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Bibliometric Review of Climate Change Adaptation Financing

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ABSTRACT

The objective of the current study is to investigate the intellectual structure, evolution of themes, and research collaboration within the research area of climate change adaptation finance through bibliometric analysis. In this regard, data were gathered from the Scopus database and analyzed through VOSviewer in order to investigate co-authorship network structure, citation network structure, and keywords cocitation patterns. It was found that the conceptual development of the research area takes place in the context of core themes, such as climate change, adaptation, and finance; however, it also evolves beyond these themes into interdisciplinarity of topics, such as risk management, sustainability, governance, and environmental economics. The trend in the analysis of keywords demonstrates the evolution of research themes from the initial focus on economy and policy to the later focus on investment, adaptive management, and adaptation in specific sectors. Finally, the analysis of co-authorship and institutional affiliations demonstrates that the research area of climate change adaptation finance is concentrated within a limited number of clusters with contributions coming primarily from the United States and other institutions; however, the participation of developing countries in this research area is increasing.

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1. INTRODUCTION

Climate change has become one of the biggest issues that the world faces in the 21st century, impacting not only ecological systems but also economy and well-being of human populations. With the temperature increase and more frequent occurrence of weather-related phenomena, the risks for populations living in such areas have risen dramatically [1]. Mitigation initiatives work on reducing the number of greenhouse gases in order to prevent future consequences, whereas adaptation has become a necessity for societies to cope with climate change effects [2].

The notion of adaptation finance is used to describe the financial resources directed to actions aimed at reducing vulnerability and increasing adaptive capacity [3]. Such resources can be sourced from various places, including international funding sources, national coffers, private sector investment, and creative financial mechanisms. Within the last decade, the importance of raising considerable financial flows for adaptation has been highlighted by

the international community through the provisions of the Paris Agreement. However, despite those promises, there continues to persist an adaptation finance gap between the cost of adaptation and allocated funds [4]–[6].

However, in recent times, the field of adaptation financing has evolved into a highly fragmented and multifaceted environment. Multilateral climate funds, bilateral aid organizations, development banks, and private organizations play their role in providing finance for adaptation projects. Furthermore, new channels for raising finance include green bonds, climate insurance, and blended finance. The challenge with fragmented sources of finance and inconsistent definitions and measurement of finance hinders the tracking and evaluation process of finances [7].

A significant body of scholarly work has been produced related to financing climate change adaptation activities in recent years. The areas covered by this academic work include issues of distribution of funding, impact analysis of adaptation programs, governance frameworks, and the constraints involved in the access to finances. However, despite the rapid rise in scholarly studies on this topic, the body of literature is still highly fragmented across various disciplines, such as environmental science, economics, development, and public policies.

A bibliometric study is a methodology that allows for a structured and numerical examination of large amounts of scientific literature. Through the examination of publication trends, citation patterns, and co-occurring keywords, bibliometric analysis enables researchers to identify the underlying intellectual architecture and dynamics of any research area. Using bibliometric analysis in the context of adaptation financing in relation to climate change would yield important information regarding the development of the research area, its key researchers, and significant themes.

Even as more literature emerges on the issue of finance in climate change adaptation, there still seems to be a notable absence of a thorough and systematic review of this area of study. Most of the studies have a narrow focus, either on particular facets of finance for climate change adaptation, regions where such adaptations take place, or methods of financing climate change adaptations. This creates problems when attempting to integrate the findings from the studies due to the inconsistency in terms used, research methods employed, and even standards of information presentation. It thus becomes difficult to navigate through the subject matter without an understanding of its trends and themes.

The main purpose of the present study is the implementation of bibliometric analysis on literature about the financing of climate change adaptation. This will be done to systematically examine the evolution of the field, detect important trends in research, and reveal the most influential researchers and topics in the field. It is assumed that through bibliometric analysis of publications, citations, and keywords, it will be possible to detect the history of development and intellectual structure of the scientific domain.

