Carbon Emission Reduction Pathway Research Based on Big Data Analysis: Literature Review and Methodological Evolution of Web of Science Platforms

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Abstract Global climate change is becoming more and more serious, and carbon emission reduction has become the focus of international attention. Based on Web of Science and China Knowledge Network database, this study adopts literature research method, comparative research method, bibliometric method and scientific knowledge mapping method to systematically analyze the literature related to carbon emission reduction pathway from 2009 to 2021. The study selected VOSviewer, CiteSpace and HistCite software to visualize and analyze the literature data, revealing the time distribution, institutional distribution, keyword co-occurrence and emergence characteristics of carbon emission reduction research. The results show that the number of Chinese carbon emission reduction research literature surged from 2009 to 2011, and reached a peak in 2021; the Department of Management and Economics of Tianjin University is the institution with the most publications, with a total of 15 publications; nine high-frequency publication authors published a total of 48 articles, which accounted for 7.97% of the total number of articles; the keyword clustering analysis formed nine different clusters, with a network density of 0.0124, a Q-value of 0.5274, S-value of 0.8613, and the clustering results are highly credible. The study shows that the research on carbon emission reduction in China mainly focuses on profile description, emission reduction methods and low carbon economy, but there is insufficient research on key contents such as emission reduction technologies, carbon neutralization methods and emission reduction strategies. Future research should pay more attention to carbon emission reduction technological innovation, carbon neutralization paths and effective strategies to promote low-carbon economic and social transformation.

Index Terms carbon emission reduction, bibliometrics, knowledge mapping, institutional distribution, low carbon economy

I. Introduction

Since the first industrial revolution, the process of global industrialization has been accelerated, but the price of rapid economic development is the huge consumption of natural resources and the continuous emission of pollutants, which leads to the ecosystem in a state of long-term imbalance, which seriously threatens the survival and development of human beings [1]-[3]. The most serious problem is the greenhouse effect caused by carbon dioxide emissions. In order to realize the dual-carbon goal and the comprehensive green transformation of economy and society, China urgently needs an effective and scientific carbon reduction path to promote the carbon reduction of the whole society. Nowadays, digital technology has already penetrated into all aspects of society, and its strong communication and low energy consumption characteristics also provide a new direction of green transformation for economic and social production [4], [5]. Therefore, the study of the optimization path of carbon emission reduction under the development process of digital technology is conducive to promoting the process of carbon reduction in China and providing digital solutions for the early realization of the vision of a beautiful China [6], [7].

As a "testing ground" in the field of big data, the establishment of the internationally renowned data platform Web of Science has successfully attracted the convergence of big data enterprises and high-end talents, promoted the in-depth excavation and efficient allocation of data resources, significantly improved the efficiency of resource utilization, and provided technological support for the low-carbon transformation [8]-[10]. In addition, big data analytics methods have also been applied more in the field of public governance. By empowering government departments to achieve scientific decision-making and fine ecological and environmental supervision, it helps optimize and upgrade the environmental governance system, promotes the widespread dissemination and acceptance of green lifestyles, and provides a solid institutional guarantee and social foundation for the transformation of the regional economy in the direction of low-carbon and sustainability [11]-[13]. It can be seen that

the establishment of the data platform Web of Science not only promotes the innovation and application of big data technology, but also profoundly reflects the advancement and representativeness of policy orientation [14]. These data platforms have led the development in technology research and development, application promotion, industrial integration and other dimensions, and become an important wind vane for the low-carbon development of the digital economy [15].

