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Mapping Global Research Trends in Carbon Accounting: A Bibliometric Analysis of WoS Publications

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KEYWORDS

Bibliometric Analysis; Green Human Resource Management; Environmental Impact; Organizational performance; Sustainability

ABSTRACT

In this study, bibliometric methods are utilized to investigate the literature on carbon accounting in detail along with the Web of Science data collection. We desire to understand the tendencies, the most important authors and publications, and the new directions in the topic due to the importance of the research on the influence of accounting carbon emissions on climatic change. We explain how the study was developed, explain the gaps in knowledge, and help with the mapping of the further stages of the development of the field. The outcome of this analysis will be of great importance in furthering our knowledge of carbon accounting and enhancing distributed team work among scientists in this field...

1. INTRODUCTION

Carbon accounting is now a very important element in the world processes to comprehend and solve the complicated issues of greenhouse gas emissions and climate change. With the scientific community striving to optimize its knowledge regarding these important problems, bibliometric studies can provide useful information on the situation within the research on carbon accounting (Li et al., 2024). This research paper is a comprehensive bibliometric analysis that makes use of the information that was in the renowned Web of Science database.

Carbon accounting has been highlighted as an imperative requirement in climate change mitigation and sustainable development in many academic articles (Wang et al., 2022). To promote knowledge-based decision-making and promote research, it is necessary to identify the major trends, authors, journals, and their themes that can be considered in the field. The paper is based on the work of the leading scholars who have made their contribution to the discussion of the carbon accounting. Through the use of bibliometrics, we will be able to clarify the dynamic aspect of carbon accounting research as well as identify significant works, and define areas where future research can be pursued.

The knowledge gained as a result of this bibliometric study does not only augment the current knowledge base but also finds practical use in strategy planning in future research projects (Aria and Cuccurullo, 2017). With climate change remaining a burning issue in the entire world, it is important to comprehend the complexities of carbon accounting studies to come up with policies and interventions that work. This research is consistent with the academic attempts to break the silence of the scientific community and establish cooperation within the practice that will eventually result in the common goal of building a sustainable and resilient future.

Objective of the research

- Analysis Temporal distribution of the literature is performed to ensure that it traces the trending and pattern over the period of time in Carbon Accounting research.
- Study the patterns of output and collaboration around the world of various nations/regions concerning research connected with carbon accounting.

- The most important authors and institutions that have made their contributions to the study of carbon accounting are named, and their role in the scholarly field is outlined.

- Evaluate the position of the carbon accounting literature on the dynamics of publications in the key journals in the field.
- A close analysis of the keywords in order to define the most popular themes, new issues, and changes in interests in the scope of the research on carbon accounting should be undertaken.
- Identify the authors, institutions, and countries that work on cross-disciplinary collaboration in the multi-dimensional carbon accounting research.

Establish the foundation of future research on carbon accounting course, via strategic planning by combining rudimentary outcomes and recommendations in its path.

2. METHODOLOGY

In this study, the bibliometric method is employed to conduct a literature review on carbon accounting, through the resources of abundance of information presented on the Web of Science database to retrieve and extract systematic data (Donthu et al., 2021). With the help of advanced bibliometric tools offered by Aria and Cuccurullo, 2017, we study the data in a manner that will allow seeing such key trends as the time distribution, the frequency of references, and the amount of studies published in various reputable journals. Second, our geospatial mapping tries to graphically demonstrate the global spread of carbon accounting studies, light of collaboration chains among various nations which is attended by VOSviewer (Van Eck and Waltman, 2010). Patterns of authorship are analyzed to evaluate and determine prominent contributors to the field, including co-authorship networks (Small, 1973) and measures of the impact of a specific scholar (Bornmann and Leydesdorff, 2014). The journal impact is determined by assessing the publication patterns in the impactful journals with references to the impact factors and citation metrics (Zupic & Čater, 2015). The most common theme and emerging topics are determined through the use of co-occurrence analysis as well as a keyword analysis.

Furthermore, we also look into the aspect of interdisciplinary collaboration where we examine the network of co-authorships between authors in different fields to understand the extent of interdisciplinarity in carbon accounting studies (Price, 1963).. As a method of identifying knowledge gaps, we use bibliometric analysis to identify areas with a low number of publications, a low rate of citations, or an unexplored topic that needs to be explored more (Aria and Cuccurullo, 2017; Donthu et al., 2021).

