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INTELLECTUAL STRUCTURE OF CARBON EMISSION AND CLIMATE CHANGE IN SUSTAINABILITY REPORTING: A BIBLIOMETRIC ANALYSIS

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ABSTRACT

The research topic of carbon emission and climate change in sustainability reporting were published in the publications used in this study are from 1999 to January 2023. The data discusses intellectual structure of carbon emission and climate change in sustainability reporting in this study came from 96 sources in the form of 79 articles, 2 books, 11 book chapters, 18 conference papers, 1 note, and 11 reviews. R-Biblioshiny in this research was for analysis and data visualization. Furthermore, additional analysis was also carried out using the Vos Viewer. From the network visualization, research related to the influence of carbon emission and climate change has not been done much and works analyzing these influences are still potential recently.

The findings of this study serve as a reference and provide direction for future researchers and provide mapping related to carbon emission and climate change in sustainability reporting. More research in this field and works analyzing these influences are needed moreover about future environmental and sustainability impact. The findings of this study serve as a reference and provide direction for future researchers and provide mapping related to carbon emission and climate change in sustainability reporting. More research on the influence of carbon emission and climate change in this field and works analyzing these influences are needed moreover about future environmental and sustainability impact in accounting scope.

This research topic still has many opportunities to be carried out within the scope of the accounting and finance journal. This research is expected to be able to provide references, especially for Indonesian Researchers who will conduct international publications on similar topics. Limitations this research is mostly based on data processing keywords that are not accompanied by reasons for selecting these keywords. In addition, the data used is limited to articles published on Scopus. Indonesian Researchers are advised to collaborate with more researchers from other countries with very productive researchers related to this topic. Opportunities for international publications will also be bigger if the publication targets journals that have published many works from Indonesian Researchers.

Keywords: *Carbon Emission, Climate Change, Sustainability Reporting*

INTRODUCTION

The increasing interest of global stakeholders in sustainable business practices has led to increased stakeholder demands for companies to report on the environmental and social impacts of their business operations or activities (Shmelev, 2012). Recent findings from KPMG reveal that Sustainability Reporting is continuously growing, with 79 percent of top companies providing Sustainability Reporting. In Sustainability Reporting it includes 3 aspects of ESG, namely environmental, Social, and Governance. Of these three aspects, the environment is one of the company's concerns that must be disclosed. Based on KPMG (2022) that businesses increasingly recognize that they have a role to play in helping to achieve climate goals, with 71% of N100 and 80% of G250 setting targets to reduce carbon emissions.
Most companies realize they must reduce their own emissions to meet carbon targets rather than relying solely on carbon credits (Siao et al., 2022).

Currently, micro-studies on carbon emissions conducted by researchers are often classified into three distinct areas (Su et al., 2023). First, it is an analysis of regulations and activities related to the carbon emissions trading market. Second, focus on the pricing and factors influencing carbon emission rights and their derivatives. Third, the study examines risks related to carbon markets, including policy, price and market risks. By analyzing quantitative data from the literature, this research can contribute to the development of more effective carbon sustainability mechanisms, strategies and reporting.

Since pre-industrial times, climate change affects all regions of the world and brings increasingly severe ecological consequences, such as extreme weather conditions, severe droughts and wildfires. Climate change is likely to cause significant and growing population shifts and will have negative impacts on environmental degradation and environmentally dependent socioeconomic systems. Tackling climate change and transitioning to a low-carbon economy is therefore essential for all governments. Many governments have adopted climate policies to address this problem (Su et al., 2023).

Climate change is caused by global warming, which is closely related to increased CO2 and greenhouse gas (GHG) emissions. To limit climate change, it is important to act on its causes. Accountants' interest in mitigating human-caused global climate change is therefore closely linked to the calculation and reporting of greenhouse gas emissions. The latter is a broad set of information that addresses the impact of human activities and businesses on the climate, such as information on carbon emissions, greenhouse gas (GHG) emissions. and other information (Xhindole & Tarquinio, 2023). Environmental issues concern not only the government but also public and private organizations in various fields of activity. Companies (especially large ones) are responsible for releasing large amounts of polluting emissions into the atmosphere. It is reasonable to expect them to actively participate in reducing these emissions by communicating the activities undertaken to achieve this target and the actual results achieved.