Climate change is increasingly becoming a major challenge facing the world, and carbon emissions are recognized as a major driver of climate warming. In the global climate governance system, carbon emission reduction has become the core strategy for countries to deal with climate change. Especially for large carbon emitting countries, how to formulate a scientific and effective carbon emission reduction path and balance the relationship between economic development and environmental protection has become an important issue of common concern for academics and policy makers. In recent years, the international community has reached a series of consensus on carbon emission reduction, including international conventions such as the Kyoto Protocol and the Paris Agreement, which provide a framework to guide the global joint response to climate change. Against this background, countries have formulated carbon emission reduction targets and action plans to promote energy structure adjustment, industrial transformation and upgrading, and low-carbon technological innovation. However, carbon emission reduction involves various fields such as energy, industry, transportation and construction, and requires systematic solutions. At the same time, different countries and regions have different resource endowments, development stages and technology levels, and the path of carbon emission reduction is also characterized by diversity. Currently, carbon emission reduction research has formed a rich accumulation of literature, covering policy measures, technological innovation, market mechanisms and international cooperation and other dimensions. However, these studies are often scattered in different disciplines and lack systematic integration and analysis. Especially in the context of the big data era, it is of great theoretical value and practical significance to utilize advanced methods, such as bibliometrics and scientific knowledge mapping, to comprehensively sort out the existing research on carbon emission reduction, and to reveal its development, evolution, and cutting-edge trends. This not only helps to grasp the overall pattern of carbon emission reduction research, but also provides direction guidance for subsequent research and scientific basis for policy formulation.

Based on this, this study intends to adopt bibliometrics and scientific knowledge mapping analysis methods to systematically analyze the carbon emission reduction related literature included in the Web of Science and China Knowledge Network databases. The study will first construct a comprehensive literature dataset, and then visualize and analyze it using professional software such as VOSviewer, CiteSpace and HistCite to examine the development of carbon emission reduction research in multiple dimensions such as temporal distribution, institutional distribution, and author distribution. In particular, through keyword co-occurrence analysis and emergence analysis, the knowledge map of carbon emission reduction research is drawn to reveal the evolution of research hotspots and cross-disciplinary characteristics. On this basis, the study will identify the frontier areas and development trends of carbon emission reduction research, provide reference for academics to deepen related research, provide theoretical support for governments to formulate carbon emission reduction policies, and provide directional guidance for enterprises to implement carbon emission reduction practices, so as to promote the synergistic development of carbon emission reduction theory and practice.

II. Research design

II. A. Research ideas

Research on the global literature in the field of contemporary art research knowledge mapping analysis, that is, literature data retrieval and statistical analysis, the use of visualization and econometrics research methods, through quantitative analysis to obtain objective research results, the use of citespace 7 software to carry out a scientific knowledge mapping analysis, the main body of the literature in the field of contemporary carbon emissions reduction research, the number of countries, the distribution of institutions, sources of journal We use citespace 7 software to conduct scientific knowledge mapping analysis to study the main body of contemporary literature in the field of carbon emission reduction research, quantity, national distribution, institutions, source journals, research directions, disciplinary types, keywords and other aspects of the "volume" of the research, to discover the scope of research in the field of contemporary art, trends, hotspots, and the direction of the evolution of the development of cutting-edge direction and route.

II. B. Research methodology

II. B. 1)   Literature research method

Literature research method refers to collecting, reading, organizing and analyzing the existing literature, and then filtering the information that is useful for the research in order to achieve the research purpose. This study mainly collects literature through the methods of keyword finding and citation finding. The sources of literature are journal

papers and e-books downloaded from China Knowledge, Google Scholar, EBSCO, PROQUEST, ERIC and other databases.

II. B. 2) Comparative research method

Comparative research method is a research method that compares two or more units of analysis to determine their differences and similarities. International research on carbon emission reduction pathways first began in 2009, and has accumulated a wealth of teaching practice. By comparing and sorting out the relevant literature and research at home and abroad, we can learn from and reflect on the comparison, and then provide assistance for the construction of carbon emission reduction pathways.