2. METHODS

The research will employ bibliometric research methodology in order to conduct a systematic review of literature dealing with climate change adaptation financing. Bibliometric analysis involves the application of quantified methods in the examination of scientific literature, which includes aspects such as authorship, citation networks, and the development of themes in a given area of research. The use of bibliometric analysis helps in uncovering critical works and scholars as well as developing trends in a given field of research. In this case, bibliometric analysis will be enhanced through the use of descriptive and network analysis methods.

The source of data used in this research will include Scopus that have gained recognition due to their vast collections of scientific journals and conference papers. A search methodology will be adopted through the use of keywords such as “climate change adaptation,” “adaptation finance,” and “climate finance adaptation” using Boolean

operators. There will be inclusion criteria put into practice, which will include consideration of only journal papers, conference papers, and review papers written in English during a specific period of time. The retrieved data will undergo further screening in order to eliminate duplicates and irrelevant sources.

The analyses are carried out through the application of VOSviewer, which make it possible to visualize and interpret the relationships existing in the data set. The methods applied in the analysis process include citation analysis, which is used to determine the most cited articles, co-authorship analysis, which helps to investigate the networks of collaboration between scholars, and keyword co-occurrence analysis, which enables the identification of research areas and trends. Temporal analysis is also applied in order to analyze the progress of research on the topic over time.

3. RESULTS AND DISCUSSION

3.1 Keyword Co-Occurrence Network

The co-occurrence network of keywords is a graphic depiction of the underlying concept structure used to study the issue of climate change adaptation financing. Through the use of keyword frequencies and co-occurrences, the analysis sheds light on the interconnections among key themes, which themes prevail in the discourse, and how research streams merge together within the discipline. The classification of keywords into specific clusters with different color codes highlights the existence of subdomains within themes, thus providing a structured view of the development of literature on the topic.

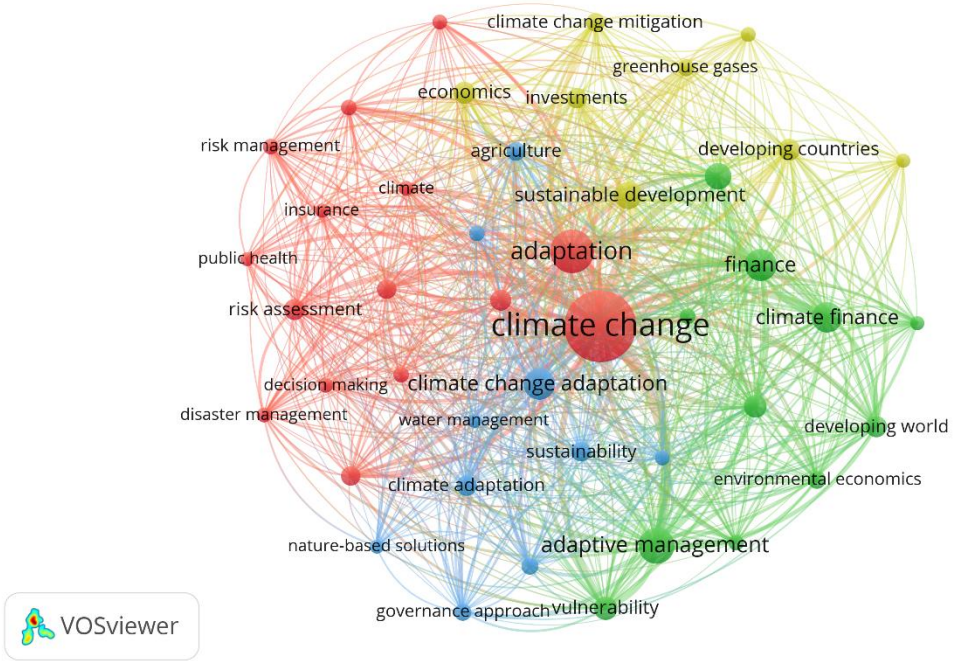

Figure 1. Network Visualization
Source: Data Analysis Result, 2026

Perhaps the most notable aspect of the network is its emphasis on the importance of the concept of "climate change", which is represented by the largest node and operates as the key hub from which different thematic clusters emerge. Its prominence suggests that the literature is still largely focused on the general climate context and has not yet become excessively specialized. Associated with "climate change" are the terms

“adaptation” and “climate change adaptation”. This association shows that the process of financing for climate change adaptation has been deeply incorporated into the broader topic of climate change research.