The purpose of this study is to conduct research related to carbon emissions and climate change in sustainability reporting. This article aims to expand knowledge of this research, describe the development of publishing activity and identify the most representative authors and journals. This research also provides insight into potential new directions, it is necessary to explain how well the research has been conducted and what types of research will be conducted in the future. The objective is to map the conceptual structure and evolution of the literature on carbon emissions and climate change in sustainability reporting, identify gaps that need to be filled in sustainable accounting research.

LITERATURE REVIEW

The systematic review of the literature in research work is of great importance to the researcher because they delve into the intellectual domain and develop research questions that enhance their knowledge of the subject. awake. These systematic reviews feature a clear algorithm that allows material selection and evaluation through a transparent and reproducible process, allowing insights into an area of knowledge. Bibliographic measurement studies envision a similarly formal and rigorous process for assuring the quality of the information used (Herrera-Franco et al., 2020). Bibliometric analysis is considered a scientific field by displaying a comprehensive map of the structure of knowledge, evaluating and measuring it, focusing on bibliometric analysis of compiled scientific publications. Throughout the research, using scientific elements from publications such as authors, journals, keywords, references and other bibliographic features, gather information about the field of study. research on its origin, development and trends. The approach taken to carry out bibliometric analysis is structured into four research phases (Herrera-Franco et al., 2020).

To explain the evolution of this research trend and to understand its future direction, this article develops a bibliographic analysis to identify various research areas relevant to this emerging topic. The bibliographic data is then processed using R-biblioshiny to display citation matrices and create and visualize bibliographic networks. In addition, an additional analysis was performed, namely a sensitivity analysis using Vos Viewer.

This study was performed quantitatively using bibliographic analysis. Bibliographic data provide insight into all key elements at the macro-study level, such as author name, publication date (journal source), descriptive characteristics, citation analysis, and are made accessible through the communication process. Bibliometrics is also an instrument for ascertaining the purpose of publication data, which is often used as easy-to-understand mathematical and statistical performance data.

This bibliometric analysis used the Scopus database to collect documentary data related to intellectual structure carbon emission and climate change in sustainability reporting. This data is then filtered again, processed with R-biblioshiny, and additional analysis is carried out, namely, sensitivity analysis using the Vos Viewer. The result is the evolution of publishing activity and identifying the most representative authors and journals related to. The population of this study is articles published in the Scopus database from 1999-January 2023.

METHOD

This bibliometric analysis used the Scopus database to collect document data with the topic of environmental accounting system model in the era artificial intelligence and blockchain technology. Scopus is an extensive multidisciplinary database of publications. Citations and abstracts from various types of publications, such as peer-reviewed papers, journals, books, patents, and conference publications, can be viewed on Scopus. Scopus also has filters such as access type, author name, year, and document type to language, which can be used to make searching easier. In addition, Scopus offers tools for storing document data in the form of citation and bibliographic information and *abstracts* and keywords in RIS, CSV, BibTeX, and plain text formats (Elsevier B.V. A, 2014).

Document data retrieval uses the keywords environmental accounting system model in the era artificial intelligence and blockchain technology. The data was taken in January 2023. This data was then filtered again, only articles in the journal type, open access, were published in english and were in the final stage. Keywords are used to make it easier to find documents with the topic of carbon emission and climate change in sustainability reporting. The bibliometric data is then processed using R-biblioshiny to show the citation matrix and create and visualize the bibliometric network. In addition, an additional analysis was also carried out, namely sensitivity analysis using the Vos Viewer.

DISCUSSION AND RESULTS

From the network visualization, research related to the influence of carbon emission and climate change has not been done much and works analyzing these influences are still potential recently.

1. Main Information

The publications used in this study are from 1999 to January 2023 which discusses carbon emission and climate change in sustainability reporting. The data used in this study came from 96 sources in the form of 79 articles, 2 books, 11 book chapters, 18 conference papers, 1 note, and 11 reviews. More complete data can be seen in Table 1.

