



Exploring the Impact of Internet Development on Carbon Emissions: A Scientometric Analysis

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Abstract. Based on the net zero carbon emission goal of the Paris Agreement, climate warming has become a global issue that the international community attaches great importance. As an engine to promote the rapid development of various fields, the Internet will undoubtedly have a particular impact on carbon emissions. In recent years, how the Internet contributes to the goal of net zero carbon emissions has become a hot topic among people. In order to provide the research frontier of the impact of the development of Internet technology on carbon emissions, this paper searches with keywords such as “carbon emissions”, “Internet technology” and “Internet”, and sorts out 423 articles retrieved from Web of Science (WoS) database. The visualization of data with scientific measurement methods aims to make the industry understand the development status of the current field and provide specific references for optimizing the research field.

Keywords: Internet technology · The Internet · Carbon emissions

1 Introduction

The rapid development of Internet technology affects all aspects of society, and the convergence of high-tech Internet technology has brought great convenience to the development of society [1]. As one of the indicators to measure a country's sustainable development, carbon emissions have attracted the attention of all countries [2]. China is very concerned about the impact of Internet development on carbon emissions, and studies indicate that the efficiency of energy conservation and emission reduction has been significantly improved due to the development of the Internet [3]. Based on China's development of the Internet mainly improves energy and carbon emission performance by promoting industrial structure upgrading and technology diffusion, and proposes effective methods that are conducive to decision-makers making decisions on energy conservation and emission reduction [4]. European countries believe green ICT infra-structure and high-tech cleaner production technologies can reduce carbon emissions [5]. Research shows that their impact on economic growth is mixed, i.e. positive in the short term and opposite in the long term [6]. Large-scale data collection, and global channels to explore the relationship between ICT development and carbon emissions, can lead to a positive impact on carbon emissions in BRICS countries [7]. In terms of e-commerce online sales, it is found that the development of the Internet has led to the

development of e-commerce, thereby reducing the waste of physical items and reducing carbon emissions [8]. The development of the Internet has also created a digital economy, which can directly affect the intensity of carbon emissions, promote scientific and technological innovation and optimize the industrial structure, indirectly affect carbon emissions, and is an important driving force for achieving carbon neutrality [9].

To sum up, the above-mentioned relevant literature still does not mention specific links and system analysis. Based on this, this paper definite visual relationship between the multiple links between Internet technology and carbon emissions, aiming to provide certain enlightenment for future development and researchers.

2 Data and Methods

The data of this study are from the WoS database. By using TS = (“ e-commerce “or” Internet technology “or” Internet “) AND TS = (“ carbon emission “) as keywords, a total of 423 bibliometrics records have been retrieved by early February 2023. Based on this data, a scientometric analysis was performed using two visualization software, VOSviewer, and Bibliometrics.

3 Findings

3.1 Core Source Analysis

The distribution ratio of research sources reflects the importance of each region to some extent. As shown in Fig. 1, use Bradford’s law to display in the form of a visual graph. The chart includes well-known research institutions, and provides information on the number of publications on “carbon emissions” and “Internet technology”, and compares them horizontally. IEEE ACCESS and SUSTAINABILITY occupy a large share in this field, and the research level of this topic is in a leading position, while the research situation of the 2018 2ND IEEE CONFERENCE and APPLIED ENERGY is in a relatively weak position. With the in-depth exploration of scholars in this field and the wave of realizing efficient utilization of resources by grasping the concept of sustainability, the research output in this field will surely increase continuously.

3.2 Three-Field Plot

Figure 2 shows a general overview of 423 articles on the country (left column), author (middle), and keywords (right column). As is shown in the chart, China, the United States, and Australia rank high in academic contribution. Among them, zhang j from China has contributed the most to the research on energy consumption, carbon emission, and the Internet of Things, with 41 papers. wu h, also from China, has made the largest contribution to energy efficiency research, with 41 papers. In addition, other scholars have looked at the interconnections between the Internet of Things, carbon emissions, sustainability, and blockchain. Countries include not only developing countries but also developed countries. The findings shed light on global knowledge networks and show how seriously Internet technology is being taken by both developed and developing countries.