II. B. 3) Bibliometric methodology

The bibliometric approach is a quantitative study of physical publication units, bibliographic units, or alternatives to both The object of the study is the quantitative aspects of the three types of formal scientific or information exchange literature, namely books, journals and electronic publications. This study focuses on the quantitative and visual analysis of literature related to carbon reduction pathways based on bibliometric theories and methods, with the help of statistical analysis software such as HistCite, VOSviewer, and CiteSpace.

II. B. 4) Scientific knowledge mapping approach

Scientific knowledge mapping method is a research method that takes scientific knowledge as a research object, and visualizes the development process and structural relationship of scientific knowledge intuitively through the procedures of data mining, information processing, knowledge measurement and graphic drawing, in order to image the core structure, development history, frontier areas and other conditions of a discipline or research field.

II. C. Data sources and literature search

In the study of foreign literature, based on the accessibility and quality of data, the Web of Science (WoS) core collection database [16] was used as the data source for the study. Based on the topic of online and offline blended courses in foreign higher education, the target literature was identified by subject search, with "carbon emission reduction pathway" as the search keyword, and the research period was limited to 2009-2021 according to the time node of the establishment of the carbon emission reduction pathway, and the deadline for data collection was May 01, 2021, and the deadline for data collection was May 01, 2021. The deadline for data collection was May 01, 2021. Accordingly, after limiting the types of literature to published papers, conference papers and review papers, this paper obtained 58 search results in the Web of Science Core Collection.

In the domestic literature search, the most commonly used ZhiNET database was selected, and based on the research theme, the theme search terms used were "carbon emission reduction" and "path analysis", "economic development", "green environmental protection" for search, in academic journals selected SCI source journals, EI source journals, Peking University core, CSSCI, CSCD source journals, in conference papers selected Chinese literature, a total of 1,105 search records, of which 37 records of conference papers.

II. D. Selection of research tools

The research tools used in the study are mainly VOSviewer, CiteSpace and HistCite software, the following is the basic introduction of the software and the reasons for its selection.

VOSviewer visualization software, which is developed by the Center for Scientific and Technological Research (CWTS) of the University of Leiden in the Netherlands, is mainly used to construct and visualize bibliometric networks, which can be used to build a network of journals, researchers, individual publications and other objects, and to provide econometric analysis based on citations, bibliographic couplings, co-citations, and collaborative relationships, and in addition to be used for the keyword co-occurrence network and text mining. It can be used to analyze the keyword co-occurrence network for text mining. It has a simple interface, strong graphical presentation ability, can handle maps containing thousands of items, and compared with CiteSpace, it has more reliable results in analyzing and processing WoS data.

CiteSpace [17], as a widely used bibliometric tool, can present knowledge intuitively with the help of visual maps, change the way people look at the world, and then realize the interpretation and foresight function of the research field. Its operation is mainly based on the Java environment, which has been running for 19 years since it was launched in 2003. After continuous improvement, it can analyze several major databases widely used in China and abroad, especially the adaptation of CNKI database makes it popular among scholars in China.

HistCite software is a boundary tool that mainly analyzes WoS data, which is able to provide detailed descriptive statistics of WoS data, analyze basic bibliometric indicators, and also build a citation network over time based on citation relationships of local literature.