Table 1. Main data information

Description	Results
MAIN INFORMATION ABOUT THE DATA	
Timespan	**1999:2023 (Early 2023)**
Sources (Journals, Books, etc.)	**96**
Documents	**122**
Annual Growth Rate %	**13,29**

Document Average Age	**4,33**
Average citations per doc	**19,84**
References	**1**
DOCUMENT TYPES	
article	**79**
book chapter	**11**
Book	**2**
conference paper	**18**
Note	**1**
Review	**11**
DOCUMENT CONTENTS	
Keywords Plus (ID)	**597**
Author's Keywords (DE)	**292**
AUTHORS	
Authors	**392**
Authors of single-authored documents	**17**
AUTHORS COLLABORATION	
Single-authored documents	**18**
Co-Authors per Documents	**3.28**
International co-authorships %	**28,69**

2. Publications and Citation Trends

The earliest publication on Scopus using the keywords carbon emission and climate change in sustainability reporting was in 1999 and continues to increase until January 2023 (Figure 2a). Publications with the topic of keywords carbon emission and climate change in sustainability reporting are the most widely available in 2021. The average publication trend growth with this topic is 1.6.

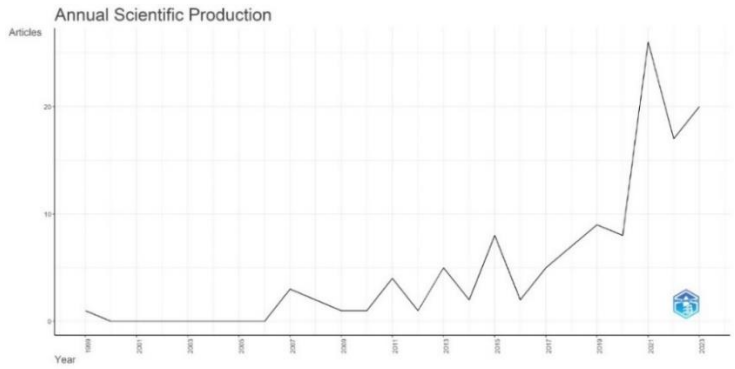

Figure 2a. Average Scientific Production

The trend of publications on keywords carbon emission and climate change in sustainability reporting is increasing from 2016 to 2017. There were as many citations with an average of more than 15, but in 2018 it decreased. There was fluctuating change from 2019 to 2022 with average citations per year more than 5.0 (Figure 2b).

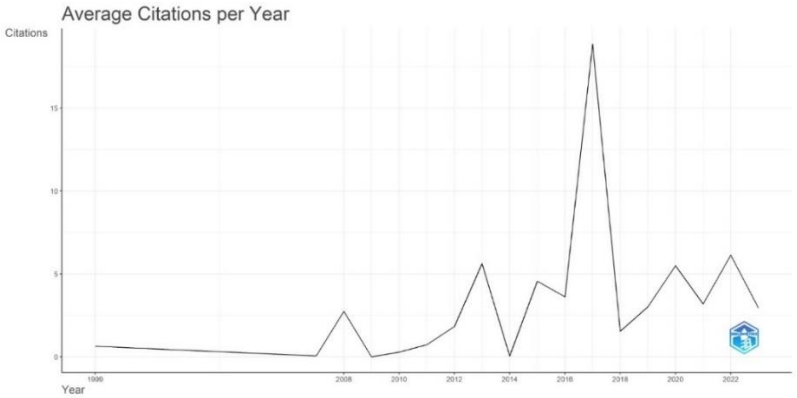

Figure 2b. Average Citations per Year

3. Most Relevant Affiliations and Most Citations

Related to the most affiliation conducted by Swedish University of Agricultural Sciences (SLU) and University of New South Wales as many as 9 documents per each university. Next was carried out by University of Washington as many as 8 documents; University of Manchester as many as 7 documents; Wageningen University as many as 6 documents. The rest ranged from 4-5 documents (Figure 3a).

