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A Bibliometric and Systematic Review of Carbon Accounting: Trends, Gaps, and Future Research on Environmental Cost and Carbon Tax

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ABSTRACT

This study examines the development of carbon accounting research in response to growing global concerns about climate change and sustainability. It aims to systematically map and evaluate the literature using a combined bibliometric analysis and systematic literature review (SLR) approach. A total of 251 Scopus-indexed articles across accounting, management, business, and finance were analyzed. Bibliometric analysis with VOSviewer identifies publication trends, keyword networks, and thematic clusters, while the SLR provides deeper qualitative insights. The findings show a steady increase in publications, indicating rising academic and practical relevance. Key research clusters include carbon disclosure and reporting, carbon management strategies, environmental cost accounting, and carbon taxation. The results also reveal a multidisciplinary orientation integrating environmental and fiscal dimensions. This study contributes by mapping the intellectual structure and thematic evolution of carbon accounting research and offering an integrative analytical approach. It further suggests future research directions, particularly in environmental cost measurement and carbon tax design.

Keywords: *Carbon Accounting, Bibliometric Analysis, Systematic Literature Review, Sustainability,.*

INTRODUCTION

Climate change, which triggers global disasters, has garnered attention and become a concern for governments to care for the environment. The United Nations has established 17 Sustainable Development Goals (SDGs) to address these global issues. One of the initiatives is tackling climate change and its impacts. Goal 13 of the SDGs specifically targets actions against climate change and its impacts, which include strengthening resilience and adaptive capacity to climate-related hazards and natural disasters in all countries. The UNFCCC stated that there needs to be cooperation between governments, companies, and civil society to reduce greenhouse gas emissions, increase resilience to climate change impacts, as well as enhance education, awareness, and human and institutional capacity in climate change mitigation.

All stakeholders have begun to launch effective and sustainable programs. For instance, there are programs to limit the use of fossil fuels and halt the construction of fossil fuel-based power plants, among others. Additionally, various

countries have started implementing carbon taxes to reduce greenhouse gas emissions, aiming to mitigate the impacts of climate change. According to a report by the Intergovernmental Panel on Climate Change, imposing carbon taxes as a policy instrument can help achieve significant emission reductions by encouraging energy efficiency and the use of clean energy sources.

Another effort specifically in the field of reporting is the implementation of Integrated Reporting (IR). The standard form of integrated reporting involves presenting three components abbreviated as ESG (Environmental, Social, and Governance). According to the International Integrated Reporting Council, Integrated Reporting focuses on applying high-quality reporting principles that enable the simultaneous reporting of financial and non-financial information to create a more holistic and transparent picture of how an organization creates value.

Additionally, there are other efforts that have been implemented voluntarily or without coercion, through accounting instruments. These initiatives often include the use of sustainable reporting standards such as GRI (Global Reporting Initiative) and SASB (Sustainability Accounting Standards Board). According to a report from (GRI, 2019), the application of sustainable reporting standards helps companies measure and disclose their positive and negative impacts on sustainability in a systematic and consistent manner, which in turn affects the company's strategic decisions.

Accounting instruments are known as a process of measurement, disclosure, presentation, and reporting. According to Kieso, Weygandt, and Warfield, accounting is an information system that identifies, records, consolidates, and reports economic information to enable users to make informed economic decisions. Accounting plays a crucial role in providing information about an entity to stakeholders, both monetary and non-monetary. One form of monetary information that entities are expected to present is information about the carbon produced by the company. According to research conducted by (Hirshleifer & Teoh, 2003), the disclosure of information about carbon emissions and their impact on the environment helps investors understand the risks and opportunities faced by the company in relation to climate change. Information about carbon can include reported emission measurements as well as the carbon taxes that have been paid.

Carbon accounting is a part of environmental accounting. The existence of environmental accounting is an effort to support one of the goals of the Sustainable Development Goals (SDGs). According to (Bebbington & Larrinaga, 2014) environmental accounting helps entities in facing sustainability challenges and supports achieving the SDGs by providing relevant information for decision-making related to the environment. The government needs to give maximum attention to the importance of carbon accounting for entities, society, and the government. Especially with the results of published research, which can serve as references for stakeholders in formulating policies. One form of policy that can be implemented is the obligation of carbon accounting reporting for companies listed on the stock exchange. (Tang & Luo, 2014a) suggest that the implementation of carbon accounting reporting policies for companies listed on the stock exchange can increase transparency and accountability regarding the environmental impact of company activities.

Carbon accounting research has become a topic of attention in the academic world and business practice, with various studies highlighting different aspects from measurement to carbon emissions management. (Schaltegger & Burritt, 2010) in the Sustainability Accounting, Management and Policy Journal examined challenges in carbon accounting and emphasized the importance of integration in environmental management. Furthermore, (Tang & Luo, 2014b) in the International Journal of Accounting & Information Management explored the implementation of carbon management systems in large companies and found that success largely depends on institutional support. (Wright & Nyberg, 2016) through Organization Studies demonstrated how large companies utilize carbon management strategies to address reputational risks. Additionally, (Baboukardos & Rimmel, 2016) in the Accounting, Auditing & Accountability Journal investigated how carbon emissions reporting affects investor confidence.

