Accounting and Auditing Research Trends under the Development of New Information Technology in the Digital Economy Era Based on CiteSpace

Shuaikun Wang[1*], Yan Wang[2]

E-mail: 309205@whut.edu.cn[1*], E-mail: 312175@whut.edu.cn[2]

School of Management, Wuhan University of Technology, Wuhan, P.R.China, 430070[1]
School of Economics, Wuhan University of Technology, Wuhan, P.R.China, 430070[2]

Abstract: This paper uses CiteSpace scientific measurement visualization software, takes the relevant literature of intelligent accounting in CNKI data and Web of Science core collection database as the research object, and summarizes the hot topics and trends of intelligent accounting at home and abroad through the analysis of the number of literature, key words, research trends and frontier analysis. The analysis shows that the research on intelligent accounting shows the following characteristics: from the perspective of time line, the research emerged after 2010, and developed on a large scale after 2014; From the perspective of content, the research hotspots include "smart contract", "big data", "blockchain" and "data privacy", which have obvious technology empowerment and demand orientation. As one of the research centers of intelligent accounting in the future, China should combine the national conditions, conduct technical exchanges with foreign countries, and deeply study the characteristics of the ecosystem of intelligent accounting, so as to provide guidance for the practical exploration of intelligent accounting.

Keywords: Intelligent accounting, Artificial intelligence, Digital economy, Bibliometrics

1 Introduction

Under the wave of information age, information technology innovation leads the wave of digital economy to impact all walks of life in society. Under the background of big data and artificial intelligence, emerging technologies such as "big intelligence moving cloud and object area ring" have been given birth, which are widely used in accounting, financial management and audit work, and the concepts of intelligent accounting, intelligent audit and financial sharing have been generated. This has brought new opportunities and challenges to the accounting industry. On March 10, 2017, Deloitte announced a partnership with Kira Systems to introduce artificial intelligence in accounting, auditing and tax work. On December 30, 2021, the Ministry of Finance issued a notice on the issuance of the Accounting Informatization Development Plan (2021-2025), which proposed a new system for the development of national accounting informatization, which also effectively helped promote the transformation of domestic accounting, as well as the help of intelligent accounting for enterprise management, organization and other directions. At the same time, the research heat in the field of intelligent accounting is also growing. From the perspective of relevant research at home and abroad, some domestic scholars have conducted systematic and comprehensive research on the transformation of

ICBBEM 2023, May 19-21, Hangzhou, People's Republic of China

DOI 10.4108/eai.19-5-2023.2334403

intelligent accounting and the system of intelligent accounting, explored the basic path for enterprises to realize intelligent finance under the guidance of the government and the promotion of the environment(Liu Qin,2020[1];Zhang Min,2020[2];Zhang Min 2021[3]), and discussed the possible application scenarios of intelligent finance in the next few years(Liu Qin et al,2018[4];Zhang Qinglong,2021[5];Zhang Qinglong,2021[6]).Some possible impacts of smart finance are widely concerned, such as the replacement of some accounting jobs by computers (Frey et al, 2017)[7], the freeing of accountants by artificial intelligence (Godfrey Billy et al, 2018)[8] and the reshaping of the accounting profession (Kirstin, 2017[9]; Allissa, 2018[10]). (Natallia Pashkevich et al, 2023)[11]proposed a technology to manage cognitive time in economic organizations called cognitive time-driven activity-based costing (CTABC) has formed a rich research foundation, but there are still few articles on macro literature review and research prospects.

In order to further understand the development status and trend of intelligent accounting research at home and abroad, and explore its possible future research direction, this paper adopts the visual bibliometrics method based on CiteSpace. This paper analyzes and combs the research literature on accounting, auditing and other financial management under the new information technology from China National Knowledge Infrastructure (CNKI) and WoS database from 2006 to 2023, and summarizes the research results and the dynamic evolution trend of development direction. Compared with the existing literature mostly focusing on the domestic development trend, this paper mainly focuses on the field of accounting and auditing, and compares and analyzes the research status and trend of artificial intelligence, big data, block chain and other technologies from the international perspective and the domestic perspective, in order to more systematically grasp the existing research context and explore the future research direction, and put forward suggestions for the transformation and development of accounting in the information age. This paper provides a reference for future research in related fields.