III. Findings and analysis

III. A. Research Distribution of Carbon Emission Reduction Pathways Based on Big Data Analysis

III. A. 1) Time distribution

China's research on "carbon emission reduction" began in 2002 with He Juhuang et al.'s "CGE Model of Carbon Tax and Carbon Dioxide Emission Reduction", which established a CGE model of China's environmental problems and analyzed the impacts of the carbon tax on various aspects of the national economy with a static model. Since 2003, when the country proposed the "low carbon economy", carbon emission reduction has entered the national vision, and since then China has gradually introduced the Energy Conservation Law, the Law on the Promotion of Circular Economy, and other laws and regulations related to energy conservation, emission reduction and response to climate change. The State Council executive meeting held in 2009 announced China's carbon emission reduction target, i.e., by 2024, China's carbon dioxide emissions per unit of GDP will be 41-47% lower than in 2005. This shows that the government has set a hard target for carbon emission reduction and that China is paying increasing attention to the issue of carbon emission reduction. The annual publication of carbon emission reduction papers from 2009 to 2021 is shown in Figure 1. As can be seen from the figure, the number of research papers related to carbon emission reduction in China surged from 2009 to 2011, and will reach a peak in 2021. In 2015 China participated in the signing of the Paris Agreement, which aims to limit the global average temperature to two degrees Celsius, thus avoiding more catastrophic consequences of climate change. China is currently the largest carbon emitter in the world. It faces major challenges in energy conservation and emission reduction. With the deepening of extreme weather and greenhouse effect hazards, coupled with the high barriers and thresholds of high-end low-carbon technologies, how to formulate good carbon emission reduction regulations and programs from a variety of aspects, including technology, regulations and management, has gradually become a hot spot for academic research.
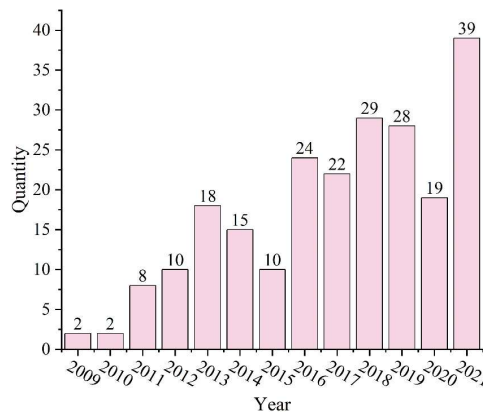
Figure 1: The annual release of carbon reduction papers

III. A. 2) Institutional distribution

The main research organizations in the field of carbon emissions are shown in Figure 2, and the individual research organizations are replaced by codes as shown in Table 1.

Table 1: Research institutions and code

Research organization	Code
Tianjin university management and economics department	S1
Economics institute of China university of economics and law	S2
School of economics and finance, xi 'an jiaotong university	S3
Beijing chemical industry university management school	S4
Central south university business school	S5
Jinan university school of economics	S6
Institute of science and technology of China university	S7
Beijing industrial university economic and business administration	S8
University of chongqing university of economics and business administration	S9
Economics institute of northeast university of finance and economics	S10

Figure 2 shows the number of papers published by research institutions in the field of carbon emissions. As can be seen from the figure, among the top 10 research institutions related to "carbon emission reduction" in terms of the number of published papers, the institution with the largest number of papers is the Faculty of Management and Economics of Tianjin University, which has published a total of 15 papers on "carbon emission reduction", followed by the School of Economics of Zhongnan University of Economics and Law and the School of Economics and Finance of Xi'an Jiaotong University. Among the 10 institutions, except for the Institute of Science and Technology Policy and Management of the Chinese Academy of Sciences, the others are domestic institutions of higher learning, which shows that the Institute of Science and Technology Policy and Management of the Chinese Academy of Sciences is an important institution for the study of "carbon emission reduction".
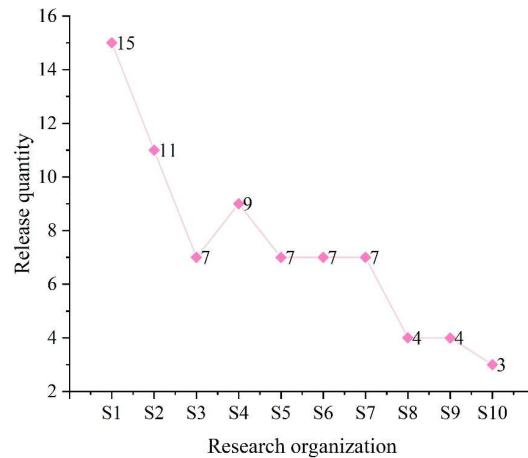