Query method and criteria

The search process exclusively targeted articles related to Carbon Accounting and employed five distinct keyword combinations. Leveraging the advanced search option, these six keyword

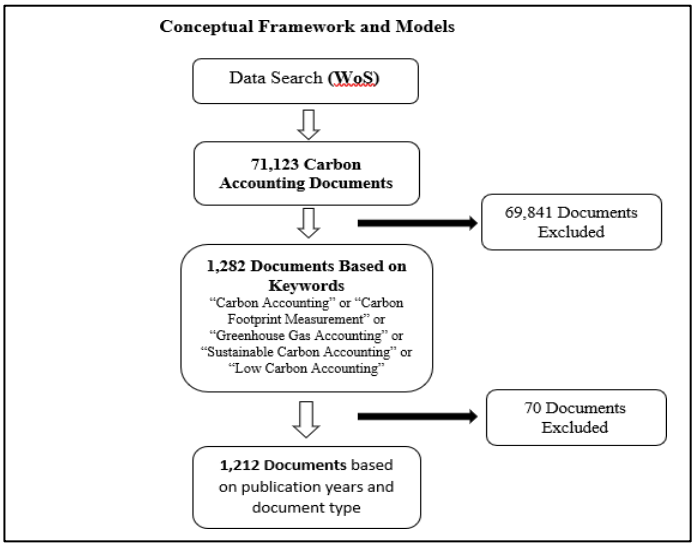

Figure 1: Steps for delimiting the literature (PRISMA Chart)

combinations were logically amalgamated as follows: TITLE-ABS-KEY "Carbon Accounting" or "Carbon Footprint Measurement" or "Greenhouse Gas Accounting" or "Sustainable Carbon Accounting" or "Low Carbon Accounting". We meticulously asses the documents and excluded the unrelated documents to subject matter.

Scope of the Study

The study aims at conducting a comprehensive bibliometric review of the carbon accounting literature based on the data of Web of Science databases. Mapping authorship trends, sources, impact, keywords, and affiliations are primarily the key focus. This especially concerns various mapping techniques: graphics systems that would aid in proving the global trend of distribution. It will focus on describing the pivotal roles and very impactful areas of publication in carbon accounting studies. The produced information will be extremely helpful to the field and will provide recommendations to scholars, policymakers, and stakeholders regarding existing tendencies and prospects of future studies. The chart illustrates the count of articles in various sources, therefore, giving an indication of the academic environment and tastes in the field. Its concentration is high in the journal with nine articles, which signifies that this journal is given a great deal of scientific attention.

Carbon Accounting

Carbon accounting has even taken a different dimension in the fight against climate change and enables measurement and tracking of green house gas emissions in industries and activities. With the increased knowledge on the issue, carbon accounting practice is increasing exponentially, as thousands of research projects are organized to enhance the methodology, measure the impacts, and enlighten the policy making process. The literature review is a comprehensive report of the available literature on carbon accounting, with the arguments being based on the major themes, theoretical frameworks, and methodological processes to determine the presence of the same in the field.

Carbon accounting is a field of study that has evolved severally and various theoretical frameworks that have been significant have been applied throughout the years. One of such frameworks is LCA (life cycle assessment) that provides a comprehensive estimate of the environmental impacts of a product or a system across its lifecycle. The other powerful framework is IOA (input-output analysis) according to Lenzen et al. (2020), which simulates economic interdependencies to trace the carbon footprints of a cross-linked sector. Moreover, other possible frameworks, including footprint accounting or embodied carbon accounting, which Wiedmann et al. (2015) address, aim at attributing carbon emissions to a particular entity or consumption pattern. Although a lot of progress has been made in carbon accounting, there are still significant gaps in knowledge and the major challenges remain. Global supply chains have issues of precision in allocating the emissions because of their complexity (Wiedmann et al., 2015). Furthermore, the discrepancy in methods and data leads to lack of uniformity in the estimate of the emissions (Peters et al., 2011). To address these problems, additional studies and universal methods as well as cohesive data collections are needed.