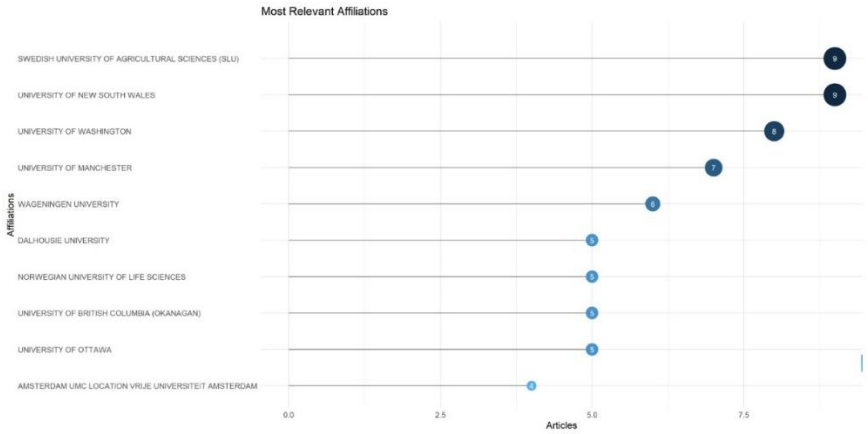

Figure 3a. Most Relevant Affiliations

Based on figure 2b, it can be seen that the most influential publications in terms of the number of global citations are articles courtesy of J Bus Ethics in 2017 as many as 436. *The order of the two articles that were the most widely cited globally also acquired Bublitz FM published in 2019 on Int Environ Res Public Healt with 70 citations, Demstichas published in 2020 on Sustainability with 62 citations (Figure 3b).*

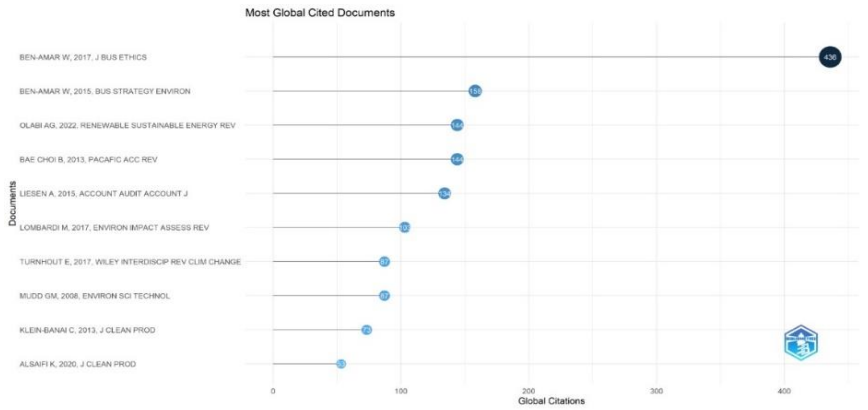

Figure 3b. Most Global Cited Documents

4. Most Relevant Sources

The journals that publish the most articles on the topic of environmental accounting system model in the era artificial intelligence and blockchain technology are the Journals of Sustainability with 4 articles, and continue with Advances in Intelligent Systems and Computing, Green Blockchain Technology for Sustainable Smart, IFIP Advances in Informastion and Commucation Tec with 2 articles each. The rest journals that publish with 1 article each (Figure 4).