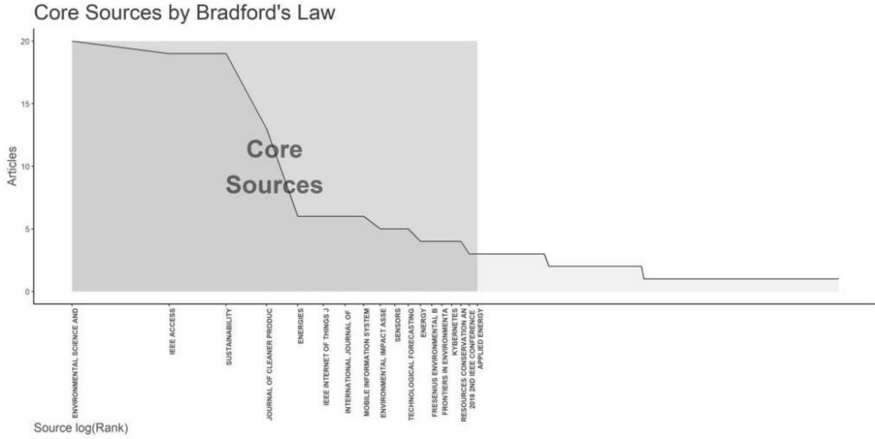


Fig. 1. Core Publication Source Analysis

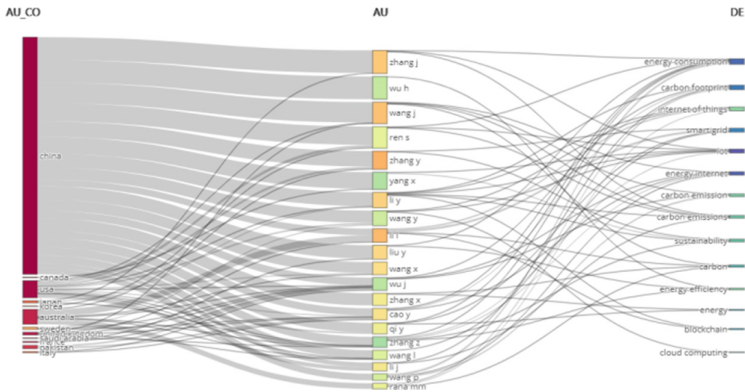


Fig. 2. Three Field Plot

3.3 Analysis of Thematic Map

We use Thematic Map to analyze the Themes of 423 papers. As shown in Fig. 3 from the Motor Themes area, Research topics such as energy carbon emissions economic growth and behavior information-systems consumers have been attached to great importance by the academic circle, and there are many related types of research with good development. It is of guiding academic significance to the fields related to carbon emission and provides a valuable reference for other scholars' research in the future. According to the Niche Themes, model intention, planned behavior areas, and vehicle-routing problems are well-developed, but not important for the current field. As can be seen from the Basic Themes, the fields of strategy construction diffusion and internet management model are very important and have far-reaching academic significance, but there are few related types of research. This field will become a key future research direction for Internet scholars.