In the European Accounting Review, (Lohmann, 2011) highlighted criticisms of carbon market mechanisms and suggested reforms for more transparent reporting. This series of research indicates significant developments in the field of carbon accounting, offering valuable guidance for more responsible and sustainable carbon management. In relation to bibliometric analysis, carbon accounting has been researched by (Kiswanto et al., 2023) and (Kurniawan et al., 2022). However, the study by (Kiswanto et al., 2023) was limited to a database of 65 articles over 12 years, and the research by (Kurniawan et al., 2022) was limited to environmental science indexed in Scopus with a Quartile 1 ranking.

Despite the growing body of literature on carbon accounting, several critical gaps remain insufficiently addressed. First, prior studies tend to exhibit limited scope and fragmentation, particularly in bibliometric research, which often relies on relatively small datasets or narrow disciplinary focuses, thereby restricting the generalizability of findings (Kiswanto et al., 2023); (Kurniawan et al., 2022). Second, the existing literature demonstrates inconsistent empirical and conceptual findings, especially regarding the role of carbon accounting in enhancing transparency, firm value, and sustainability performance. For instance, while some studies argue that carbon disclosure improves investor confidence and decision usefulness (Baboukardos & Rimmel, 2016), others highlight symbolic or legitimacy-driven reporting practices that may not reflect substantive environmental performance (Lohmann, 2011); (Wright & Nyberg, 2016). Third, prior research has largely focused on either quantitative bibliometric mapping or qualitative literature synthesis in isolation, with limited attempts to integrate both approaches into a unified analytical framework. Consequently, there is still a lack of comprehensive understanding regarding the intellectual structure, thematic evolution, and future research directions of carbon accounting studies. Addressing these gaps, this study offers a novel contribution by combining bibliometric analysis with a systematic literature review to provide both macro-level mapping and in-depth conceptual insights, particularly emphasizing the emerging roles of environmental costs and carbon taxation within the carbon accounting framework.

Research on carbon accounting has been published since 1970 and remains an intriguing subject of study through to 2024. This research aims to evaluate both quantitatively and qualitatively using two approaches: bibliometric analysis and

systematic literature review. The objectives are (1) to identify the growth trend in carbon accounting research and the quantity of its references, (2) to explore the literature from the perspective of publishing countries, publishers, and journal types, (3) to examine the most productive authors and the quantity of citations, and (4) to discuss the main research areas, primarily in the fields of accounting, finance, auditing, and taxation.

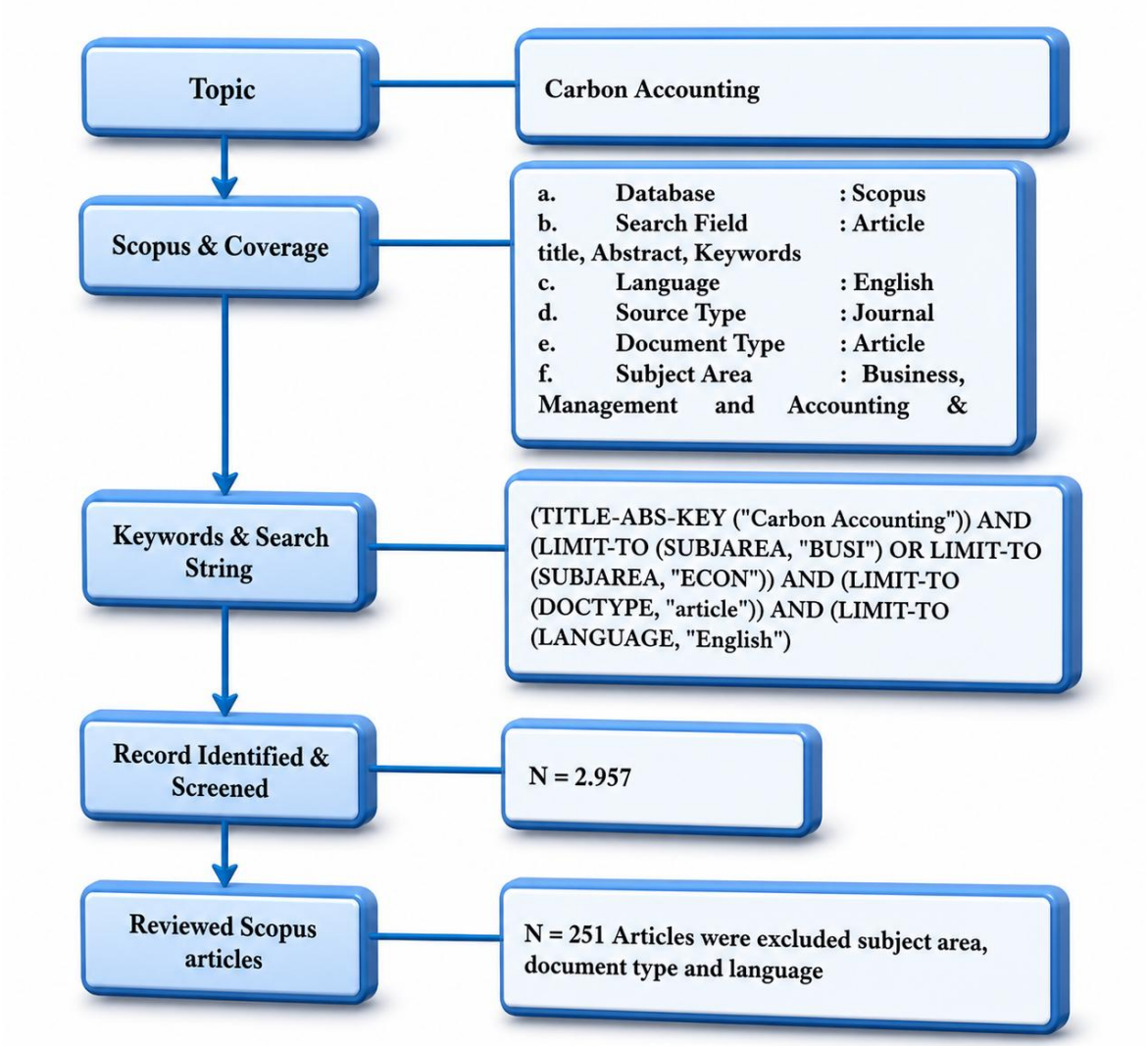
The novelty of this research lies in the recommendation of new directions for carbon accounting research, involving the design of environmental costs and carbon taxes. Additionally, the integration of two approaches—bibliometric analysis and systematic literature review—provides not only quantitative insights but also in-depth qualitative analysis. The results of this study can provide guidance for academics, practitioners, and policymakers in enhancing carbon accounting practices and sustainability reporting