2 Data Sources and Research Methods

2.1 Data sources

For domestic research, this paper used CNKI as the source of literature data to search relevant Chinese literature, including CSSCI, CSCD, EI and core journals of Peking University. Time span is 2006-2023, excluding review meeting, notice, reports the research articles. Finally, a total of 694 valid literature data were retrieved.

For foreign studies, this paper used the core collection database of Web of Science as the source of literature data to search relevant foreign language literature, including SCI, SSCI and SCIE journals. The time span was from 2006 to 2023. After excluding non-research articles such as conference papers and online publications, a total of 264 valid literature data were retrieved.

2.2 Research methods

This paper uses bibliometric methods and CiteSpace software to visually analyze the trends of accounting and audit research under the new information technology in the digital economy era. Based on the literature produced by domestic and foreign scholars in the field of intelligent

finance and accounting research from 2006 to 2023, this paper uses CiteSpace software to carry out visual analysis of Chinese and English literature, draws the co-occurrence map of high-frequency keywords, and then carries out keyword clustering analysis and keyword burst analysis. The keyword time zone map and keyword time line knowledge map are drawn in order to deeply study the research status and development trend of the field.

3 Results and analysis

3.1 Statistics of time distribution of literature

The number of published papers is an important indicator to analyze the heat of the field and the quality of scientific research. The number of published papers can reflect the changes of scientific knowledge in the field and the attention of scholars to it. By counting the number of domestic and foreign literature published in the field of intelligent finance and accounting from 2006 to 2023, the trend of the number of papers published in this field is shown in Figure 1.

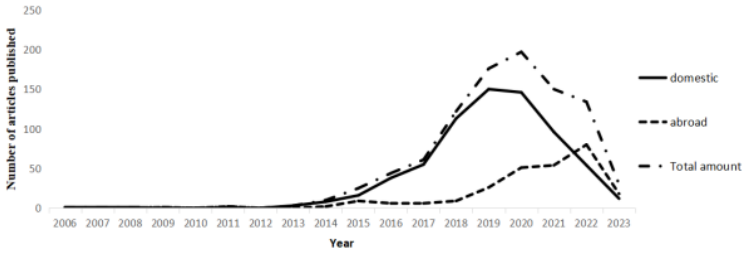

Figure 1: Time distribution of the number of papers published in the field of intelligent accounting at home and abroad.

From the trend of publications, the number of publications at home and abroad was relatively small from 2006 to 2013, with an average of 1.125 per year. Most of the articles were theoretical exploration of intelligent accounting now and predictive research of the future, and the overall research was still in the embryonic stage. The overall research is still in the embryonic stage of exploration. Since 2014, the domestic and foreign development has produced a watershed, and the number of domestic publications has exceeded that of foreign publications. From 2014 to 2017, both domestic and foreign publications entered a growth stage, with an average of 29.25 publications per year in China. Concepts such as artificial intelligence, big data, blockchain and digital economy entered the public vision, and scholars paid close attention to concepts such as financial sharing center. From 2018 to 2021, the number of publications at home and abroad maintained a high growth rate, and scholars from all sectors maintained high enthusiasm for the application and development of emerging technologies represented by big data and cloud in the field of finance and accounting. Since 2022, the heat has gradually cooled down, and the number of publications has decreased, but the depth of research has not decreased. Blockchain, artificial intelligence and other new technologies have promoted the in-depth development of intelligent accounting. In 2019, the number of foreign publications increased sharply, and in 2022, the number of publications exceeded that of domestic publications. The overall development showed an upward trend.

3.2 Analysis of domestic and foreign keyword research hotspots

The analysis of research hotspots is very important to understand the development status of intelligent accounting field and the frontier hot trend of future development, and can grasp the scientific problems that are widely concerned by the academia today. Based on the discussion of keywords on research hotspots, the top 10 high-frequency keywords at home and abroad are selected as shown in Table 1, where centrality represents whether the node keywords have a hub role. At the same time, the co-occurrence graphs of domestic and foreign keywords are drawn as shown in Figure 2 and Figure 3.