It can be seen that the red cluster symbolizes a risk-based and policy-driven perspective. Words like “risk assessment,” “risk management,” “insurance,” “disaster management,” and “decision making” reflect the dominant concern with the management of risks and vulnerabilities related to the climatic change. It shows that a considerable proportion of studies considers financing for adaptation in relation to mechanisms associated with risk management and resilience building. Another indicator showing the connection between adaptation financing and socio-environmental risks is represented by the inclusion of the word “public health” in the red cluster.

The green cluster is highly connected to the financial and economic aspects of adaptation to climate change. The presence of the keywords "finance," "climate finance," "environmental economics," and "developing countries" confirms the financial nature of this knowledge stream. The term "developing world" further highlights the geographical dimension of the topic, implying that studies dealing with adaptation financing tend to be focused mainly on developing nations.

The cluster of blue color depicts a governance and sustainability-focused viewpoint. Key terms like “adaptive management,” “water management,” “sustainability,” “vulnerability,” and “governance approach” show that the cluster emphasizes institutions and adaptive measures. It stresses the significance of aligning financial strategies with governance and environmental management systems. The term “nature-based solutions” points to an increasing trend towards sustainable and ecological adaptation methods within academic literature.

The yellow group seems to link economic development and mitigation issues with adaptation funding. The keywords "sustainable development," "greenhouse gases," "climate change mitigation," "investment," and "agriculture" imply that there is some intersection between the adaptation and mitigation agenda. This implies that the research is now increasingly acknowledging the mutual dependency in relation to cutting down on emissions and adaptation funding. The presence of "economics" and "investment" further underscores the influence of financing in mitigating climate change impacts.

Visualization of co-occurrence of keywords using an overlay shows the chronological development of the themes under study in the context of financing adaptation to climate change. In this analysis, each color is assigned according to the mean publication year of every keyword. Early research areas in this study are marked by shades of dark blue, whereas newer ones are colored green up to yellow. Such visualization helps to trace developments in the studied area, including the identification of basic and newer research themes.