METHOD

This study employs a combined approach of bibliometric analysis and systematic literature review (SLR) to examine the development of carbon accounting research. Bibliometric analysis is used to identify publication patterns, collaboration networks, and the geographic distribution of research, while also enabling the mapping of thematic structures through network analysis and clustering techniques using VOSviewer. As noted by (Khatib et al., 2022), bibliometric analysis facilitates a comprehensive understanding of research development in terms of documents, citations, authorship, and productivity within a specific field.

The research process is structured systematically as illustrated in Figure 1, beginning with the identification of the research topic, namely carbon accounting, followed by data collection from the Scopus database, which was selected due to its extensive coverage of high-quality peer-reviewed publications. The search was conducted using the query TITLE-ABS-KEY (“Carbon Accounting”), focusing on titles, abstracts, and keywords. To ensure the relevance and consistency of the dataset, several inclusion criteria were applied, including language (English), source type (journal), document type (article), and subject areas (Business, Management and Accounting; Economics, Econometrics and Finance).

Figure 1. Articles selection process



Source: Figure by authors, 2025

The initial search yielded 2,957 documents, which were subsequently screened based on the predefined criteria. This screening process involved evaluating bibliographic information to ensure alignment with the research objectives. After applying inclusion and exclusion criteria, a final dataset of 251 relevant articles was obtained, while the remaining documents were excluded due to incompatibility in subject area, document type, and language.

The selected articles were then analyzed using VOSviewer to map the structure and evolution of carbon accounting research. The bibliometric techniques applied include co-occurrence analysis to identify relationships among keywords and emerging research themes, co-citation analysis to explore the intellectual structure of the field, and bibliographic coupling to examine connections among recent publications. To complement the quantitative findings, a systematic literature review was conducted to provide deeper conceptual insights. This stage focuses on

synthesizing theoretical perspectives, identifying research gaps, and evaluating the evolution of research themes in carbon accounting. Unlike traditional narrative reviews, the SLR approach emphasizes transparency, systematic procedures, and analytical rigor, thereby enhancing the validity and reliability of the findings (Yuwono et al., 2024). Overall, the integration of bibliometric analysis and SLR enables a more comprehensive understanding of both the quantitative trends and qualitative developments in carbon accounting research, while also strengthening the transparency and reproducibility of the research process.

RESULT AND DISCUSSION

This section presents the results of the bibliometric analysis and systematic literature review on carbon accounting research. The analysis is structured to provide a comprehensive overview of the development and characteristics of the literature, including document types, keyword networks, geographic distribution, research institutions, journal contributions, and citation patterns. Furthermore, this section also explores the main research themes and emerging trends identified through network visualization and clustering analysis. By integrating quantitative bibliometric findings with qualitative insights from the systematic literature review, this section aims to provide a deeper understanding of the intellectual structure and evolution of carbon accounting research.

