How organizations can use carbon emissions data to achieve carbon neutrality

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Abstract — To help China achieve the "dual carbon" goal at an early date and mitigate global climate change brought about by the greenhouse effect, people are increasingly interested in topics such as carbon neutrality, sustainability, and energy, which has led to apparent changes in many cross-disciplinary disciplines. While upgrading the organization industry, people often neglect to implement measures from the energy side. The study is based on 492 articles retrieved from the Web of Science (WoS) database between 1900 and 2023, and conducted comprehensive data and visual analysis of keywords such as "carbon neutrality", "carbon emissions", and "carbon footprint". Bibliometrics show that publications have proliferated since 2008 and also involve multiple disciplines, such as management, sustainable development studies, public health, energy, and other related major fields. At the same time, research institutions in China, the United Kingdom, and Singapore have excelled in such disciplines. The authors use big data analysis technology and visualization software to comprehensively analyze the research results in the form of charts from the aspects of literature publication and citation trends, top research institutions, and keyword clustering, which provides research ideas for research organizations to use carbon emission data to achieve carbon neutrality.

1. Introduction

In 2021, the State Council of China issued the "Notice on Strengthening the Reporting Management of Greenhouse Gas Emissions of Chinese Enterprises", which clarified key carbon emissions enterprises such as power generation, petrochemical, chemical, building materials, steel, non-ferrous metals, and papermaking, and required these industries to implement the national " more powerful carbon emission reduction measures must be taken in the requirements of the "double carbon" target. In recent years, numerous scholars have conducted research on this topic. To reduce carbon leakage in the paper industry and achieve carbon neutrality more effectively, countries must take action, such as upgrading manufacturing technologies and processes[1]. The upgrading of industrial structure will have a significant negative regulating effect on the impact path [2]. Methane emission reduction in coal mines in the carbon peak and carbon neutrality stages is a key link in coordinated development, and the development path of AGE under the background of dual carbon is constructed[3]. To achieve the goal of "dual carbon", China needs to speed up the process flow, improve production equipment, reduce the use of coal, oil, and other energy sources [4], adopt sustainable intelligent manufacturing, and provide a new strategy for energy management through the application of advanced information technology[5]. However, China's coal power industry is under great pressure under the "dual carbon background" and urgently needs to change direction, and the existing national-level carbon accounting is insufficient to support the development of site-specific carbon emission reduction policies and measures[6]. Although reducing carbon emissions has become an inevitable trend, more and more companies are beginning to pay attention to the cost of carbon emissions, but the high cost of carbon emissions is unaffordable for some enterprises[7]. Organizations must value the potential of carbon sinks[8], and if they want to use carbon data to achieve carbon neutrality, they also need to do so through the use of renewable energy[9]. Based on the views of the above scholars, we know that the paper industry is closely related to the coal power industry. China is still a coal-dominated high-carbon energy mix, resulting in the paper industry's carbon emissions being second only to energy-intensive industries. Therefore, it is a powerful measure to reduce the carbon emissions of the paper industry through the efficient and clean use of coal from the root cause. At present, the paper industry and coal power industry are still important pillars of China's economy and are closely related to the lives of ordinary people. This paper collates 492 articles from the WoS database to explore how organizations can use carbon emission data to achieve carbon neutrality and contribute to China's early completion of the "dual carbon" goal by drawing key phrases and co-citing keywords.
2. Data and Methods

To obtain literature related to carbon emissions and carbon neutrality, the scientometric analysis of this paper uses the Scientific Network (WoS) tool to conduct an "advanced search" query, with the object to be studied as the core keyword (including its similar meaning phrase), and search within the main area of work of the research object. Finally, the keywords and research areas are set as follows:

\[ TS=\text{("carbon emission") AND TS = ("carbon neutrality" OR "carbon neutral" OR "carbon-neutral" OR "carbon positive" OR "carbon-positive" OR "carbon negative" OR "carbon-negative" OR "carbon accounting" OR "net-zero" OR "decarbonization") AND TS=\text{("organize" OR "business" OR "industry")} \]

Up to January 2023, a total of 492 articles (including SCI-EXPANDED, SSCI, A&HCI, ESCI). For exploratory analysis, the mapping was developed using VOSviewer and Bibliometrix.

3. Research Results

This section will comprehensively analyze the research results in the form of charts and graphs from the aspects of literature publication and citation trends, top research institutions, keyword clustering, etc.