Table 1: High-frequency keywords of intelligent accounting research at home and abroad

Domestic high frequency keywords			Foreign high frequency keywords		
Freq	Centrality	Label	Freq	Centrality	Label
426	1.19	Audit	87	0.10	Big Data
415	1.13	Big data	52	0.34	Artificial Intelligence
305	1.20	Accounting	44	0.16	Cloud
142	0.37	Artificial intelligence	28	0.08	Blockchain
126	0.64	Blockchain	23	0.18	Smart Contracts
51	0.07	Influence	20	0.06	Systems
34	0.09	Informatization	17	0.38	Data Security
34	0.08	Challenge	17	0.04	Management
22	0.11	Application	16	0.35	Performance
21	0.22	Countermeasure	16	0.07	Framework

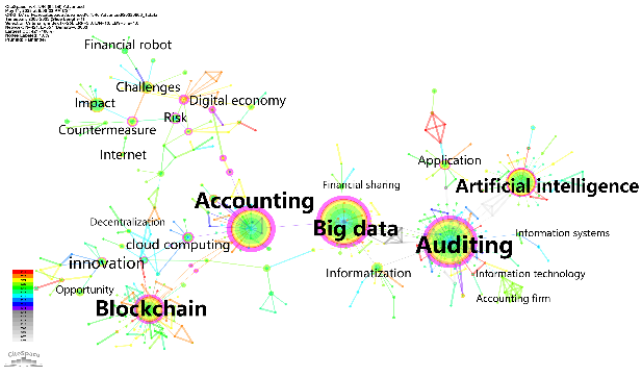

FIG. 2: Co-occurrence diagram of keywords in domestic intelligent accounting research.

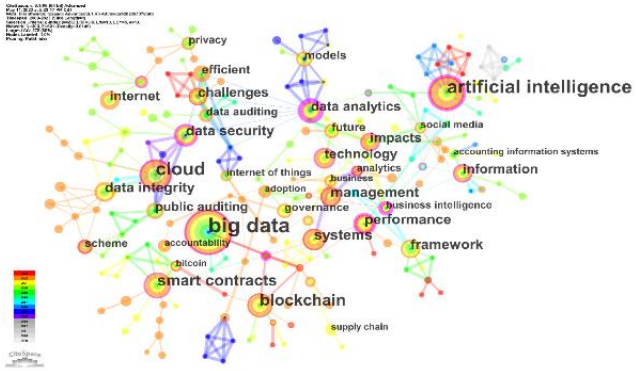

FIG. 3 Co-occurrence diagram of keywords in foreign intelligent accounting research.

In terms of high-frequency keywords, the top five domestic keywords were audit, Big Data, accounting, Artificial Intelligence and Blockchain, while the top five foreign keywords were big data, artificial intelligence, Cloud, blockchain and Smart Contracts. Among the domestic keywords, the frequency and centrality of "big data", "artificial intelligence", "blockchain", "cloud computing" and "digital economy" are high, indicating that accounting audit is widely using emerging digital technologies. In addition, the frequency and centrality of keywords such as "application", "countermeasures" and "risk" are also high, indicating that the application of emerging technologies is still a double-edged sword. It is necessary to take measures to deal with risks in advance. The high frequency and centrality of keywords such as "Big Data", "Artificial Intelligence", "Cloud", "Data Analytics" and "Information" in foreign keywords indicate that the integrated development of multiple technologies and the research field of intelligent accounting are rich. Similar to China, the high frequency and centrality of keywords such as "Data Security", "Privacy" and "Challenges" also represent that there are risks in the application of emerging technologies, and the future development still needs to pay attention to the management and response of risks.

3.3 Cluster analysis of domestic and foreign research hotspots

In order to further clarify the research hotspots in the field of intelligent accounting, CiteSpace software is used for keyword clustering analysis, and LLR log-likelihood algorithm is used for clustering labels to obtain the text clustering results of domestic and foreign research in the field of intelligent accounting, as shown in Figure 4 and Figure 5.

Among them, "#" represents the name and number of the cluster tags, which are sorted according to the number of nodes from more to less, and each cluster tag represents a research topic. As shown in Figure 3, the LLR log-likelihood algorithm is used to obtain the domestic Q value (clustering module value) of 0.8461 and S value (clustering average contour value) of 0.9894. As shown in Figure 4, the foreign Q value is 0.7967 and S value is 0.9391 by LLR log-likelihood algorithm. The Q value of the two figures is much higher than 0.3, which indicates that the clustering structure is significant, and the S value is much higher than 0.7, which indicates that the clustering efficiency is high and the clustering results are convincing.