Figure 2: Major research institutions in the field of carbon emissions

III. A. 3)   Distribution of highly cited authors

Generally speaking, the academic influence of scholars in a certain field can be referenced by the number of their publications. As shown in Table 2, the nine authors of high-frequency publications have 48 articles, accounting for 7.97% of the total number of articles (602), among which Zhang Yi and Zhang Junbiao have published nine papers respectively. Zhang Junbiao's 9 papers have been cited 243 times, which is the top of the citation frequency list, followed by Zhang Junbiao, who is ranked 2nd in terms of the number of publications, with 9 papers cited 22 times, and then followed by Xu Yingzhi (24 times), Sun Rui (1 time), and Pan An (78 times). Zhang Junbiao measured the carbon emissions from agricultural land based on the main carbon sources of agricultural land utilization, and found that efficiency and structural factors have an inhibiting effect on carbon emissions, but the effect is not significant enough. The study further found that the scale factor has a strong driving effect on carbon emissions from agricultural land, and accordingly put forward a policy proposal for carbon emission reduction. Xu Yingzhi analyzes the indirect effect of internal emissions and its partial transfer mechanism by constructing an input-output model, and analyzes it empirically to conclude the different characteristics of carbon emission reduction responsibilities of each industrial sector and make policy recommendations for carbon emission reduction.

Table 2: The study of carbon emission reduction is a high yield author

Serial number	Author	Output / article	Start time	Induced frequency / secondary
1	Zhang Yi	9	2011	243
2	Zhang Jun biao	9	2011	22
3	Xu Ying zhi	8	2011	24
4	Sun Rui	5	2011	1
5	Pam An	5	2015	78
6	Zhao Li xiang	5	2014	8
7	Zhang Tong bin	4	2017	29
8	Ding Hao	2	2010	4
9	Liu Xue zhi	1	2017	37

III. B. Keyword clustering and co-occurrence analysis

III. B. 1) Keyword co-occurrence analysis

In bibliometrics, the importance of keywords is self-evident, they are the embodiment of the key issues of the research literature and the cornerstone of analyzing academic hotspots. Through keyword co-occurrence network analysis, researchers can extract high-frequency keywords from the literature and form network diagrams by connecting them, thus visualizing the hot trends in the research field.

In this study, 1,604 Chinese literatures were analyzed in citespace software as samples. The time slice was set to 1 year, the node type was selected as keywords, and the pruning strategy used pathfinder as well as merged network pruning. Keeping other parameters as default, the keyword co-occurrence map of Chinese carbon emission reduction research was generated using citespace software as shown in Figure 3 and the keyword index information table as shown in Table 3.

In these analyses, "carbon emission reduction" appears as the most important node, with a frequency of 404 times, and the intermediary centrality is 0.53, followed by the two keywords of "carbon emissions" and "energy conservation and emission reduction", and their intermediary centrality is greater than 0.1, indicating that the research topics of carbon emission reduction in China are relatively focused, mainly focusing on the overview description of carbon emission reduction, carbon emission reduction methods, and low-carbon economy. The index information of the keywords with the top 15 research frequencies is shown in Table 3, and the mediational centrality of most of the high-frequency keywords is greater than 0.1, indicating that their importance is more prominent. However, there is a lack of discussion on important contents such as emission reduction technologies, carbon neutralization methods and carbon reduction strategies in the field of carbon emission reduction. The academic development trend and evolution of "carbon emission reduction" should ultimately serve the carbon emission reduction technology and strategy, therefore, the future research direction of carbon emission reduction can focus on the latest development of carbon emission reduction and carbon neutralization technology and carbon emission reduction strategy.
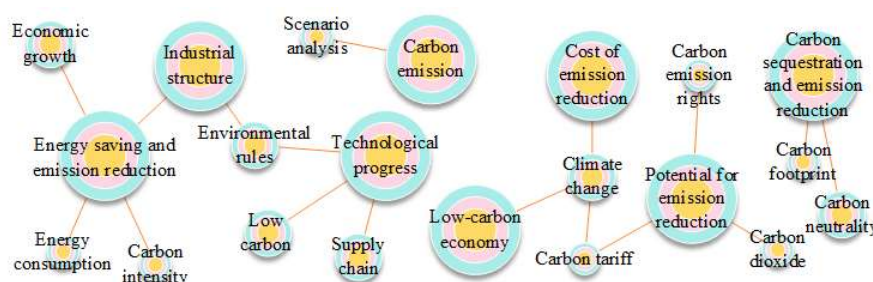