In the recent times, there are new trends in carbon accounting studies, which are of interest. Of special importance in terms of informing mitigation measures across geography, which would enable spatial analysis on carbon foot-printing lines such as those conducted by Yamamoto et al. in (2016). Besides, as the value of the principles of the circular economy continues to intensify, effective approaches must be formulated to consider the carbon storage and sequestration in the recycled materials (Tukker et al., 2017). By exploring such frontiers, there is a tremendous potential of moving the field in the right direction to realize a sustainable future.**Result and Discussion**

Most relevant Source

The figure 2 shows the number of papers in different sources hence, gives an idea of the state of the academic field and the preferences in the field. Special focus is particularly on the Journal of Cleaner Production, of which nine articles are cited that indicate a strong scientific focus on the publication. Accounting Auditing & Accountability Journal come second with four

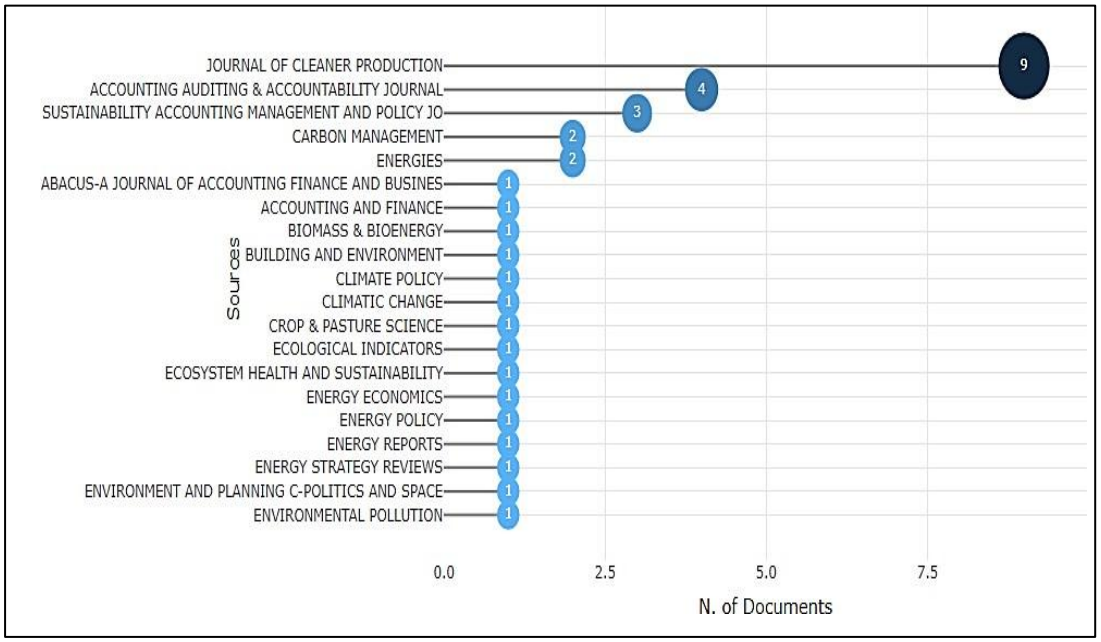

Figure 2: Most Relevant resources

publications that have been used in the accounting and sustainability studies interface. Sustainability Accounting Management and Policy Journal is one of the most prominent journals in the study of sustainability accounting since it publishes three papers. Sustained interest may be judged by two in Carbon Management, and two in Energies. The following journals are one article each: "Abacus-A Journal of Accounting Finance and Business Studies," "Accounting and Finance," "Biomass and Bioenergy," "Building and Environment," "Climate Policy," "Climatic Change," "Crop and Pasture science, "Ecological Indicators," "Ecosystem Health and Sustainability, "Energy Economics," "Energy Policy, "Energy Reports and Energy Strategy Reviews. The variety of sources proves the multidisciplinary character of the study, which includes the elements of accounting, finance, energy, and environmental science.

Author's Productivity

This table presents the list of the authors and the number of articles where their respective share is given as a fraction, as a scholarly contribution of the author: Ascui F has three articles whose fractionalized value is 1.25 and thus is a very contributing one. Brander M, on the other hand, has three articles with higher fractionalized value of 2.25 therefore contributing to a great extent. With two articles and the value of 0.67 that can be fractionated, Gibassier D also makes a moderate contribution.