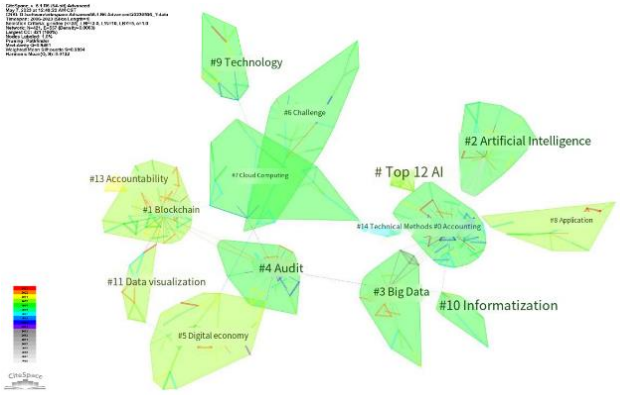

FIG.4: Clustering results of domestic intelligent accounting research texts

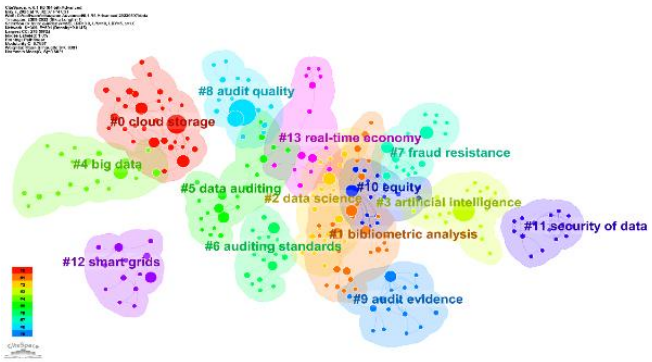

FIG.5: Clustering results of foreign intelligent accounting research texts

The domestic text clustering results are divided into 15 categories as shown in the FIG 4. It can be found through research:First, in the information age, emerging digital technologies are widely integrated and applied in the accounting industry. On the basis of decentralized and distributed ledger, blockchain technology is widely practiced in enterprises, universities, government agencies and so on. Second, in the digital environment, the research and reform of accounting key points, accounting objects, accounting activities, accounting personnel and other accounting elements. Third, under the background of technology upgrading, the update of accounting methods, the security of accounting data, the technology of accounting personnel and other requirements are put forward.

The clustering results of foreign texts are divided into 14 categories. Most foreign countries are concerned about the correctness and security of accounting data and financial fraud. With the wide application of cloud technology, data security is the primary consideration. At the same time, the foreign research content is rich, and the application of emerging digital technology is multi-directional and multi-dimensional thinking. Audit content also appears frequently. Audit standards, the quality and update of audit database are facing reform, and new forms of audit certificates are facing tests.

3.4 Analysis of domestic and foreign research trends

Keyword time zone view is a further analysis of keywords. It adds time factor to the knowledge graph, and focuses more on the visual analysis and research of the update and development of keywords from the time dimension. The keywords in each time period in the time zone view are all the new keywords in that time period. If they co-appear with previous keywords in the same article, they will be connected with a line. The previous keyword frequency is increased by 1, and the circle becomes larger. The time-zone view of domestic and foreign keywords in the field of intelligent finance and accounting obtained in this paper is shown in Figure 6 and Figure 7.

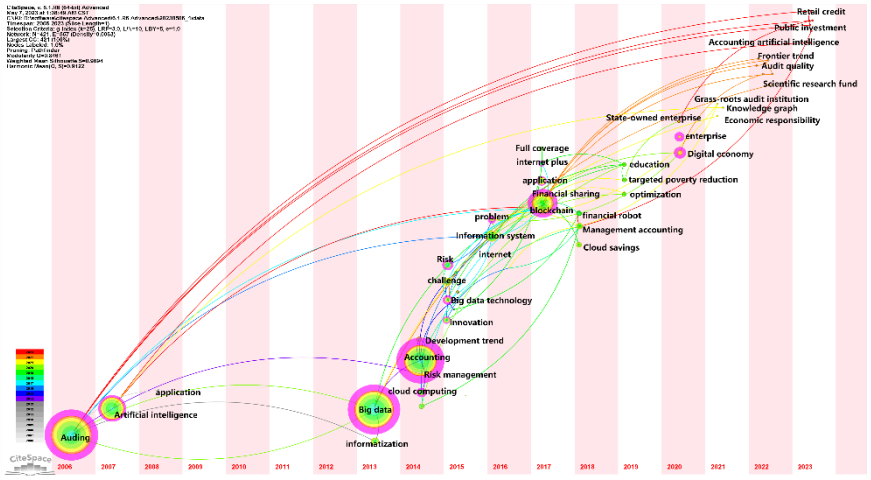

FIG.6: Time zone view of keywords in domestic intelligent accounting research.