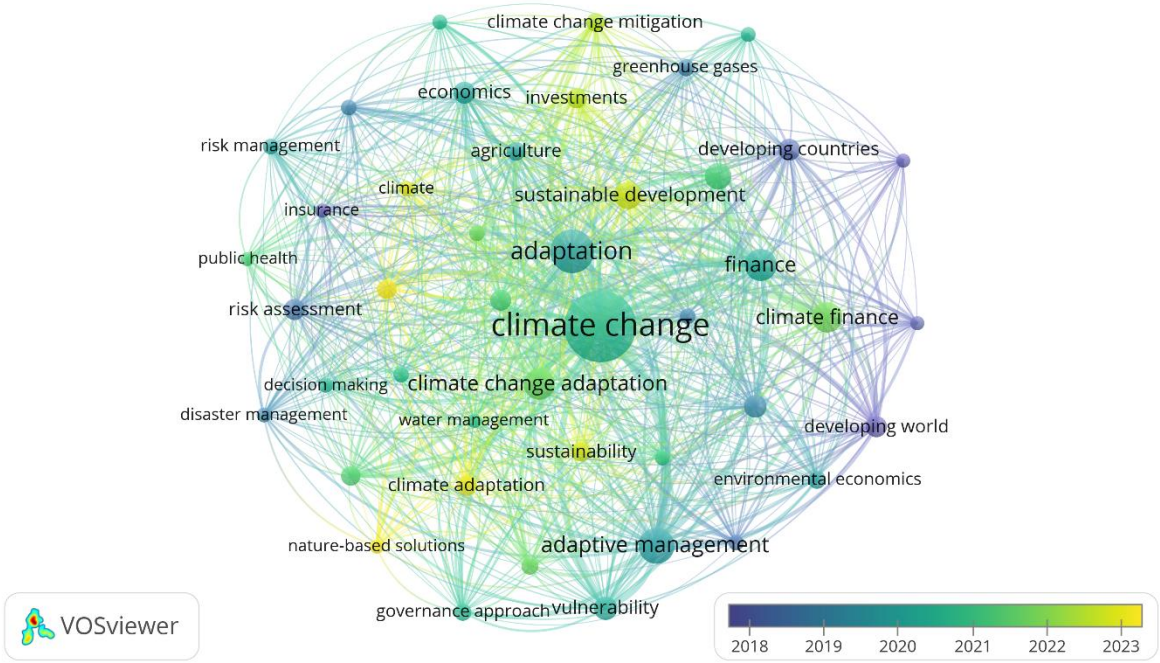

Figure 2. Overlay Visualization
Source: Data Analysis Result, 2026

The key words like "climate change," "adaptation," and "climate change adaptation" are highlighted in greenish colors, showing their persistence through the whole period under investigation. These words represent steady points in the literature, serving as bridges between different research fields during all times. Around these main keywords, one can find some less fresh words like "climate finance," "developing world," and "environmental economics." It means that initial research work was mainly focused on the creation of economic and geographic preconditions for the funding of adaptation.

As the research advances, the direction tends towards integration and sustainability-related themes. The terms “sustainable development,” “finance,” “adaptive management,” and “sustainability” can be seen in green hues, showing how prominent these terms have become in recent years. This shows that the discussion has gone past basic economic issues and now embraces a broader perspective that includes governance and environmental management. “Adaptive management” is another term gaining popularity among these keywords, indicating an increase in flexible approaches to coping with climate change challenges.

The newer emerging topics are highlighted in yellow color such as “risk assessment,” “investments,” and also “agriculture” to some extent. These are just a few topics which denote the shift towards implementation and financial decisions in relation to the subject area under consideration. With the emergence of such topics in the later period, one could easily gauge that the research arena is shifting towards application and operational aspects of the issue at hand.

The density map shows the frequency and strength of connection among keywords used in the research on funding for climate change adaptation. Lighter zones show keywords that occur more often and have greater connections between them, whereas darker zones reveal less prevalent or peripheral issues. The density map serves as an effective tool in highlighting well-established research themes as well as secondary themes that make up the intellectual framework of the field.