Document Types Distribution Of The Carbon Accounting Literature

The distribution of document types obtained from the Scopus data extraction, as shown in table 1, indicates that articles are the most dominant document type with a percentage of 76.89%. This reflects a strong tendency among researchers to publish their findings in the form of articles, which often serve as the primary medium for disseminating scientific research. Other document types, such as book chapters (11.55%) and conference papers (3.98%), also play important roles, albeit with smaller percentages.

Book chapters are often used to contribute knowledge in a broader and more comprehensive context, whereas conference papers typically reflect ongoing research or preliminary findings presented at academic conferences. Review documents (3.59%) serve as summaries or evaluations of literature on specific topics, providing comprehensive insights and often becoming essential references for new researchers in the field. On the other hand, books (1.59%), notes (0.80%), editorials (0.80%), letters (0.40%), and errata (0.40%) play more specific roles in the scientific literature, such as presenting information concisely, discussing editorial issues, or correcting errors in publications.

Table 1. Document types distribution of the carbon accounting literature.

Number	Document Type	Count	%
1	Article	193	76,89%
2	Book chapter	29	11,55%
3	Conference paper	10	3,98%
4	Review	9	3,59%
5	Book	4	1,59%
6	Note	2	0,80%
7	Editorial	2	0,80%
8	Letter	1	0,40%
9	Erratum	1	0,40%
	Total	251	100%

Source: processed data, 2024

In terms of language, English overwhelmingly dominates as the most commonly used language in these documents. This is understandable given that English serves as the lingua franca of the international scientific community, allowing research findings to be accessible to a global audience. Besides English, a number of documents are also written in Chinese, German, and French, albeit in smaller quantities. The presence of documents in various languages highlights the significant contributions from researchers in non-English-speaking countries across various fields of study, reflecting the global diversity of scientific literature. The ability to access and understand literature in multiple languages is crucial for international collaboration efforts and enriches the quality and breadth of existing research.

Network Visualization Analysis

In research on carbon accounting, keywords play a crucial role in understanding the focus and trends of the topics being discussed. In addition to the main keyword "carbon accounting," several frequently occurring keywords include "carbon," "climate change," "greenhouse gases," and "carbon emissions." These keywords reflect the close relationship between carbon accounting and broader environmental issues such as climate change and greenhouse gas emissions. In network visualization, keywords that appear larger in size indicate a higher frequency of occurrence, signifying that these topics have a significant influence in the literature.

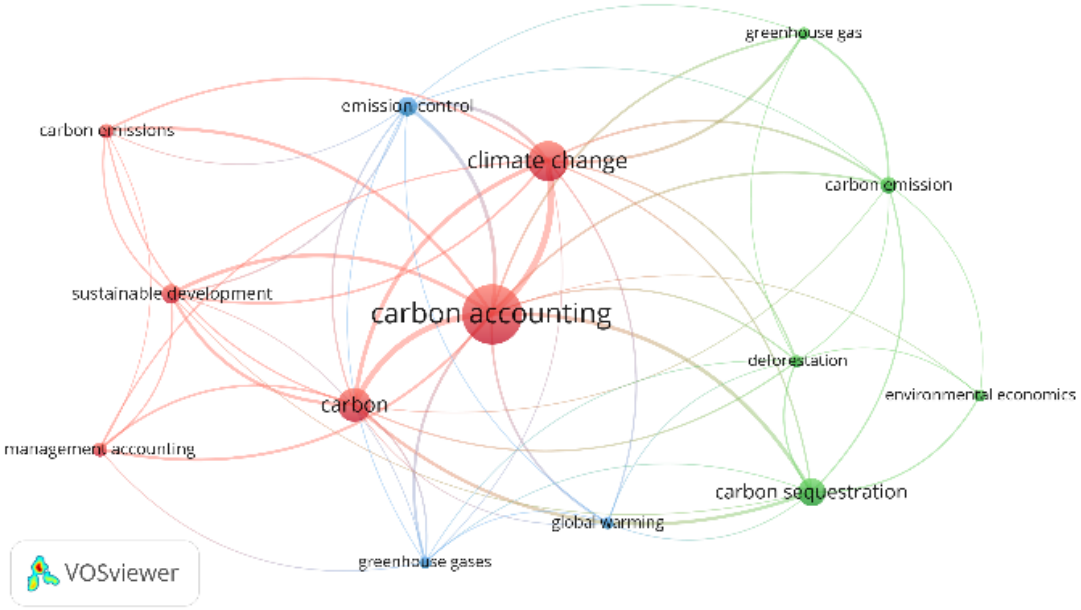


Figure I. Visualization of the Carbon Accounting Word Network
Source: VOSviewer, 2024

Additionally, keywords such as "sustainable development," "management accounting," "emission control," and "global warming" also frequently appear in carbon accounting research. These keywords illustrate the researchers' efforts to integrate sustainability principles and accounting management in efforts to control emissions. Network visualizations, such as the one shown in Figure 1, enable us to see how these keywords are interconnected and form a complex structure, indicating that carbon accounting research is intrinsically linked with various other disciplines.