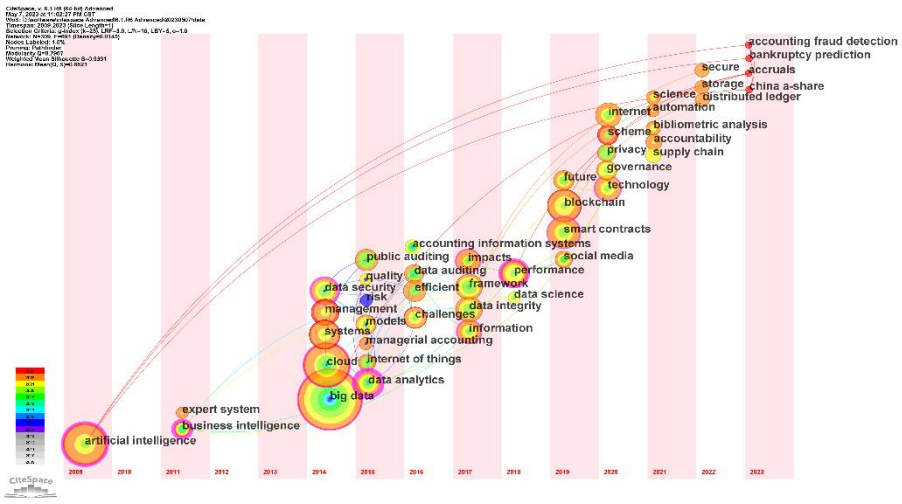

FIG.7: Time zone view of keywords in foreign intelligent accounting research.

The development of intelligent accounting research in China can be roughly divided into three stages: the first stage is the initial stage (2006-2012), the number of published papers and keywords in this period are less and highly concentrated It is not difficult to find that in the initial stage, artificial intelligence enters the field of vision and introduces the application and development of audit work. Emerging technologies bring the development of new systems, and the overall development is in the direction of informatization, networking and intelligence. The second stage is the development period (2013-2018), in which the number of published papers and keywords increased significantly. The connection density between keywords is large, and the keywords are closely related to the previous keywords. Most of the high-frequency keywords focus on emerging digital technologies, and different technologies are integrated and applied to each other. Digital currency, represented by blockchain, attracted widespread attention during this period. Due to its high price and large fluctuation, a large number of enterprises invested in digital currency, which led to a strong impact on the quality requirements of accounting information. The current accounting standards lack of accounting treatment methods for digital currency, which caused a lot of discussion. At the same time, the influence of digital technology is gradually expanding, and the use of new technology financial fraud, fraud and other situations occur from time to time. The demand for risk management of intelligent accounting is increasing day by day. The third stage is the maturity stage (since 2019). In this period, the digital economy exploded, and the integration of management accounting and financial accounting systems became the future trend of accounting development. Blockchain technology explored the introduction of security audit, trusted computing and other mechanisms to solve the problems of personal privacy leakage and trust crisis of both parties in the sharing economy system architecture. Intelligent accounting is expanding outwards and deepening downward.

The development of intelligent accounting research in foreign countries is similar to that in China, which can be roughly divided into three stages. In the first stage from 2009 to 2013, the emergence of high-frequency keywords such as "Artificial Intelligence", "Expert System" and "Business Intelligence" indicates that accounting is moving towards the direction of intelligence and informatization. During the second stage (2014-2019), a large number of high-frequency keywords appeared.By analyzing the content of keywords, we find that more digital technologies enable accounting, and the integration of digital technologies can reconstruct the traditional accounting model (O'Leary, 2017)[12]. The research direction in this period changed from the application level and functional level such as theoretical basis, technical characteristics and application scenarios to the organizational level and management level. The third stage is the maturity stage (2020 to present), during which the number of published papers is still increasing, and the new keywords are closely related to the previous keywords. In this stage, some foreign scholars explored the impact of blockchain application on corporate governance from the aspects of capital market, corporate governance, accounting and taxation, and found that blockchain could reduce organizational accounting costs, transaction costs and agency costs (Kimania et al,2020)[13]. At the same time, with the outbreak of digital economy, financial fraud and data privacy and other management problems have become the focus of foreign research.