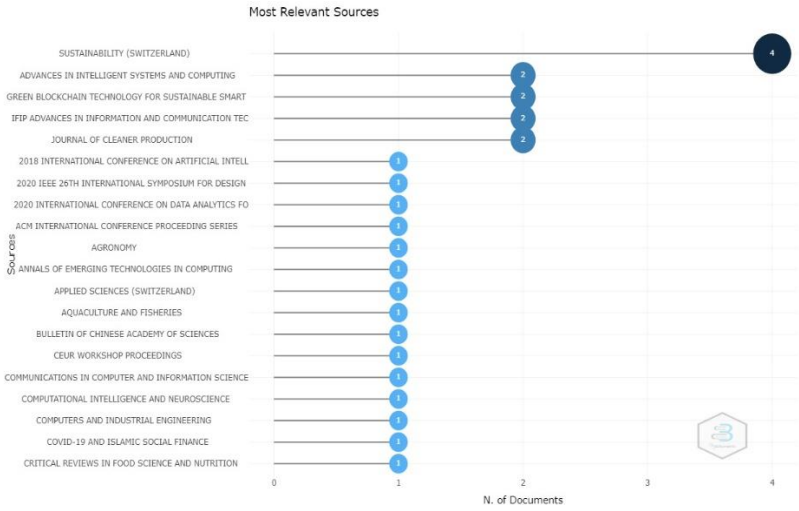

Figure 4. Most Relevant Sources

5. Most Cited Countries

Related to the most influential countries (most citations), led by the Canada with 667 citations, followed by Australia with 359 citations, USA with 178 citations, Sweden with 151 citations, United Arab Emirates with 144 citations, Netherlands with 140 citations, Italy with 103 citations, United Kingdom with 96 citations, Ecuador with 55 citations, and Kuwait with 53 citations. Information is shown in figure 5.

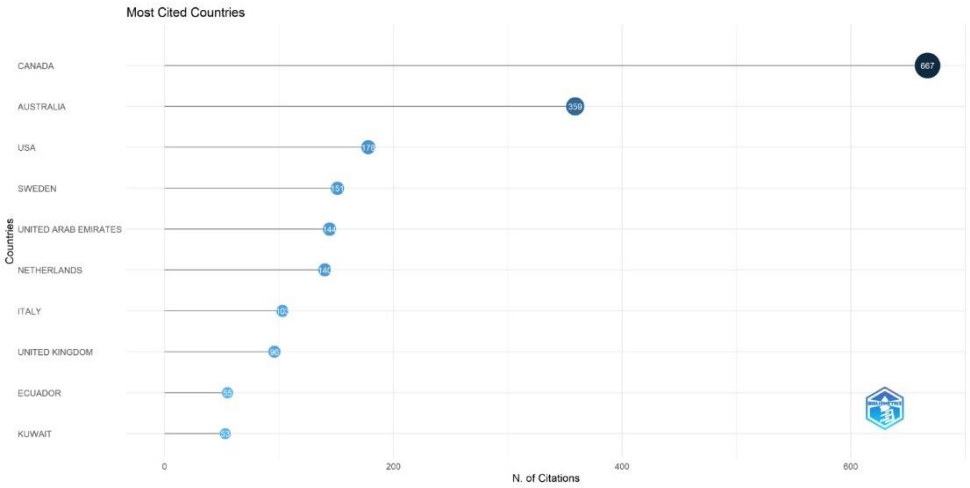

Figure 5. Most Cited Contries

6. Corresponding Author's Country

Related to figure 6 related to the corresponding author, it was found that most were from Australia. Followed by UK, USA, Canada, China, Sweden, Ecuador, India, Italy, Malaysia, Netherlands, South Africa, Turkey, France, Indonesia, Norway, Portugal, Romania, Saudi Arabia. In general, it appears that authors collaborate with other authors in the same country, known as Single Country Publication (SCP), rather than Multiple Country Publication (MCP). Australia, UK, USA, India, Italy, Malaysia, South Africa,

Turkey, Indonesia, Portugal, and Romania are dominated by the SCP, while Netherlands, Ecuador, and Saudi Arabia are dominated by the MCP. Canada, China, Sweden, France, and Norway are dominated by the SCP and MCP.