Table 1: Author's Productivity

Authors	Article	TC	Article Fractionalized
Ascui F	3	3.75	1.25
Brander M	3	6.75	2.25
Gibassier D	2	1.34	0.67
Lovell H	2	2.00	1.00

Richards GP	2	2.00	1.00
Abubakar A	1	0.17	0.17
Aggeri F	1	0.50	0.50
Al-Ghamdi SG	1	0.20	0.20
Al-Matari EM	1	0.17	0.17

There has been a balance of impact per article in those two articles that have been published by the authors Lovell H (2 articles with fractionalized values of 1) and Richards GP (2 articles with fractionalized values of 1). Other first-time authors such as the article by Abubakar A, Aggeri F, Al-Ghamdi SG, and Al-Matari EM respectively have fractional values 0.17, 0.5, 0.2, and 0.17, respectively, which is relatively less significant in its contribution. The TC of Brander M is the highest, which means that it has a lot of impact, whereas the TC of Abubakar A, Al-Ghamdi SG, and Al-Matari EM is the lowest, as these articles have only one published work.

Word Cloud

The repetition of the terms Climate Change and Emissions shows a primary theme of control and knowledge of the consequences of the emissions of the green-house gases on the climate. The prevalence of the term Management is used to show that the practices and techniques in the field of sustainability and emissions management are explored. Greenhouse Gas Emissions and Sustainability are works that are concerned with tracking of emissions and creation of sustainable procedures. Moreover, the words used like a Footprint and Consumption refer to an investigation of consumption pattern and carbon footprints.

Words such as Governance, Policy can imply that it is concentrated on organisational and regulation levels, though the input-output Analysis term is also mentioned and refers to the role of economic models in the process of carbon footprint. When all of these terms are considered as a whole, they would provide a summary of carbon accounting research in several aspects of multifaceted and multidisciplinary study researches.

Country Scientific Production

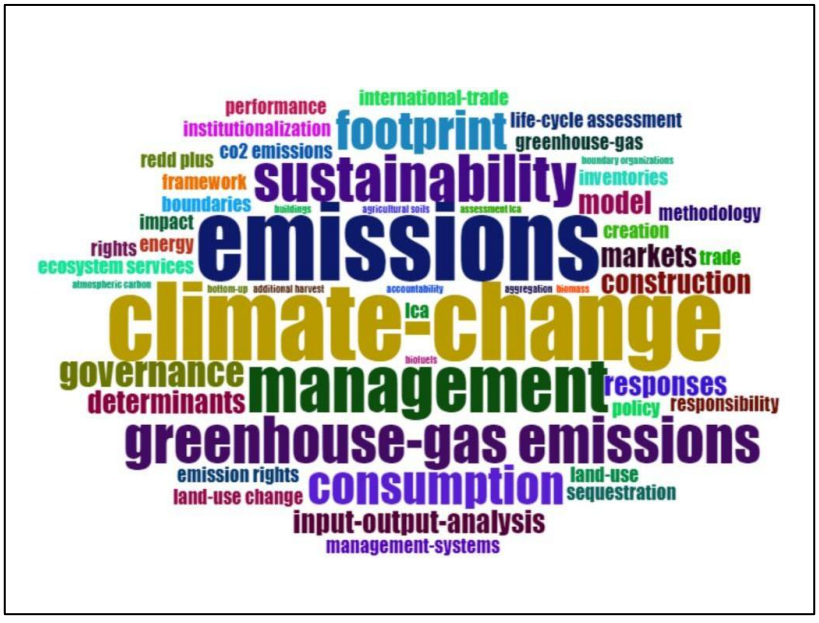

Figure 3: Word Cloud

The table 2 gives insight into the geographical concentration of a research or data based on the documents collected. The most mentioned countries are Australia and UK with 23 mentioned in each. This number of mentions may reflect that the attention to both Australia and the UK is rather high, which may allow assuming the comparison or the study with the specific