By sorting out the evolution trend of the keywords of intelligent accounting research at home and abroad, it can be found that in the early stage of the research, the newly developed accounting information system is the common ground of intelligent accounting research at home and abroad. In this regard, the co-enabling of emerging digital technologies is a research hotspot

and the main vein of subsequent research, but there are also some differences. Domestic research mainly explores whether the accounting information system based on digital technology can solve the difficulties of financial sharing and integration of business and finance from the application level or the functional level. Domestic research mainly explores whether the accounting information system based on digital technology can solve the difficulties of financial sharing and integration of business and finance from the application level or functional level. In the later stage of research, domestic research has shifted from information system to functional level such as accounting and audit supervision, while foreign research has focused on the organizational level such as privacy issues and security issues and management level such as corporate governance while new technology brings labor revolution. It can be seen that in the application research of intelligent accounting, the technology application problems of digital technology enabling accounting, the management problems of enterprises after the empowerment of new technology, and the privacy problems and security problems at the organizational management level are still the hot topics and trends of future intelligent accounting research.

3.5 Research frontier analysis at home and abroad

Burst Detection is to study the distribution time of keyword occurrence frequency and detect keywords with high frequency change rate from many words. Based on CiteSpace software, this paper conducts keyword burst detection analysis on existing literature of intelligent accounting. the Top 20 keywords with the strongest citation bursts are selected to obtain the keyword burst detection diagram of intelligent accounting research at home and abroad, as shown in Figure 8 and Figure 9.

FIG.8: Keyword emergence diagram of domestic intelligent accounting research

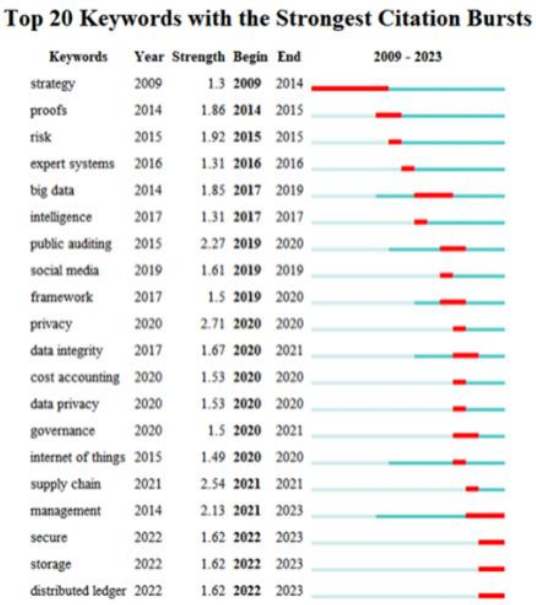

FIG.9: Keyword emergence diagram of foreign intelligent accounting research

Since 2006, the domestic emergent keywords have been changing constantly. The top five emergent keywords are "blockchain" (6.32), "big data" (3.58), "digital economy" (2.96), "financial robot" (2.91), and "cloud computing" (2). The key words of "big data" showed a sudden change and great intensity from 2014 to 2016, and then "cloud computing" and "cloud accounting" appeared one after another, which reflected the development iteration of new technology from the technical level to the application level. From 2021 to now, the two keywords of "blockchain" and "digital economy" have changed and become new research hotspots in the past two years. In the era of digital economy, on the basis of blockchain technology, digital currency has a strong impact on accounting standards, accounting methods, accounting systems and other accounting elements.

The top five keywords of bursting strength in foreign countries are "Privacy" (2.71), "Supply Chain" (2.54), "Public Auditing" (2.27), "Management" (2.13) and "Risk" (1.92). The mutation of "Risk" in 2015 indicates that at that time, the research had developed to accounting risk management enabled by digital technologies such as big data. In 2019, "Public Auditing" emerged, and the research and development shifted to the functional level such as accounting & audit supervision. After 2020, After 2020, the keywords of "Privacy" and "Management" appeared suddenly and with great intensity, which have become international research hotspots in the past two years. That is, under the application of new technologies, the complete establishment of organizational management system of enterprises, as well as the security and privacy issues existing at the level of organizational management system are the frontier hot spots of intelligent accounting research.