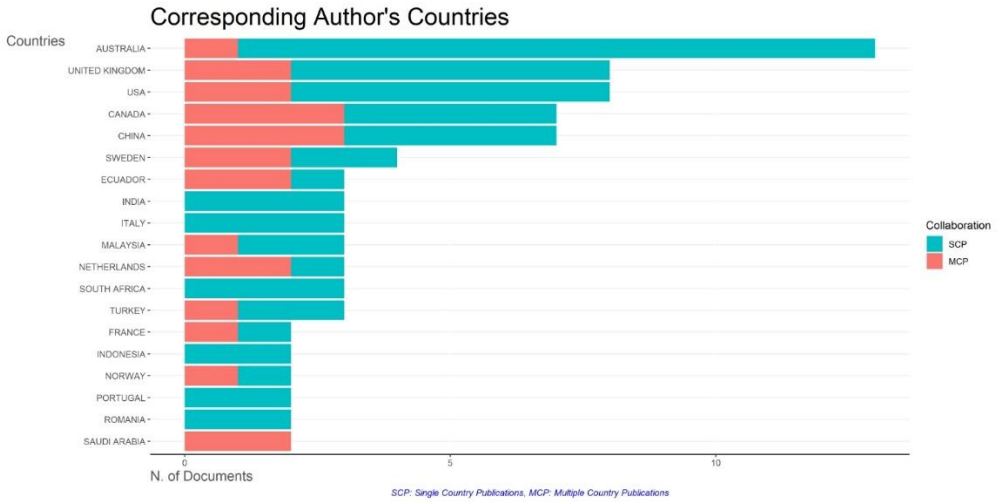

Figure 6. Corresponding Author's Country

7. Most Relevant Author

Figure 7a shows the ten most prolific authors of articles with the key topic of Intellectual Structure of Carbon Emission and Climate Change in Sustainability Reporting. The blue dot shows the number of publications; the bigger the circle size, the more the number of publications. Meanwhile, the color density shows the number of citations; the darker the color, the more citations. The author's productivity picture shows that the top rank is occupied by Ben-Amar W, Marello P, Zorio-Grima A, followed by Blujdea V, Mcillkenny P, Andelkareem MA, Abhayawansa S, Abreu Mcsd, Adhikariparajuu M, Agung Uigk.

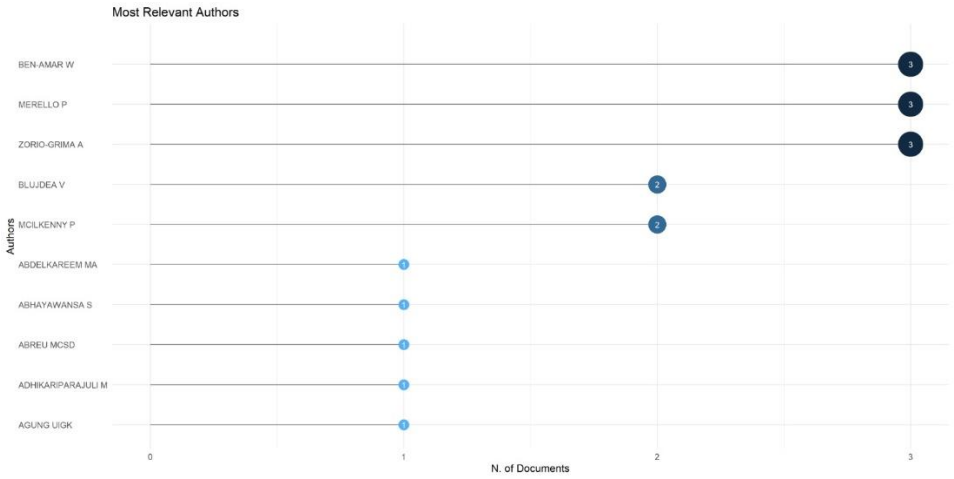

Figure 7a. Most Relevant Authors

8. Trend Topics

Figure 8 shows that there has been trend topics between 2010 until early 2023. Data analytics became trend topics in 2022 until early 2023. Global Warming 2012 till early 2023, Climate Change from 2017 till 2021, carbon emission from 2018 till 2021, economic and social effects from 2010 till 2020 and followed trend topics of Carbon Emission and Climate Change such as Greenhouse Gas Emissions, Carbon Footprint, Sustainable Development, Environmental Sustainability, etc.