Furthermore, keywords such as "deforestation," "carbon sequestration," and "environmental economics" expand the scope of carbon accounting research into other specific issues related to land-use change and environmental economics. Deforestation and carbon sequestration are two crucial aspects of climate change mitigation that are often examined within the context of carbon accounting. Meanwhile, "environmental economics" reflects the economic approach used to analyze the implications of environmental policies and actions. By mapping and understanding these keywords, we can gain deeper insights into the various dimensions encompassed in carbon accounting research.

To further deepen the analysis beyond keyword frequency and relationships, this study examines the temporal evolution of research themes in carbon accounting using overlay visualization in VOSviewer. The results indicate a clear shift in research focus over time. In the earlier period, carbon accounting studies were primarily centered on emission measurement, carbon footprint calculation, and environmental accounting techniques, reflecting a technical and measurement-oriented perspective (Bowen & Wittneben, 2011); (Stechemesser & Guenther, 2012). Over time, the research focus has evolved toward more strategic and

governance-related themes, including carbon disclosure, carbon management, sustainability reporting, and ESG integration, indicating a transition from technical accounting practices to broader organizational and institutional dimensions (Kolk et al., 2008); (Liao et al., 2015).

More recent studies highlight the emergence of topics such as carbon governance, climate risk disclosure, carbon taxation, and environmental cost integration, which reflect increasing regulatory pressures and the growing importance of sustainability in corporate strategy. This thematic shift suggests that carbon accounting is no longer limited to measurement functions but has become an integral part of corporate governance, risk management, and policy frameworks. Overall, the evolution of research themes demonstrates a progression from measurement-oriented approaches, disclosure and management, governance and strategic integration, indicating the maturation of carbon accounting as a multidisciplinary and policy-relevant research field.

Analysis Of Countries And Regions

Articles discussing carbon accounting show a wide distribution, spanning across 59 different countries. This information indicates that the issue of carbon accounting has global relevance and is of concern in various parts of the world. Table 2 highlights the top countries contributing to the publication of articles based on region and country. China ranks highest with a total of 53 articles, accounting for 21.12% of the total publications. This reflects a significant level of commitment and attention from academics and researchers in China toward carbon issues, both in the context of managing carbon emissions and understanding their environmental and economic impacts. As a country with high carbon emissions, China is also likely driven to delve deeper into this research in an effort to achieve future carbon mitigation targets.

Table 2. Top 15 most productive countries in research on Carbon Accounting

Number	Country	Total Publications	%
1	China	53	21,12%
2	Australia	40	15,94%
3	United Kingdom	38	15,14%
4	United States	31	12,35%
5	Spain	15	5,98%
6	Germany	14	5,58%
7	Canada	14	5,58%

8	France	13	5,18%
9	Italy	12	4,78%
10	New Zealand	9	3,59%
11	Netherlands	9	3,59%
12	India	9	3,59%
13	Hungary	9	3,59%
14	Sweden	6	2,39%
15	Turkey	5	1,99%

Source: processed data, 2024

Australia, with 40 articles or 15.94%, ranks second in publications on carbon accounting. Australia's strategic position in climate change and carbon mitigation efforts, as well as its environmental policies, likely encourages academics in the country to make significant contributions to the scientific literature. Similarly, the United Kingdom and the United States, with 38 articles (15.14%) and 31 articles (12.35%) respectively, are known for their prestigious academic institutions and progressive environmental policies, making them key players in carbon accounting research. The substantial number of articles from these countries not only reflects the volume of research but also highlights their significant contributions to the development of strategies, policies, and practices related to carbon emissions management.

Ranked fifth, Spain contributes 15 articles or 5.98% of the total publications. Spain's role in this context highlights the importance of international collaboration in addressing carbon emissions and climate change issues. Although the majority of contributions come from a few countries with high research and environmental development capacities, participation from various nations indicates that this issue has a global impact and requires a comprehensive approach from all corners of the world. Overall, the distribution of articles from different countries provides an overview of global concern regarding carbon accounting and underscores the importance of cross-national research in tackling one of the greatest challenges of the 21st century.

Analysis Of Research Institutes

A total of 349 carbon accounting articles collected from 160 academic institutions underline their crucial role in developing and disseminating knowledge related to carbon accounting. Table 3 further explores and identifies the top 15 institutions based on the number of publications they have produced. Western

Sydney University in Australia holds a dominant position with 12 publications, representing 4.78% of the total articles. This dominance reflects the institution's dedication and focus on the study of carbon accounting, as well as Australia's overall contribution to the scientific literature in this field.

Macquarie University, also from Australia, follows with 10 articles, which account for 3.98% of the total publications. The fact that two institutions from Australia top this list is not surprising given Australia's influence in global environmental policies and commitment to innovative research. Macquarie University is well-known for its various studies in the fields of environment and sustainability, showcasing their capability in understanding and developing effective carbon accounting practices. The consistency of institutions from Australia further solidifies the country's position on the global research map, particularly concerning environmental issues.