4 Conclusion

Based on CiteSpace software, this paper conducts quantitative and statistical analysis on relevant literature in the field of intelligent accounting in CNKI and WoS databases through bibliometric methods. Through keyword cluster analysis, the knowledge groups in the field of intelligent accounting research are counted, and the research themes and research hotspots in each knowledge group are refined. Through keyword emergence map and keyword time zone map, the dynamic evolution analysis of relevant literature in the field of intelligent accounting is carried out, so as to provide reference for further research on intelligent accounting. The findings of this paper are as follows:

Firstly, the research heat of intelligent accounting is increasing. At present, the research on intelligent accounting is developing rapidly. Since 2014, the number of papers published in the field of intelligent accounting has skyrocketed. With the empowerment of digital technologies such as big data, blockchain, artificial intelligence and digital economy, the research topics in the field of intelligent accounting tend to be diversified. Because the existing research on the application of digital technology integration in accounting is still at the level of framework construction, the research heat will continue to maintain in the future.

Second, there are differences between domestic and foreign development. Domestic scholars pay more attention to the impact of technological advantages on the functional level such as financial sharing and the integration of industry and finance, while foreign scholars focus more on the organizational level such as security, privacy and efficiency, and the management level such as corporate governance while the new technology brings revolution.

Third, the research topics are diversified, with obvious technology empowerment and demand-oriented. Through the keyword time zone map and keyword co-occurrence map, it is found that over time, the research topics continue to merge, and the clustering of keywords decreases, but the degree of diversification increases. The birth of each emerging digital technology will have an impact on the research in the field of intelligent accounting, and the overall research is moving towards the goal of "decentralization" of intelligent finance.

Relying on the technical network and architecture built by information technology such as big data, artificial intelligence, cloud computing, mobile Internet, Internet of Things, block chain and environmental experience, intelligent accounting emerges at the right moment, which promotes accounting into the intelligent era with the characteristics of real-time, intelligent and collaborative.

REFERENCES

[1] Liu Qin. The Development system of intelligent finance and its core link exploration [J]. Finance and Accounting,2020,No.610(10):11-14.

[2] Zhang Min. Enterprise Financial Intelligence: Elements · Paths · Stages [J]. Journal of Finance and Accounting Monthly,2020,No.885(17):7-11.

[3] Zhang Min. Ten Hot Issues of intelligent Finance [J]. Finance and Accounting Monthly,2021,No.894(02):25-30.

[4] Liu Q, Yang Y. Discussion on architecture, implementation path and application trend of intelligent finance [J]. Management Accounting Research,2018,1(01):84-90+96.
[5] Zhang Qinglong. Review of intelligent Finance Research [J]. Finance and Accounting Monthly,2021,No.895(03):9-16.
[6] Zhang Qinglong. Analysis of application scenarios of intelligent finance [J]. Finance and Accounting Monthly,2021,No.897(05):19-26.
[7] Frey,C. B. ,M. A. Osborned. 2017. The Future of Em-ployment: How Susceptible are Jobs to Computerisation? Tech-nological Forecasting and Social Change,114:254~280
[8] Godfrey-Billy,K.2018.Artificial Intelligence will Set Accountants Free. Accountancy: 1~2.
[9] Kirstin,G. 2017. How Artificial Intelligence will Change the Accounting Profession. Accountancy,1409: 1~2
[10] Allissa,K. 2018. How AI will Reshape the Accounting Profession. Buffalo Law Journal, 90(33): 1~13
[11] Natallia Pashkevich, Fabian von Schéele, Darek M. Haftor.2023.Accounting for cognitive time in activity-based costing: A technology for the management of digital economy. Technological Forecasting and Social Change,Volume 186, Part B
[12] O'Leary D.E..Configuring blockchain architectures for transaction information in blockchain consortiums: The case of accounting and supply chain systems [J]. Intelligent Systems in Accounting Finance & Management, 2017（4）: 138~147.
[13] Kimania D., Adamsb K., Attah-Boakyec R.. Blockchain, business and the fourth industrial revolution: Whence, whither, wherefore and how？ [J]. Technological Forecasting and Social Change, 2020（161）: 254~269.