Table 2: Scientific Production	
Region	**Frequency**
Australia	23
UK	23
China	11
France	9
Denmark	8
USA	7
Sweden	6
Malaysia	4
Saudi Arabia	4
Germany	3

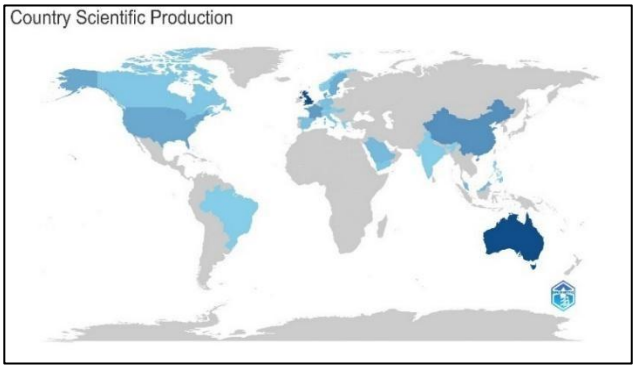

Figure 4: Country Scientific Production

attention to these two countries. The next nearest country is China with 11 occurrences, which is less notable but significant. France 9 has a mention compared to Denmark, United

States of America (USA) and Sweden which has 8 mentions respectively, with followings of 7 and 6 mentions respectively. These results indicate the degree of moderate importance of this country in the whole data set. In addition to this Malaysia, Saudi Arabia have the same rate of mention where they received each 4 mention. The percentage of different countries that the dataset represents is indicative of potential regional concentrations, collaborations, or other special cases that could be relevant to the research.

Bradford Laws

The figure 5 looks to Bradford Law, a principle of bibliometrics that defines the uneven distribution of scholarly output across different sources. Original data is marked into separate

areas, in accordance with this principle. The epicentre of the scholarly prominence is situated in Zone 1 which houses select journals with a significant influence on the dynamic of scholarly prominence namely: 16 out of the total 50 articles, with a significant influence made by the following journals: Journal of Cleaner Production, Accounting Auditing and Accountability Journal, Sustainability Accounting Management and Policy Journal. The second tier of significance is represented by Zone 2 that consists of intermediate contributors such as journals like Energies and Abacus-A Journal of Accounting Finance and Business Studies.

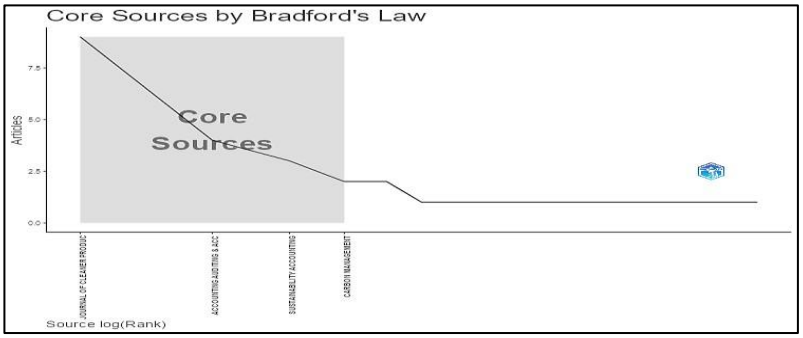

Figure 5: Bradford Laws

Journals in Zone 3 all constitute the periphery and contribute little to the cumulative frequency. This hierarchy is perfectly compatible with the Law of Bradford, and it is clear that a small number of central sources generate most of the scholarly production, followed by a larger group of marginal creators, and then a long tail of less influential sources. This subtle sense of the stratum of importance of journals to the science plays a crucial role in understanding the taste of scholars and the current research environment (Bradford, 1934).

Most Global Cited Document

Germany is the most influential country in the world of carbon accounting with a total of 348 citations and a mean citation of 174 citations per article. The UK follows with a total number of 316 total citations and an average of 26.3 citations per article and Australia is a very strong competitor with 232 total citations and 25.8 citations per article

Sweden and Austria have a high performance of mean of 169 citations per article. Some other contributors are Denmark, Netherlands, USA, Brazil, and Hungary. This kind of data is a clear confirmation of the prevalence and pervasive research in carbon accounting across the globe. Interestingly, Germany, the United Kingdom, and Australia are top of both quantity and quality. The Figure 5 results demonstrate the participatory and powerful character of the research activities in carbon. accounting in different countries.