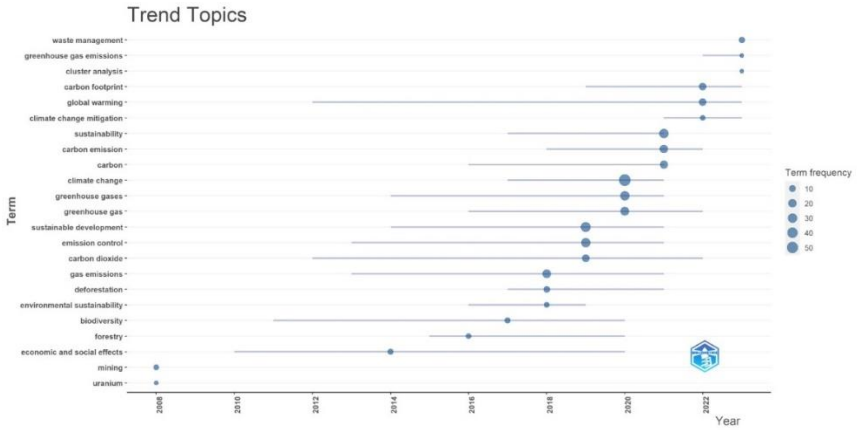

Figure 8. Trend Topics

9. Keywords

In figures 9 it shows that the keywords that are widely used are climate change as many as 57 articles, then sustainable development 35 articles, then greenhouse gases and sustainability as many as 30 articles, then emission control as many as 29 articles, and greenhouse gas, gas emission, carbon, carbon, dioxide as many as about +/-20 articles.

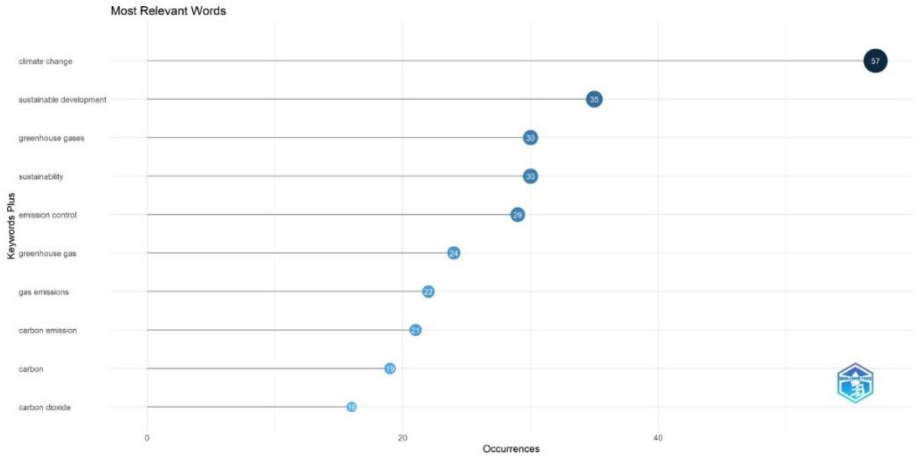

Figure 9. Most Relevant Words

10. Conceptual Structure

Furthermore, additional analysis was also carried out using the Vos Viewer. The research results show sustainability, carbon emission, environmental policy is still an interesting topic to research until now, as indicated by the trend of annual publications. However, specific research directions show that intellectual structure of carbon emission and climate change in sustainability reporting still potential to discuss. Even though research abour carbon emission and climate change in sustainability reporting between has been studied before. The bigger the keyword writing, it shows that the keyword has various associations with other keywords (Figure 10).

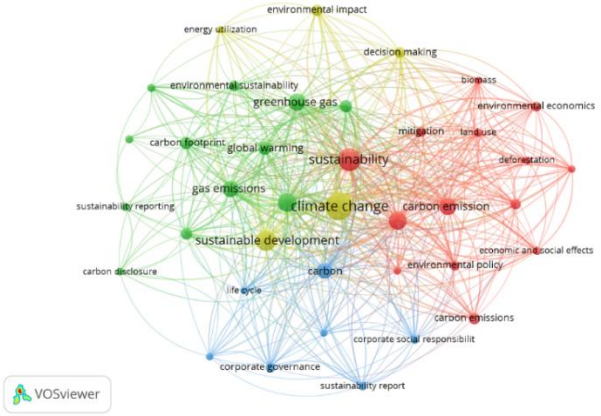

Figure 10. Thematic Map Vos Viewer (Co Occuranceship)

11. Density Visualization

Additional analysis with VosViewer was performed to confirm the systematic literature review results with Biblioshiny. Figure 11 shows some authors regarding that carbon emission and climate change in sustainability reporting. Climate change, carbon emission, sustainability, greenhouse gas, sustainable development is the potential topic. Future research can follow the trend of this topic because previous researchers have not widely studied it.

