









Strategic Role of Climate Finance: A Bibliometric Analysis

Nurul Afifah¹ , Nugraha Nugraha² 
Imas Purnamasari³ , Yayat Supriatna⁴ 
Agus Rahayu⁵  and Lili Adi Wibowo⁶ 

^{1,2,3,4,5,6} Universitas Pendidikan Indonesia, Bandung, Indonesia
nurul.afifah@upi.edu

Abstract. This research aims to conduct a bibliometric analysis of climate finance articles published during the period of 2014 to 2023. The Scopus database was utilized to gather information on studies related to climate finance. A total of 4708 articles were collected with the keyword climate finance. A selection of 1110 document articles were determined to be suitable for analysis in this research endeavor. Climate finance research continues to grow year after year. This study identified the contributions of authors, journals, countries, keywords, and articles using bibliometric analysis. Several countries have contributed to publications of climate finance. The largest contribution came from the United Kingdom. The journal that has published the most articles related to climate finance is Sustainability Journal (Switzerland). Monasterolo, I stand out as the most cited author. The most prominent keyword is Climate Change. Climate finance plays an important role in supporting climate change mitigation and adaptation activities. It can be said that climate finance is the core of sustainable finance.

Keywords: Climate Change, Climate Finance, Sustainability.

1 Introduction

The issue of climate change has garnered substantial attention in recent years due to the increasing frequency and severity of extreme weather events. Consequently, the depletion of moisture in the soil has become a growing concern, as it hinders crop cultivation and contributes to land desertification. The primary cause of this phenomenon is the lack of rainfall [1]. Climate change is a matter of paramount importance that has the potential to impact the health and welfare of every person on the planet [2]. Climate finance is the study of domestic and worldwide funding of public and private investment to promote climate change mitigation and adaptation [3].

Baiardi's research shows, an order magnitude greater of the participants feel that asset markets are underestimating rather than overestimating climate risks [4]. There exist physical, regulatory, and technical climate-related concerns that have the potential to adversely impact the outcomes of multiple investment management clients,

pension beneficiaries, and institutional investors shareholders. These concerns can broadly be categorized as portfolio company risks [5].

In recent years, bibliometric analysis has seen a major increase in popularity in the field of business research [6]. The objective of this study is to analyze the collection of literature by using quantitative metric indicators such as citations, authorship, and patterns concerning institutions and geographic areas of bibliographic substances (such as articles, books, review papers, and proceedings), which are frequently observed over a specific time period [7]. The data gathered on May, 15th 2023 from the Scopus data-base.

The goal of this research is to use bibliometric analytic methodologies to acquire a comprehensive understanding of climate finance. The study's findings will be disclosed by answering the following questions:

RQ 1: How is the trend of climate finance in academic journals?

RQ 2: What country has the most contribution to the development of this study?

RQ 3: Which journals have the most publications in climate finance?

RQ 4: Which authors have the most citations in climate finance publications?

RQ.5: Which keywords are the most prominent subject to climate finance publication?

RQ.6: How climate finance plays a role in sustainable development?

2 Method

The bibliometric analysis used in this study went through 4 stages including: setting criteria and searching for information sources, limiting data, processing data using softwares such as open refine, tableau desktop, and vos viewer, and the last stage is analyzing and interpreting data. This quantitative technique is frequently used to map scholarly literature in order to discover patterns and trends [8]. This procedure entails obtaining information on the type of publication, title, keywords, authors, and countries [9]. Noyons defines bibliometrics as two key procedures: performance analysis and science mapping [10]. This is critical for filtering articles within a multidisciplinary bibliographic database to ensure that they are relevant to the issue under inquiry [11].

3 Result and Discussion

The Scopus database was chosen because of its most comprehensive collection of scientific publication citations and abstracts in the world [12]. To get the highest level of accuracy in study findings, researchers must choose appropriate and relevant keywords [13]. The selection of keywords has a direct impact on the outcome of findings in a bibliometric research study [14]. Several studies have found that climate finance is an important influencing factor in sustainability and has a major impact on climate change [15]. While the majority of the bibliometric data looks to be correct, there are still numerous instances of duplicate meta data with numerous keywords and article keywords, hence Open Refine software is critical for resolving this issue [16]. The

study's findings are presented using VOS Viewer, which displays graphs, tables, and maps that make use of the program's network visualization capabilities [17]. The frequency of journal article publications is studied in a bibliometric analysis, which takes into account characteristics such as the country of origin, the publisher, the author, and the most often referenced or cited articles [18]. The results are displayed as a network graph with nodes representing the keywords and network lines establishing relationships between those nodes [19]. The strength of keyword associations is visually depicted by lines indicating common keyword co-occurrences, while the network overlay displays the scope of these connections [20]. The utility of bibliometric analysis stems from its capacity to provide a thorough grasp of a certain field of research [21]. The assessment of qualitative and quantitative includes tasks like developing a publication profile for a certain topic and examining the structural and trend aspects of research undertaken in a specific field [22]. Theoretical frameworks elucidating climate finance are increasingly utilized to shed light on specific phenomena [23].