3.1. Annual Trends

The data shows that the number of publications on this topic began to appear in 2008, showed a sharp upward trend after 2019, and peaked in 2022. At the same time, from 2014 to 2020, the citation trend of this topic has increased year by year, and the growth trend of citations is consistent with the growing trend of publications, revealing the growing interest in the topic.

3.2. Main Publication Sources and Organizations

Figure 1 visualizes the coupled network of authors' countries, authors, and publications. The left side of Figure 1 shows that the authors are mainly from countries such as Asia and Europe, and the countries that have contributed the most research in this area are mainly China, the United Kingdom, and Singapore. The right side of Figure 1 and Figure 2 show major publishing journals such as the JOURNAL OF CLEANER PRODUCTION, SUSTAINABILITY, ENERGIES, etc, indicating the interdisciplinary nature of the research, covering management, sustainable development studies, public health, energy, and other related major disciplines. At the same time, the number of papers in these journals that meet the relevant topics is at a high level overall, fluctuating in the range of 10-40 articles.

3.3. Analysis of Authors' Keywords

To build a keyword network, this paper uses VOSviewer software to construct the author's keyword co-occurrence network diagram. The author has 1670 keywords. After the screening, 33 more important keywords were selected and analyzed, and the so-called "more important" keywords appeared at least 6 times. According to the symbiotic relationship, the 33 keywords studied in this paper are divided into 6 clusters, and each cluster corresponds to a different color.

According to Figure 3, the red cluster is the group with the most keywords in the figure, including "carbon neutrality", "carbon emission", "carbon footprint", "carbon reduction", "carbon emission reduction", "carbon peak", and "embodied carbon". Through observation, it is found that the keyword "carbon neutrality" is most closely related to other clusters. Although the green cluster has a smaller node area than the red cluster, it also has seven keywords, namely "renewable energy", "carbon
Among them, the most important node is "renewable energy". At present, the energy we use is still traditional high-carbon energy mainly coal, and to meet environmental requirements, we need to increase the exploration of renewable energy. As the only node representing the country in the figure, the largest node in the yellow cluster, "China" is closely linked to carbon emission data due to policies such as the "dual carbon" goal proposed by the government.

Figure 4 is a strategic coordinate diagram, with density representing the vertical axis and centrality representing the horizontal axis. Centrality is the degree of association between different topics; Cohesion between density measurement nodes. In Figure 4, "dynamism" is the most central, the most relevant, and it is important to the field, but it is not well developed; "CO2 emissions", which is the densest and most cohesive, is important to the field and is well developed. We need to increase the efficient use of vitality to help achieve the "dual carbon" goal.

Fig.3 Co-citation graph of author’s keywords

Fig.4 Thematic Map

4. Conclusion

With the development of the social economy, climate change has become more and more important, and the topic of how organizations can use carbon emission data to achieve carbon neutrality has received unprecedented attention in the field of this. This study analyzes the theme of carbon neutrality, and the results of the scientific econometric analysis show that:

(1) Since 2019, the number of publications and citations related to carbon neutrality has grown rapidly, with China, the UK, and Singapore playing an important role.

(2) Countries such as China, the United Kingdom, and Singapore are likely to continue to constitute key organizational cooperation systems in this field in terms of their current breadth and progress.

(3) The coupling analysis of the main publications reflects the interdisciplinary nature of the research topic, and the research models of "cleaner production", "sustainability" and "energy" will become new research directions and hot areas. The citation rate of a paper is positively correlated with the coupling degree of the literature. These classic journals and studies, such as the JOURNAL OF CLEANER PRODUCTION, SUSTAINABILITY, ENERGIES, etc., have been widely recognized, widely used, and have had a great impact.

(1) From the perspective of keyword cluster analysis, the largest nodes in the figure, "carbon neutrality", "carbon emissions" and "carbon footprint" are closely related to organization and energy.

At present, the main factor affecting greenhouse gas emissions is energy use[10], and key carbon emitters such as the paper industry still rely on coal power. Traditional industries need to accelerate product upgrading, and at the same time must adopt more powerful carbon emission reduction measures, strengthen the efficient and clean use of coal, and increase the use of renewable energy. These findings will help China achieve the "dual carbon" goal as soon as possible and provide guidance and assistance to researchers in related fields.
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References