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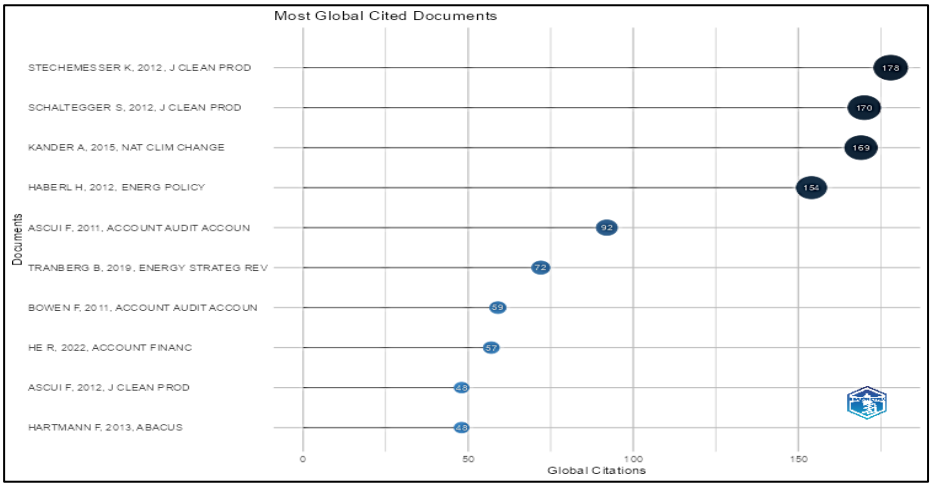

Figure 5: Most Global Cited Document

Three Field Plot

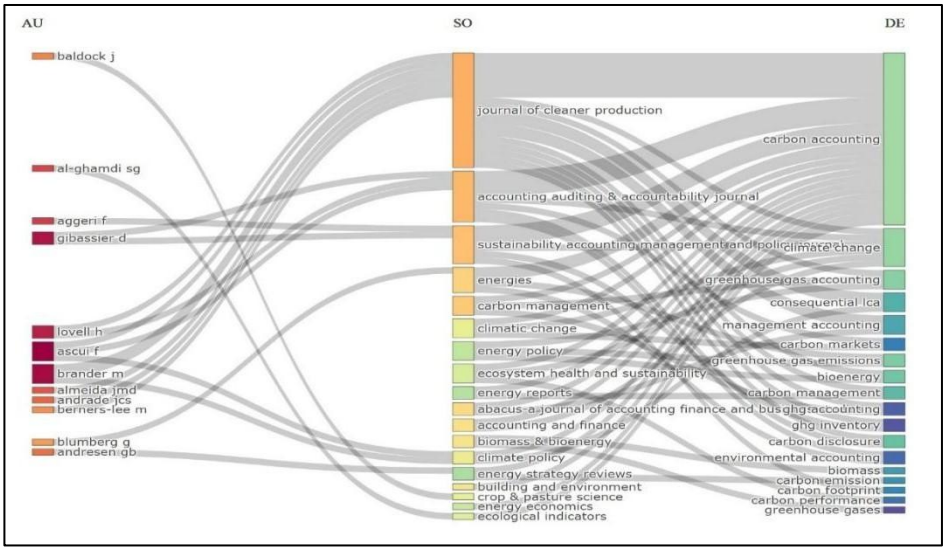

Figure 6: Three Field Plot

Every point of the Figure 6 is an author, i.e. he is a symbol of his contributions to one or several research articles connected to the carbon counting. To this extent, the trend can be observed during the visualization process of other entities such as identification of prolific authors whose contribution can be said to have been substantial, cooperation between the authors, and the spectrum of. Even the research participants in the field are reflected in the plot. The plot below shows how the scholarly output is distributed across the journals.