Table 3. Top 15 most productive institutes in research on Carbon Accounting

Number	Affiliation (Country)	Count	%
1	Western Sydney University (Australia)	12	4,78%
2	Macquarie University (Australia)	10	3,98%
3	The University of Edinburgh (United Kingdom)	8	3,19%
4	Budapesti Corvinus Egyetem (Hungary)	7	2,79%
5	University of Edinburgh Business School (United Kingdom)	7	2,79%
6	Macquarie Business School (Australia)	7	2,79%
7	The University of Newcastle (Australia)	6	2,39%
8	Chinese Academy of Sciences (China)	6	2,39%
9	Research Center for Eco-Environmental Sciences Chinese Academy of Sciences (China)	5	1,99%
10	Joint Center for Global Change Studies (Europe)	4	1,59%
11	The Australian National University (Australia)	4	1,59%
12	University of Canterbury (New Zealand)	4	1,59%
13	Tsinghua University (China)	4	1,59%
14	The University of Sydney (Australia)	4	1,59%
15	Leuphana Universität Lüneburg (Germany)	4	1,59%

Source: processed data, 2024

The University of Edinburgh, with 8 articles or 3.19%, and its affiliated university, University of Edinburgh Business School, with 7 publications or 2.79%,

demonstrate that this institution also has a strong commitment to carbon accounting. This academic institution from the United Kingdom is well-known for its research focused on climate change, environmental policy, and business sustainability. The significant contributions from the University of Edinburgh reflect its major role in understanding and developing integrative and multidisciplinary approaches to carbon accounting issues.

Budapesti Corvinus Egyetem (Corvinus University of Budapest) also stands out with 7 articles (2.79%). This university, based in Hungary, demonstrates that high-quality research on carbon accounting is not limited to traditionally large countries but also includes institutions in Eastern Europe that actively participate in this global discourse. Research from this university provides diverse perspectives and adds significant value to the existing literature by offering comparisons across different regional contexts. Table 3 not only highlights the individual contributions of each institution but also demonstrates that carbon accounting research is a collective effort. These institutions are the main driving forces in enhancing our understanding of carbon accounting practices and in developing more effective strategies and policies for carbon management at a global level.

Distribution Of Journals

A total of 251 carbon accounting articles are distributed across 111 journals with a broad scientific scope, encompassing fields such as accounting, management, business, economics, econometrics, and finance. This indicates that the issue of carbon accounting is a multidisciplinary topic that attracts interest from various academic perspectives. Table 4 identifies the 20 most productive journals in publishing articles related to carbon accounting, with the Journal of Cleaner Production leading significantly.

Journal Of Cleaner Production, which published 55 articles or 21.91% of the total, is the most productive journal on this list. This journal is well-known as a platform focused on sustainability solutions and environmentally friendly industrial innovation. The significant number of carbon accounting articles published in this journal indicates its important role in promoting cleaner industrial practices and accounting policies that support carbon emission reduction efforts. This productivity also reflects the researchers' trust in this journal as a credible medium for disseminating their research findings.

Table 4. Top 15 most productive journals in research on carbon accounting

Number	Affiliation (Country)	Count	%
1	Journal Of Cleaner Production	55	21,91%
2	Ecological Economics	10	3,98%
3	Sustainability Accounting Management and Policy Journal	9	3,59%
4	Accounting Auditing and Accountability Journal	9	3,59%

5	Forest Policy And Economics	8	3,19%
6	Corporate Carbon and Climate Accounting	8	3,19%
7	Social And Environmental Accountability Journal	6	2,39%
8	Resources Conservation and Recycling	6	2,39%
9	Frontiers In Energy Research	5	1,99%
10	Trees Forests and People	4	1,59%
11	Resources Science	4	1,59%
12	Meditari Accountancy Research	4	1,59%
13	Proceedings of the International Conference on Industrial Engineering and Operations Management	3	1,20%
14	International Journal of Energy Economics and Policy	3	1,20%
15	Environment Development and Sustainability	3	1,20%

Source: processed data, 2024

Ecological Economics, which ranks second with 10 publications or 3.98%, makes a significant contribution to the carbon accounting literature by focusing on the interaction between ecosystems and economic systems. This journal emphasizes the importance of understanding the economic impact of environmental policies, including carbon accounting, in the effort to achieve sustainable development. Articles published in this journal tend to discuss how carbon accounting policies can affect economic and ecological performance overall.

Sustainability Accounting Management and Policy Journal dan Accounting Auditing and Accountability Journal, each with 9 publications or 3.59%, also play a significant role in carbon accounting research. These journals focus on how accounting and auditing practices can be applied in the context of sustainability. Publications in both journals often explore ways to enhance transparency and accountability in carbon emission reporting, as well as integrate carbon accounting considerations into business strategies and management policies.