Figure 3: keywords Co-occurrence network

Table 3: High yield institution information

Frequency	Intermediate center	Year
50	0.01	2012
45	0.08	2012
34	0.05	2009
27	0.05	2012
26	0.07	2008
26	0.05	2004
25	0.05	2009
22	0.00	2012
21	0.00	2013
21	0.00	2011
17	0.00	2011
15	0.00	2014
15	0.07	2012
15	0.05	2018
15	0.01	2012
15	0.01	2015
15	0.03	2013

III. B. 2) Keyword clustering analysis

Clustering is a theme formed on the basis of keyword co-occurrence inductive summary, more intuitive representation of the main research areas, keyword clustering analysis using clustering algorithm log-likelihood method (LLR) data analysis to extract labels, drawing a keyword clustering mapping as shown in Figure 4. In general, Q>0.3 indicates that the clustering division has obvious structural characteristics, S>0.5 indicates that the clustering classification is more reasonable, and S>0.7 indicates that the results of the clustering analysis are persuasive. The node size is proportional to the number of citations, and the thickness of the connecting line indicates the degree of closeness between individual keywords.

This computing literature data analysis, as can be seen from the figure, the figure includes 174 nodes, 390 connecting lines, the network density is 0.0124, Q=0.5274>0.3 significant features, S=0.8613>0.7, close to 1, so, it can be concluded that the results of this clustering analysis is convincing. The analysis of this calculation results in 9 different clusters, which are carbon emissions, carbon reduction, green finance, carbon neutral, tourism, emission reduction potential, low carbon transition, government subsidies, and carbon trading. It can be seen that the scope areas involved are wide, covering carbon emission research and carbon emission reduction popular areas. From the sigma value index, "carbon emissions", "carbon emission reduction", "carbon neutral", "green finance" and so on. The keyword innovation theme shows that economic, financial and environmental changes are relatively new themes, and the relationship between the environment and economic development is also closely related to promote economic and social transition to low-carbon development, which will help to realize the "dual-carbon" goal at an early date.
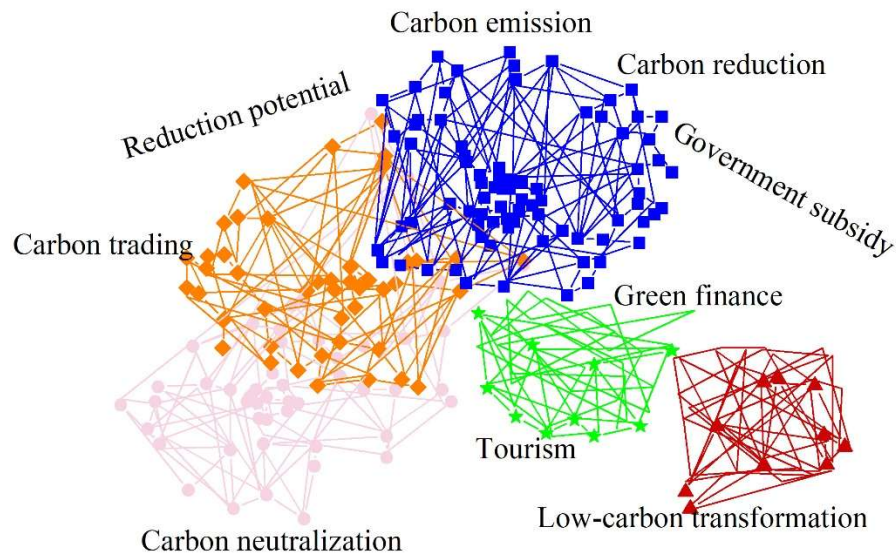