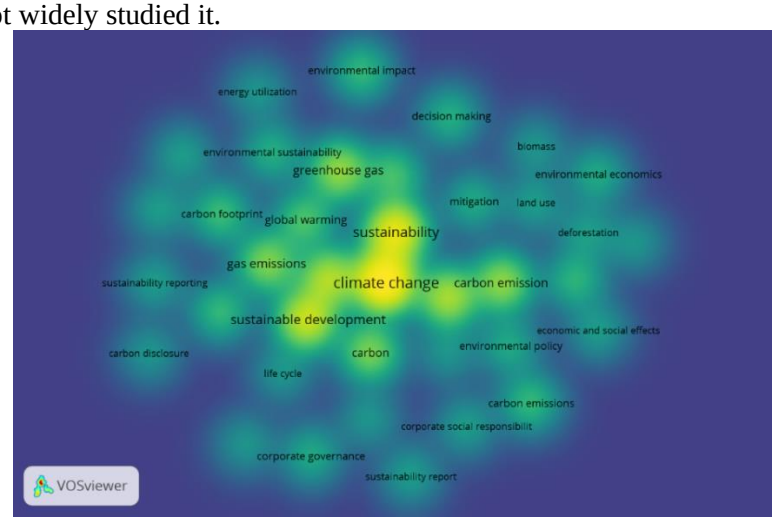

Figure 11. Network Visualization Vos Viewer (Co Occurance)

CONCLUSION

Articles with the topic of carbon emission and climate change in sustainability reporting were published in the publications used in this study are from 1999 to January 2023 (Early 2023). The data discusses intellectual structure of carbon emission and climate change in sustainability reporting in this study came from 96 sources in the form of 79 articles, 2 books, 11 book chapters, 18 conference papers, 1 note, and 11 reviews. R Biblioshiny in this research was for analysis and data visualization. Furthermore, additional analysis was also carried out using the Vos Viewer. From the network visualization, research related to the influence of carbon emission and climate change has not been done much and works analyzing these influences are still potential recently.

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REFERENCES

Elsevier B.V. A. (2014). *Scopus-quick-reference-guide (2014)*. 14.

Herrera-Franco, G., Montalván-Burbano, N., Carrión-Mero, P., Apolo-Masache, B., & Jaya-Montalvo, M. (2020). Research trends in geotourism: A bibliometric analysis using the scopus database. *Geosciences (Switzerland)*, *10*(10), 1–29. https://doi.org/10.3390/geosciences10100379

Shmelev, S. E. (2012). Ecological economics: Sustainability in practice. *Ecological Economics: Sustainability in Practice*, *January 2012*, 1–243. https://doi.org/10.1007/978-94-007-1972-9

Siao, H. J., Gau, S. H., Kuo, J. H., Li, M. G., & Sun, C. J. (2022). Bibliometric Analysis of Environmental, Social, and Governance Management Research from 2002 to 2021. *Sustainability (Switzerland)*, *14*(23). https://doi.org/10.3390/su142316121

Su, L., Yu, W., & Zhou, Z. (2023). Global Trends of Carbon Finance: A Bibliometric Analysis. *Sustainability (Switzerland)*, *15*(8). https://doi.org/10.3390/su15086784

Xhindole, C., & Tarquinio, L. (2023). Climate change reporting: a systematic literature review. *International Journal of Global Environmental Issues*, *22*(1), 60–88. https://doi.org/10.1504/IJGENVI.2022.10052469