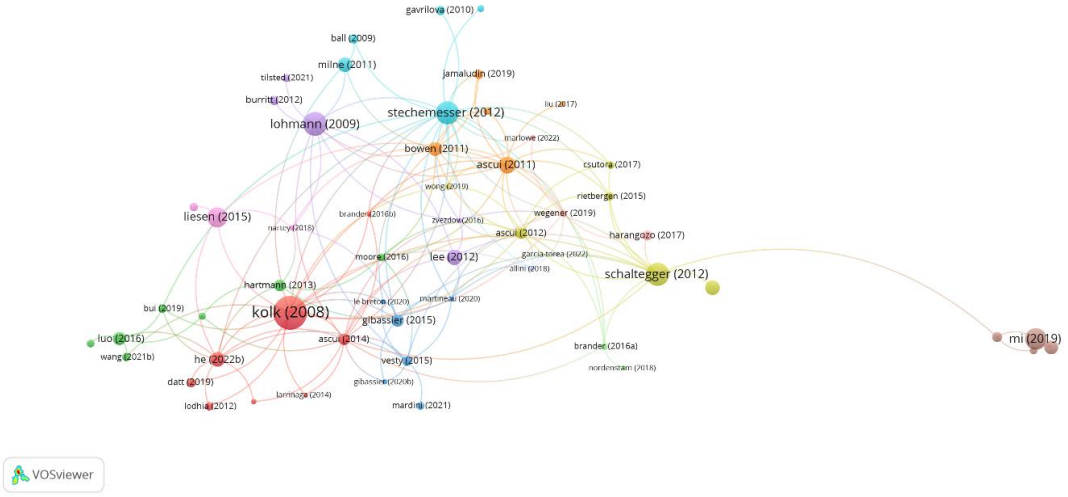
Forest Policy And Economics, contributing 8 publications or 3.19%, demonstrates that carbon accounting is also relevant in the context of forest management and forestry economics. Articles in this journal likely explore the relationship between carbon accounting policies and forest resource management, including how forests can contribute to climate change mitigation through carbon sequestration. The journal's contributions enrich the carbon accounting literature with more varied and in-depth perspectives, highlighting that carbon accounting is indeed a complex issue requiring diverse research approaches.

Overall, the distribution of carbon accounting articles across various journals reflects the broad scope and complexity of the issue. The diversity of journals indicates that carbon accounting research is not confined to a single discipline but also touches on various aspects of economics, management, and public policy. This underscores the importance of a comprehensive and integrated approach in studying and implementing carbon accounting policies to achieve global sustainability goals.

Citation Analysis

Articles on the topic of carbon accounting have formed a citation pattern that reveals interconnections between publications. This citation analysis is useful for understanding how research in this field influences each other and builds knowledge. Figure 2 shows that there are four main clusters that serve as important references in carbon accounting research. Each of these clusters consists of various interrelated studies and forms a theoretical and methodological framework that helps guide further research in this field.

Figure 2. Citation Network Visualization



Source: VOSviewer, 2024

The citation network analysis reveals four major clusters that represent distinct yet interconnected streams in the development of carbon accounting research. Cluster 1 primarily focuses on the integration of carbon accounting into corporate strategy and sustainability performance, emphasizing its role as a managerial and decision-support tool (Kolk et al., 2008). This cluster reflects a strategic perspective in which carbon accounting is embedded within corporate governance and performance management frameworks. Cluster 2 highlights critical perspectives on carbon markets and emissions trading schemes, addressing issues related to transparency, measurement reliability, and potential manipulation (Lohmann, 2009). This cluster contributes to the normative and critical discourse by questioning the effectiveness and accountability of market-based mechanisms.

Meanwhile, Cluster 3 centers on the adoption and implementation of carbon accounting practices within organizations, including methodological challenges and standardization issues (Stechemesser & Guenther, 2012). This stream

represents the technical and operational dimension of carbon accounting. In contrast, Cluster 4 focuses on the linkage between carbon accounting, sustainability reporting, and strategic decision-making, highlighting its role in performance evaluation and stakeholder communication (Schaltegger & Csutora, 2012). The relationships among these clusters indicate a progressive evolution of the field, where technical measurement approaches (Cluster 3) support strategic applications (Cluster 1), while critical perspectives (Cluster 2) provide evaluative insights that shape governance and reporting practices (Cluster 4).

Collectively, these clusters contribute to the development of carbon accounting as a multidisciplinary field, integrating technical measurement, strategic management, critical evaluation, and institutional governance. This integration not only advances theoretical understanding but also strengthens practical applications of carbon accounting in addressing climate change and sustainability challenges. This finding also aligns with legitimacy, stakeholder, and institutional perspectives, where carbon accounting evolves as a response to increasing societal, regulatory, and organizational pressures.

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Analysis Of Research Hotspots Of Carbon Accounting

One of the crucial elements in the carbon accounting framework for reducing greenhouse gas emissions is the consideration of environmental costs and tax costs. Environmental costs are all the expenses incurred by a company or organization related to the management of the environmental impact of their activities. This includes costs associated with prevention, control, remediation, compensation, and compliance with environmental obligations.