Figure 4: Keyword cluster map

III. C. Keyword emergence analysis

Under the control panel menu of the citspace visualization interface, click refresh in the burstness item while keeping all the default parameters unchanged. Subsequently, click VIEW to analyze the keyword emergence. The emergence of keywords in the field of domestic carbon emission reduction research is shown in Fig. 5, which includes the year, intensity, first appearance year, and end year, and the red horizontal bar indicates the duration of the emergence of keywords. It can be found that a total of 15 keywords have occurred the emergence phenomenon. The emergence of these keywords is divided into two phases with 2014 as the boundary. Before 2014, the long-term emergence of carbon dioxide and greenhouse gases indicates that the early focus of carbon emission reduction research was directed at the direct impact of carbon emissions on the environment, and the emergence of these keywords reflects the foundational work of emission reduction research, which mainly focuses on the identification of emissions and environmental impact assessment. Over time, the emergence of keywords such as

climate change, low carbon economy, energy efficiency and low carbon demonstrates the initial response to emissions reduction, attempting to promote carbon emissions reduction from the economic model and policy level, and the addition of carbon tariffs reflects the need for collaboration on emissions reduction at the international level, which has gradually shifted from ideological advocacy to practical policy tools.
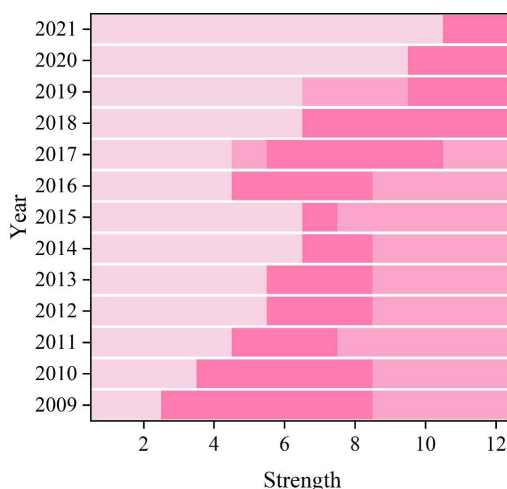

Figure 5: Keywords with the strongest citation bursts

IV. Conclusion

By systematically analyzing the literature related to carbon emission reduction in the Web of Science and China Knowledge Network databases, the article reveals the development lineage and structural characteristics of the carbon emission reduction research field. The data show that China's carbon emission reduction research has shown rapid growth after 2009 and will reach its peak in 2021, reflecting the increasing attention of the state to carbon emission reduction. In terms of institutional distribution, the Department of Management and Economics of Tianjin University, the School of Economics of Zhongnan University of Economics and Law, and the School of Economics and Finance of Xi'an Jiaotong University are the main research forces in the field, with Tianjin University taking the first place with 15 published documents. The keyword clustering analysis formed nine different clusters, including carbon emission, carbon reduction, green finance, and carbon neutrality, with a Q-value of 0.5274 and an S-value as high as 0.8613, indicating that the clustering results are highly credible and persuasive. The keyword emergence analysis shows that carbon emission reduction research has experienced an evolutionary process from focusing on direct environmental impacts to exploring economic policy tools, and the focus of research has gradually shifted from the ideological level to practical application. Currently, China's carbon emission reduction research mainly focuses on overview description, emission reduction methods and low carbon economy, but the research on the core content of emission reduction technology, carbon neutralization methods and carbon emission reduction strategies needs to be deepened. Future research should strengthen the exploration of carbon emission reduction technology innovation, deepen the study of carbon neutral realization path, promote the economic and social transformation to low carbon development, and provide academic support for the early realization of the "double carbon" goal.