All of the data points in the graph above are individual outlets of publication, so it offers the possibility of observing different trends. As an example, the journals that are ranked the highest are not there due to the high citation or impact but are very prolific, which means that they have published a lot on carbon accounting. Niche journals on the other hand might be ahead of times in certain specific subtopic.Publication trends in them may have changes over time. There is also a relationship between each data point and a distinctive topic or theme under carbon accounting and then the respective one can extract inferences regarding the extent and magnitude of areas of researches done in the literature. Such knowledge can highlight some of the major themes that have attracted considerable attention of scholars, new issues of increased concern, or interdisciplinary overlaps between carbon accounting and related disciplines.

Temporal

There are also other significant additions in 2016, 2018, and 2019 which add up to over 6 percent of the total records. The years between 2001 and 2010 have the lowest representation

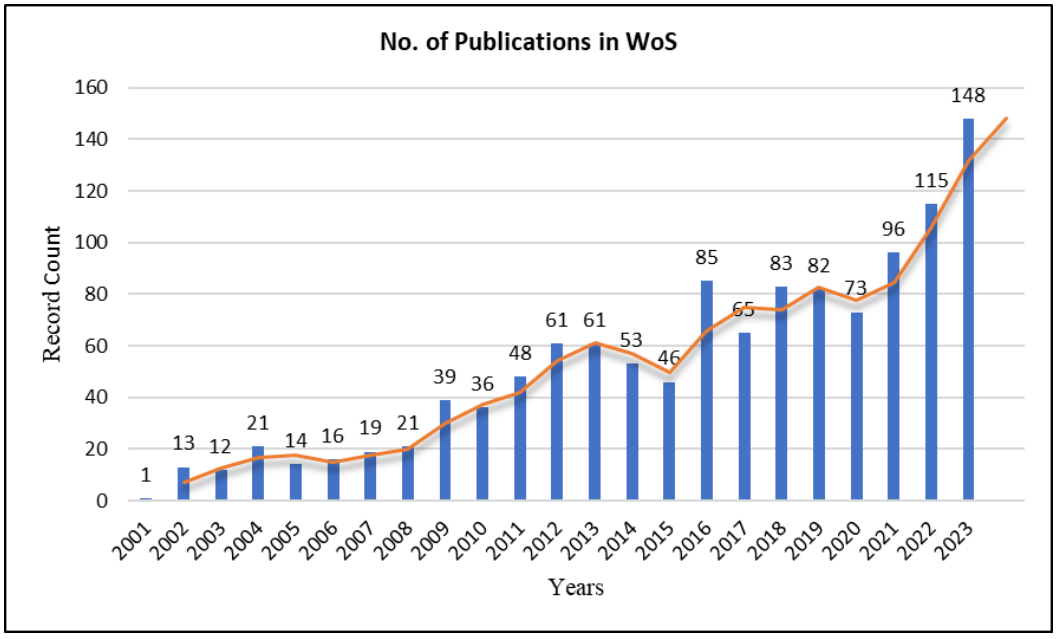

Figure 7: Temporal Chart of Publication

with 2001 being the least contributing with a figure of 0.08. What is highlighted in the latter pattern of distribution is an indication of the current raised level of research activity which, more than likely, was catalyzed by growing sense of urgency and awareness regarding the issues of climate change during the latest years.

Conclusion

This paper gives the general review of the literature on the topic of carbon accounting, with references to the data in the

Web of Science and other bibliometric sources. It aims at finding trends, significant authors, significant journals, and new subjects in the field, which would be used to create the necessary strategies and direct further research operations. In the modern times, it is understood that carbon accounting is gaining relevance in explaining and fighting the impacts of climatic change and gas emissions. In this work, we make contribution to the dynamics of carbon accounting research that explains how carbon accounting research has been transforming over the years. The findings show that the scope of work has risen in the recent past in the field in response to the growing awareness of the climate change problems. This analysis also relates to the topic of carbon management in that the global cooperation in the research of carbon accounting has mentioned some authors and institutions as the key contributors.

Further, the determination of hot topics and new themes of carbon accounting literature will be done through effective journal and key word analysis. These lessons prove to be of great significance when it comes to directing future studies and in bridging the gaps on knowledge on carbon accounting. The supplement of higher-order collective goals of having a sustainable future, as developed in this paper, is the enhancement of carbon accounting knowledge and the encouragement of scientific cooperation. The insights it obtains are essential in influencing policy-making and spurring effort in the right direction to curtail the effects of climate change.

cent years

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