After a thorough examination of the data collection, a selection of 1110 document articles were determined to be suitable for analysis in this research endeavor. The study spans the years 2014 to 2023. Climate finance research continues to grow year after year. In 2014, the number of research on climate finance was 27 articles. The major growth began in 2020 and culminated in 2022 with 277 articles. The data shows that there was a very steep fall in 2023 due to the research shut off on May 15, 2023. As of that date, there were 149 articles. This indicates that 2023 is still highly possible to expand the number of climate finance research projects.

The data analysis reveals the identification of 51 distinct countries that publish articles. Table 1 shows that the United Kingdom held the lead in terms of contributing to these publications, with 287 articles. The United States published the second greatest number with 230 articles. Germany, China and Netherlands each generated 147, 112 and 98 articles.

Table 1. 5 countries with the most publication

Country	No. of publication
United Kingdom	287
United States	230
Germany	147
China	112
Netherlands	98

As delineated in Table 2, the most productive, contributive, and influential journals within these subjects are highlighted. In the first place is Sustainability (Switzerland) journal with 105 publications, follow by Climate Policy, Climate Change, Energies, and Environmental Research Letters journal with 57, 28, 26, and 18 publications respectively.

Table 2. 5 Journals with the most contribution in publication.

Journal	No. of Publication
Sustainability (Switzerland)	105
Climate Policy	57
Climate Change	28
Energies	26
Environmental Research Letters	18

Moreover, out of the 1110 articles identified in this study, Monasterolo I stand out as the most cited author with a total citation count of 471. The second most cited author is Schmidt T.S with a total of 311 citations, trails notably behind the top cited author. Steffen B., come in third with 303 citations in this field. Subsequently, Zenghelis D with 283 citations, Pauw W.P has 218 citations, Volz U with 216 citations, Mushtaq S has 205 citations, Koh L.P with 200 citations, Shahbaz M with 192 citations, and Rogelj J. with a total of 179 citations, occupy the top 10 cited authors.

VOS viewer software is used to create an interactive link map showing which keywords appear together most often. Table 3 shows that the keyword "climate change" appears most often, showing up 85 times. The second most common keyword is "green finance" which is used 60 times. Other frequently appearing keywords include "sustainable development goals" 49 times, "sustainability" 49 times, "sustainable finance" 43 times, "renewable energy" 39 times, "Paris agreement" 31 times, "climate finance" 28 times, "redd+" 26 times, and "mitigation" 23 times. These ten keywords have had a significant impact on this study. Climate finance is the eighth most often used research keyword.

Table 3. 10 most prominent keywords.

Keyword	Appearance
Climate Change	85
Green Finance	60
Sustainable Development Goals (SDG)	49
Sustainability	49
Sustainable Finance	43
Renewable Energy	39
Paris Agreement	31
Climate Finance	28
Redd+	26
Mitigation	23

Climate finance study begins with the phenomenon of climate change. Climate finance plays an important role in supporting climate change mitigation and adaptation activities in The Paris Agreement objectives. Meanwhile, green finance funds environmental goals consisting of Paris Agreement objectives and other environment related goals. Broadly defined, SDG finance supports the Sustainable Development Goals, which consist of environmental goals, social goals, economic goals and other

SDGs. The broadest scope is sustainable finance that funds the SDGs and other sustainability related policy objectives. It can be said that climate finance is the core of sustainable finance.

4 Conclusion

This research aims to undertake a bibliometric analysis of climate finance publications between the years 2014 and 2023. The Scopus database was utilized to gather information related to climate finance studies. The number of climate finance articles has been steadily increasing year after year, with a significant rise from 2020 to 2022. However, in 2023, there was a decline in the number of publications due to the research being halted on May 15th of that year. Despite this, it is still possible for the number of climate finance research projects to expand in 2023. A total of 4,708 articles were collected using the keyword "climate finance." The United Kingdom contributed the most to the research with 287 papers, while the Sustainability Journal (Switzerland) published the most articles related to climate finance with 105 papers. The most cited author was Monasterolo I. with 471 citations, and the most frequently used keyword was "Climate Change." Climate finance plays a critical role in supporting climate change mitigation and adaptation activities, and can be considered the core of sustainable finance.