Funding

References

[1]   Sarkodie, S. A., Owusu, P. A., & Leirvik, T. (2020). Global effect of urban sprawl, industrialization, trade and economic development on carbon dioxide emissions. Environmental Research Letters, 15(3), 034049.

[2]   Wen, X., Wang, S., Li, S., Cheng, L., Li, K., Zheng, Q., & Zhang, B. (2024). Impact factors of industrial pollution and carbon reduction under the "dual carbon" target: A case study of urban aggregation in the Pearl River Delta and Yangtze River Delta. Sustainability, 16(5), 1879.

[3]   Wang, Y., Zhang, X., Zhu, L., Wang, X., Zhou, L., & Yu, X. (2024). Synergetic effect evaluation of pollution and carbon emissions in an industrial park: An environmental impact perspective. Journal of cleaner production, 467, 142891.

[4]   Giest, S. (2017). Big data analytics for mitigating carbon emissions in smart cities: opportunities and challenges. European Planning Studies, 25(6), 941-957.

[5]   Su, Y., Yu, Y., & Zhang, N. (2020). Carbon emissions and environmental management based on Big Data and Streaming Data: A bibliometric analysis. Science of The Total Environment, 733, 138984.

[6]   Li, Z., & Wang, J. (2022). The dynamic impact of digital economy on carbon emission reduction: evidence city-level empirical data in China. Journal of Cleaner Production, 351, 131570.

[7]   Yi, M., Liu, Y., Sheng, M. S., & Wen, L. (2022). Effects of digital economy on carbon emission reduction: New evidence from China. Energy Policy, 171, 113271.

[8]   Wang, Z., Wei, Y., & Wang, S. (2022). Exploring the research situation of carbon finance: A scientometric analysis on Web of Science database. Journal of Climate Finance, 1, 100003.

[9]   Cabeza, L. F., Chàfer, M., & Mata, É. (2020). Comparative analysis of web of science and scopus on the energy efficiency and climate impact of buildings. Energies, 13(2), 409.

[10]   Xue, J., & Liu, Y. (2022). A bibliometric analysis of carbon finance based on web of science (WoS). American Journal of Industrial and Business Management, 12(12), 1831-1841.

[11]   Louhghalam, A., Akbarian, M., & Ulm, F. J. (2017). Carbon management of infrastructure performance: Integrated big data analytics and pavement-vehicle-interactions. Journal of Cleaner Production, 142, 956-964.

[12]   Singh, S. K., & El-Kassar, A. N. (2019). Role of big data analytics in developing sustainable capabilities. Journal of cleaner production, 213, 1264-1273.

[13]   Liu, X., & Ma, L. (2023). Sustainable development of business economy based on big data algorithm under the background of low-carbon economy. Sustainability, 15(7), 5840.

[14]   Sarkodie, S. A., & Strezov, V. (2019). A review on environmental Kuznets curve hypothesis using bibliometric and meta-analysis. Science of the total environment, 649, 128-145.

[15]   Udara Willhelm Abeydeera, L. H., Wadu Mesthrige, J., & Samarasinghalage, T. I. (2019). Global research on carbon emissions: A scientometric review. Sustainability, 11(14), 3972.

[16]   Jialong Liu,Chaojun Li,Wanping Mei & Hanzhi Qin. (2024). The research progress and research trends in acute coronary syndrome nursing: A review of visual analysis based on the Web of Science database. . Medicine,103(7),e35849-e35849.

[17]   Zhang Xiaoxue,Fang Gege,Gaoshuo Zhang & Cui MengXin. (2025). The "Knowledge Landscape" of Subculture Studies: A Review Based on CiteSpace Analysis (1998-2023). Journal of Global Information Management (JGIM),33(1),1-30.