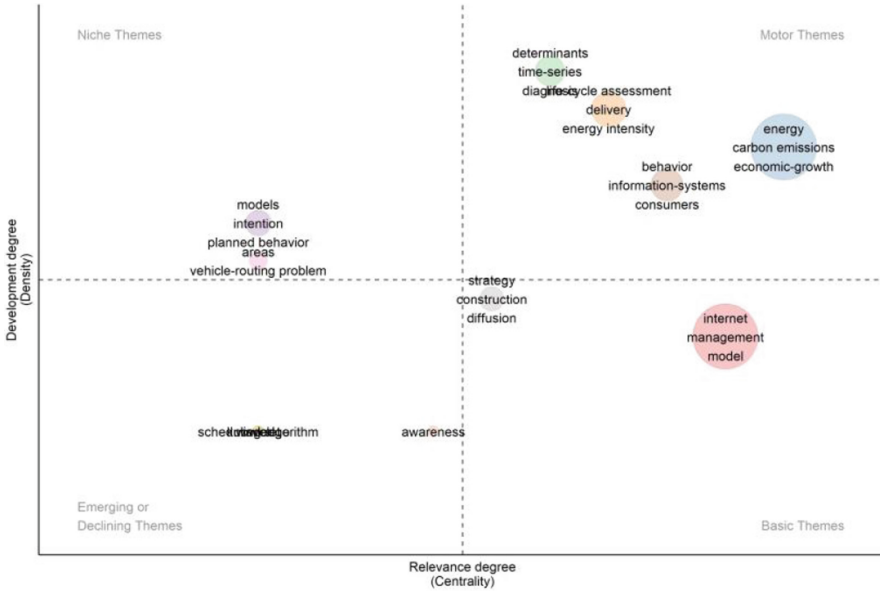


Fig. 3. Thematic Map

3.4 Author Keyword Analysis

Figure 4 shows the visualization results of keyword analysis. The first cluster is based on research on Internet stuff (green), It mainly focuses on the relationship between machine learning, energy internet, smart city, smart grid, energy consumption, and carbon emissions, among which the node “internet of things”, as the largest node in the cluster, radiates outward and is closely connected with the node “energy management”. The second cluster, Internet, E-commerce, and Sustainability (blue), consists of topics such as Internet development, transportation, and carbon dioxide, and discusses how the development of Internet and e-commerce can promote sustainable development and reduce carbon emissions. The third cluster, carbon dioxide emissions and digital economy (red), focuses on the sustainable development of China’s ICT and environment. The fourth cluster carbon footprint (yellow) is mainly related to renewable energy, green network, and climate change. It can be seen that building a green net-work and paying attention to climate change and renewable energy are conducive to making the carbon footprint more clearly identifiable. The fifth cluster (purple) is mainly reflected in energy consumption, cloud computing, energy efficiency, green carbon dioxide calculation, and other aspects. In the figure, it is obvious that “carbon emissions”, “internet of things”, “energy consumption” and “sustainability” are located in the important nodes of the red, green, purple, and blue groups respectively.

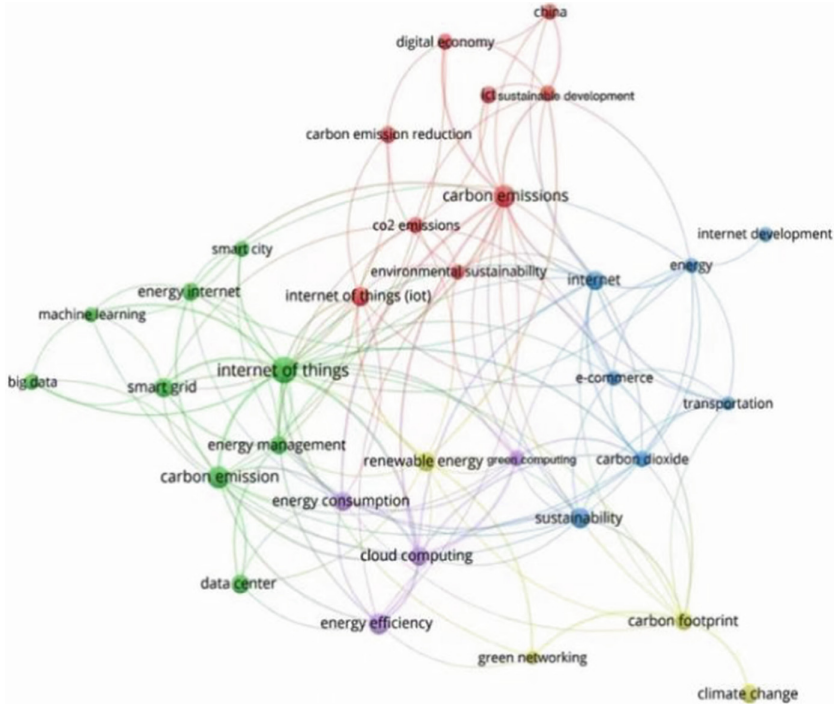


Fig. 4. Author Keyword Analysis

4 Conclusions

Based on the above visualization data analysis, important conclusions can be drawn as follows:

First, a number of related research publications exploring Internet development and carbon emissions will continue to rise in the future. Second, the major research journals related to this research topic are IEEE ACCESS and SUSTAINABILITY. Third, China, the United States, and Canada are the top three countries with the largest research contribution. Forth, energy carbon emissions economic-growth and behavior information-systems consumers are well developed, which has great guiding significance for the research and development of the Internet and the field of carbon emissions. Fifth, at present, the main research contents on internet development and carbon emission include “internet of things”, “Internet, e-commerce and sustainability”, “carbon dioxide emission and digital economy”, “carbon footprint”, “energy consumption, cloud computing, energy efficiency”, etc.

To sum up, the research field of the combination of the Internet and carbon emissions is currently in a state of rapid development. China is the main force in this research field, and many new research directions are still in the preliminary stage and need to be further explored by scholars.

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