets the requirements of clustering. From the average year, except for 2019, the rest of the years are reflected, which shows that there are fewer new research hotspots in 2019.

TABLE VI. LIST OF KEYWORD CLUSTERING INFORMATION

Cluster ID	Size	Silhouette	Mean year	Cluster labels (LLR)
0	36	0.698	2018	New retail
1	24	0.497	2017	Online and offline
2	19	0.48	2016	E-commerce
3	17	0.415	2017	Retail industry
4	14	0.758	2016	Amazon
5	4	0.917	2017	the People's Republic of China

a) Cluster0: New retail: New retail is a concept defined by the innovation of traditional retail methods, but how to define the boundaries between new retail and traditional retail models is the first problem to be solved. Zhou Xiaobo and Liu Zhangyong took Alibaba and Jingdong as examples to discuss the retail innovation gimmick dispute under the new retail model, and analyzed innovative paths such as integrating new retail online and offline channels, new retail service experience and scenes, and reconfiguring new supply chain digital systems under the new retail model [5]. Wang Juan explores the supply-side reform path of traditional retail industry in China with new retail background [6]. Liu Yalan started from the development of China's new retail industry and existing problems, and analyzed the development of new retail in the case of Amazon, Alibaba and Jingdong, and then proposed innovative policy recommendations for the development of China's new retail market. [7]

b) Cluster1: Online and offline: The concept of O2O has gradually faded away, and now it is gradually being replaced by the concept of "new retail." The integration of online and offline is the main way of new retail, and its upgrade caters to the needs of new retail [8]. Han Qianqian uses Alibaba's "Double Eleven" as an example to explore the promotion effect of "Double Eleven" online and offline integration and interaction on new retail, and to analyze the spillover effect with Suning and Gome.com.cn [9]. Kang Yingqing believes that compared with the situation that the previous e-commerce carnival and consumer desperately consumed online, and the physical business can only watch silently, under the new retail mode, the physical business has attracted the attention of most consumers by integrating online and offline and launching various preferential measures, and it has formed an effective resistance to traditional online consumption [10].

c) Cluster2: E-commerce: E-commerce is the foundation of new retail development, and new retail has also promoted the transformation and development of e-commerce. Starting from the new retail concept proposed by Ma Yun, Hong Tao explores the online consumption of Jingdong, Alibaba, and analyzes the practice of online consumption promotion of Jingdong, Alibaba, the second largest retailer in the United States, and Three Squirrels to promote offline consumption, and then analyzes the status quo, characteristics and development trends of e-commerce development [11]. Zhang Yi believes that against the background of the transformation of retail 4.0, the only way out for new retailers to become e-commerce [12]. Dong Junjun also believes that e-commerce is turning to new retail is a new direction and pattern of its development [13]. Jesse believes that the new retail is a reconciliation between the physical store and the e-commerce [14].

d) Cluster3: Retail industry: The retail industry grasps the development of the entire retail industry from a macro perspective. Most of the current researches are cut in the theme from big data [15], blockchain [16], unmanned

retail [17], smart retail [18], digital transformation [19], smart supply chain [20], emerging technology [21], etc. This discussion of the development direction of the entire industry has a good guiding role for the practice of the industry.

e) Cluster4: Amazon: Amazon, located in Seattle, Washington, is one of the first companies to start e-commerce on the Internet. Founder Jeff Bezos believes that the important advantage of online retail compared with physical stores is that it can provide consumers with more choices of products. Therefore, expanding the category of websites and creating integrated e-commerce to form economies of scale has become Amazon's strategic considerations [22]. As a global e-commerce giant, Amazon was the first to open a black-tech retail store Amazon Go, which is the unmanned retail store full of "black technology" without checkout queues. The emergence of Amazon Go means that Amazon is the first to start testing the field of self-service shopping, and has become the pioneer of new retail [23]. In addition, starting from Amazon's acquisition of the Whole Foods Market, it means that Amazon's aggressive entry into the offline field has already taken place [24].

f) Cluster5: the People's Republic of China: The emergence of this keyword reflects the researcher's study height and depth of the development of China's new retail industry. Mike Webster believes that in the context of the new retailism in the Chinese market, as digital power increases and omni-channel grows, the balance between consumers and retailers is inevitably changing [25]. When the China General Chamber of Commerce Expert Working Committee evaluated the top ten hot spots of 2017 China's business, it proposed that a large number of new formats and new models will emerge, and the integration and reconstruction will inevitably lead to "new retail" [26].

IV. CONCLUSION

This paper uses Citespace5.3.R4 to conduct scientific measurement analysis and knowledge graph display on the results of China's new retail research results collected by CNKI. Through analysis, it is found that, first of all, the research output in this field has developed rapidly. In less than four years, the research literature has reached more than 2,200. Secondly, in this field, there is less cooperation between authors and a lower level of cooperation, and a strong, stable research community has not yet formed. Cooperation between research institutions is lower, which is very unfavorable for overcoming major issues in this field. Thirdly, through keyword co-occurrence analysis, it is found that the number of high-frequency vocabularies generated is large, but there are fewer keywords with prominent features, and there are not many keywords with centrality. There are only six clusters formed, and most of them are concentrated in 2016 to 2018. There are no new topics and clusters in 2019. It can be seen that the current research mainly focuses on the deep research on previous topics.

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