(Bennett, 1991) explains concepts such as externality costs, which encompass the negative impacts not accounted for in market prices, such as pollution and ecosystem damage. Measuring environmental costs involves the monetary valuation of these externalities, using methods such as avoidance costs, willingness to pay, and cost-benefit analysis. (Porter & van der Linde, 1995) propose the concept that increased environmental regulation does not necessarily increase costs for companies but can drive innovation that enhances productivity and competitiveness. They measure environmental costs through the impact of environmental policies on production factors, such as capital expenditure on clean technology, operational costs associated with regulation, and the potential for increased energy and material efficiency.

A carbon tax is an economic instrument implemented by the government to impose a cost on carbon dioxide (CO2) emissions produced by a product or activity. The purpose of a carbon tax is to reduce greenhouse gas emissions by providing a financial incentive to lower emissions. In the context of carbon accounting reporting, environmental costs are reported as part of a company's operational costs and may be included in sustainability or environmental reports. Carbon taxes are reported as tax liabilities in financial statements.

Additionally, it is mentioned in the sustainability report regarding emission reduction policies and carbon tax compliance. (Marron & Toder, 2013) Carbon tax measurement is based on the concept of the carbon emission price per ton of carbon dioxide and uses economic models to simulate the impact of carbon tax

implementation on emissions and state revenue. (Pearce, 1991) explains that carbon tax measurement is conducted through a theoretical approach that combines economic and environmental analysis. (Pearce, 1991) considers various carbon tax scenarios and uses econometric models to estimate their impact on emission reductions, changes in energy prices, and energy consumption. Additionally, it involves controlling for several supporting variables such as energy demand elasticity, clean energy substitution capability, and other macroeconomic impacts to assess the effectiveness of the carbon tax.

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Discussion & Future Research

The findings of this study provide comprehensive insights into the evolution of carbon accounting research, aligning with the study's objective to map research trends, identify thematic structures, and propose future research directions. The results confirm a significant and continuous growth in carbon accounting publications, reflecting its increasing relevance in addressing global climate change and sustainability challenges. The identification of dominant research clusters, namely carbon disclosure and reporting, carbon management and strategy, environmental cost accounting, and carbon taxation, demonstrates that the field has evolved beyond its initial focus on emission measurement toward more strategic, regulatory, and governance-oriented dimensions. This shift indicates that carbon accounting is no longer limited to technical measurement practices but has become an integral component of organizational strategy and sustainability governance.

Furthermore, the findings highlight a growing integration between environmental and fiscal dimensions, particularly through the emergence of environmental cost accounting and carbon taxation as key research themes. This integration reflects the increasing need for organizations to align environmental performance with financial implications, thereby enhancing decision-making processes and policy effectiveness. From a theoretical perspective, this evolution supports the relevance of legitimacy, stakeholder, and institutional theories in explaining how organizations respond to increasing environmental pressures and regulatory demands. From a practical standpoint, the results provide important implications for policymakers and practitioners, particularly in designing more effective carbon accounting frameworks that incorporate both environmental cost measurement and carbon tax mechanisms.

In terms of future research, this study emphasizes the need to further explore the role of environmental cost accounting and carbon taxation as strategic instruments within carbon accounting systems. Additionally, future studies should investigate the integration of carbon accounting within ESG frameworks, as well as the quality and effectiveness of carbon disclosure practices across different institutional contexts. These directions highlight the importance of advancing carbon accounting toward a more integrated, multidisciplinary, and policy-oriented research agenda.

CONCLUSION

The bibliometric analysis and literature review of carbon accounting research focus on the fields of accounting, management, business, economics, econometrics,

and finance. The discussion covers various aspects such as document types, keywords, countries and regions, research institutions, journal distribution, citation analysis, and major research topics in carbon accounting. Research articles are the most dominant document type, comprising 76.89%. This reflects a strong tendency among researchers to publish their findings in article form, which is often the primary medium for disseminating scientific research. Other document types, such as book chapters (11.55%) and conference papers (3.98%), also play important roles, though their percentages are smaller.

Keywords play an important role in understanding the focus and trends of the discussed topics. In addition to the main keyword "carbon accounting," several frequently appearing keywords include "carbon," "climate change," "greenhouse gases," and "carbon emissions." These keywords reflect the close relationship between carbon accounting and broader environmental issues such as climate change and greenhouse gas emissions. Articles discussing carbon accounting show a wide distribution, spanning 59 different countries. This information indicates that the issue of carbon accounting has global relevance and is a concern in various parts of the world. Western Sydney University in Australia holds a dominant position with 12 publications, representing 4.78% of the total articles. This dominance reflects the institution's dedication and focus on carbon accounting studies, as well as Australia's overall contribution to the scientific literature in this field.

A total of 251 carbon accounting articles are distributed across 111 journals with a wide scientific scope, covering fields such as accounting, management, business, economics, econometrics, and finance. This indicates that the issue of carbon accounting is a multidisciplinary topic that attracts interest from various academic perspectives. Articles on carbon accounting have formed citation patterns that reveal interconnections between publications. This citation analysis is useful in understanding how research in this field influences each other and builds knowledge

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