References

1. Mikhaylov, A., Moiseev, N., Aleshin, K. & Burkhardt, T. Global climate change and greenhouse effect. *Entrep. Sustain. Issues* 7, 2897–2913 (2020).
2. Giglio, Stefano; Kelly, Bryan; Stroebl, J. Climate Finance. *Annu. Rev. Financ. Econ.* 13, 15–36 (2021).
3. Hong, H., Karolyi, G. A. & Scheinkman, J. A. Climate finance. *Rev. Financ. Stud.* 33, 1011–1023 (2020).
4. Baiardi, D. What do you think about climate change? *J. Econ. Surv.* (2022) doi:10.1111/joes.12535.
5. Krueger, P., Sautner, Z. & Starks, L. T. The importance of climate risks for institutional investors. *Rev. Financ. Stud.* 33, 1067–1111 (2020).
6. Khan, M. A. et al. Value of special issues in the journal of business research: A bibliometric analysis. *J. Bus. Res.* 125, 295–313 (2021).
7. Donthu, N., Kumar, S., Mukherjee, D., Pandey, N. & Lim, W. M. How to conduct a bibliometric analysis: An overview and guidelines. *J. Bus. Res.* 133, 285–296 (2021).
8. Zhang, L. & Eichmann-Kalwara, N. Mapping the Scholarly Literature Found in Scopus on “Research Data Management”: A Bibliometric and Data Visualization Approach. *J. Librariansh. Sch. Commun.* 7, 0–19 (2019).
9. Li, Y. et al. Environmental Concerns and Pollution Control in the Context of Developing Countries A comprehensive review on green buildings research: bibliometric analysis during 1998-2018. 46196–46214 (2021).
10. Noyons, E. C. M., Moed, H. F. & Luwel, M. Combining mapping and citation analysis for evaluative bibliometric purposes: A bibliometric study. *J. Am. Soc. Inf. Sci.* 50, 115–131 (1999).

11. Chen, X., Zou, D., Xie, H. & Wang, F. L. Past, present, and future of smart learning: a topic-based bibliometric analysis. *Int. J. Educ. Technol. High. Educ.* 18, (2021).
12. Carrión-Mero, P., Montalván-Burbano, N., Herrera-Narváez, G. & Morante-Carballo, F. Geodiversity and mining towards the development of geotourism: A global perspective. *Int. J. Des. Nat. Ecodynamics* 16, 191–201 (2021).
13. Gusenbauer, M. & Haddaway, N. R. Which academic search systems are suitable for systematic reviews or meta-analyses? Evaluating retrieval qualities of Google Scholar, PubMed, and 26 other resources. *Res. Synth. Methods* 11, 181–217 (2020).
14. Armitage, C. S., Lorenz, M. & Mikki, S. Mapping scholarly publications related to the sustainable development goals: Do independent bibliometric approaches get the same results? *Quant. Sci. Stud.* 1, 1092–1108 (2020).
15. Richardson, B. J. The evolving marketscape of climate finance. *Clim. Law* 4, 94–106 (2014).
16. Anjan Pal & Mukhopadhyay, P. Fetching Automatic Authority Data in ILS from Wikidata via OpenRefine. *SRELS J. Inf. Manag.* 353–362 (2022) doi:10.17821/srels/2022/v59i6/170677.
17. Al Husaeni, D. F. & Nandiyanto, A. B. D. Bibliometric Using Vosviewer with Publish or Perish (using Google Scholar data): From Step-by-step Processing for Users to the Practical Examples in the Analysis of Digital Learning Articles in Pre and Post Covid-19 Pandemic. *ASEAN J. Sci. Eng.* 2, 19–46 (2021).
18. Suzan, V. & Suzan, A. A. A bibliometric analysis of sarcopenia: top 100 articles. *Eur. Geriatr. Med.* 12, 185–191 (2021).
19. Luckyardi, S., Hurriyati, R., Disman, D. & Dirgantari, P. D. The Influence of Applying Green Marketing Mix by Chemical Industries; VOSviewer Analysis. *Moroccan J. Chem.* 10, 73–90 (2022).
20. Finandhita, A., Mega, R. U., Jumansyah, R., Rafdhi, A. A. & Oktafiani, D. VOSviewer Application Analysis: Computational Physical Chemistry Case Study. *Moroccan J. Chem.* 10, 91–101 (2022).
21. Yang, W., Zhang, J. & Ma, R. The prediction of infectious diseases: A bibliometric analysis. *Int. J. Environ. Res. Public Health* 17, 1–19 (2020).
22. Deng, Z., Wang, H., Chen, Z. & Wang, T. Bibliometric Analysis of Dendritic Epidermal T Cell (DETC) Research From 1983 to 2019. *Front. Immunol.* 11, 1–17 (2020).
23. Zhang, L., Ling, J. & Lin, M. Artificial intelligence in renewable energy: A comprehensive bibliometric analysis. *Energy Reports* 8, 14072–14088 (2022).

Open Access This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits any noncommercial use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