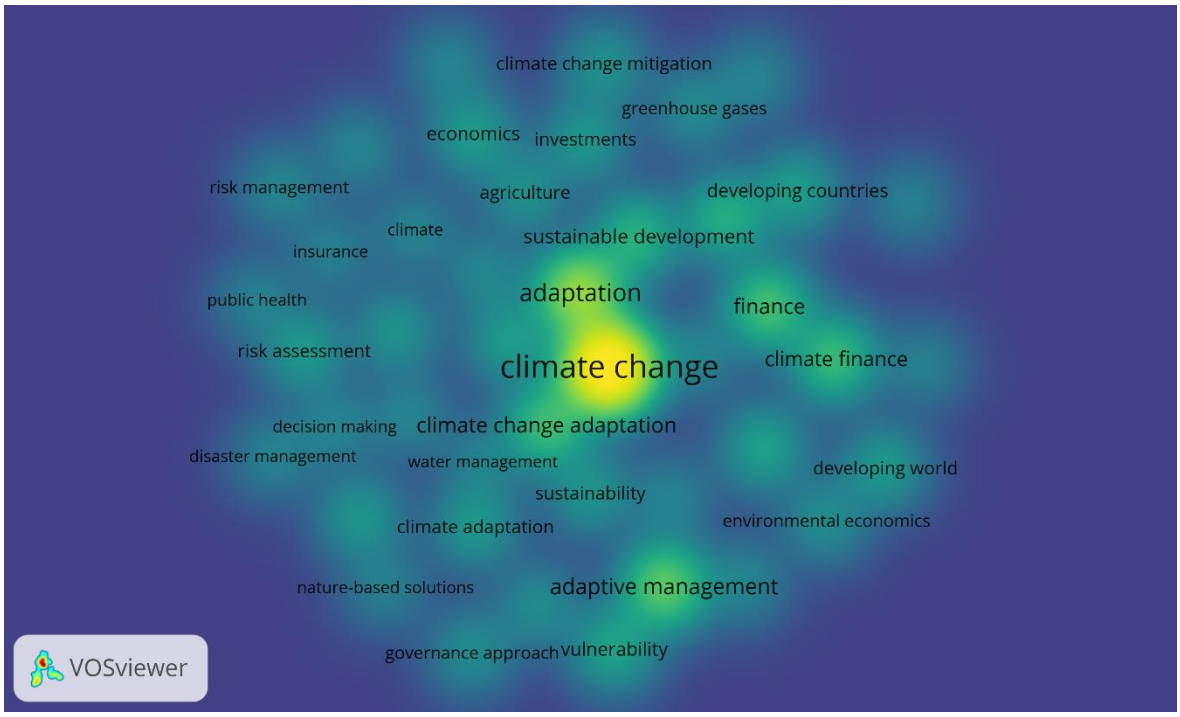

Figure 3. Density Visualization
Source: Data Analysis Result, 2026

This is because the highest density and concentration cluster exists in the keyword "climate change." The keywords related to it including "adaptation," "climate change adaptation," "finance," and "climate finance" reflect the strong structure and organization of the research domain in relation to the interrelation of climate-related hazards, adaptation measures, and financial processes. These clusters reflect the fact that most scholars examine adaptation finance as part of climate change rather than as an independent issue.

It is also apparent that some other moderately dense clusters exist near "adaptive management," "sustainable development," "risk assessment," "vulnerability," "developing countries," and "environmental economics." This indicates the involvement of concepts of governance, development, risks, and equity in the subject matter. On the other hand, there seem to be relatively less dense clusters near "nature-based solutions," "public health," "insurance," and "disaster management."

3.2 Citation Analysis

This subsection analyzes the citation patterns within the body of literature to identify the most influential publications in climate change adaptation financing research.

Table 1. Top Cited Research

Citations	Authors and year	Title
813	[8]	Climate change 2014 impacts, adaptation, and vulnerability Part B: Regional aspects: Working group ii contribution to the fifth assessment report of the intergovernmental panel on climate change
782	[9]	The 2018 report of the Lancet Countdown on health and climate change: shaping the health of nations for centuries to come
477	[10]	Increasing stress on disaster-risk finance due to large floods
435	[11]	Nature-based solutions for urban climate change adaptation: Linking science, policy, and practice communities for evidence-based decision-making

Citations	Authors and year	Title
316	[12]	Climate finance
298	[13]	Keys to successful blue carbon projects: Lessons learned from global case studies
285	[14]	A typology of adaptation actions: A global look at climate adaptation actions financed through the Global Environment Facility
259	[15]	The Role of Hydropower in Climate Change Mitigation and Adaptation: A Review
235	[16]	Developing climate-smart agriculture to face climate variability in West Africa: Challenges and lessons learnt
201	[17]	The contribution of climate finance toward environmental sustainability: New global evidence

Source: Scopus, 2026

Table 1 highlights the most influential publications in the field of climate change adaptation financing, as reflected by their citation counts, indicating the intellectual foundations and dominant directions of the literature. The highest cited works, such as [8] and [9], demonstrate the central role of large-scale global assessments, particularly those linked to the IPCC and global health–climate nexus, in shaping the discourse. These foundational studies emphasize the systemic impacts of climate change, the urgency of adaptation, and the integration of health and environmental considerations. Subsequent highly cited works reflect thematic diversification, including disaster-risk finance [10], nature-based solutions [11], and the emerging domain of climate finance [12], indicating a shift toward more specialized and policy-relevant topics. Additionally, studies on blue carbon, hydropower, and climate-smart agriculture highlight sector-specific adaptation strategies, while more recent contributions, such as [17], emphasize the linkage between climate finance and environmental sustainability outcomes.

3.3 Co-Authorship Analysis

This subsection examines the collaboration structure among authors contributing to the field of climate change adaptation financing. By mapping co-authorship networks, the analysis identifies key researchers, collaboration clusters, and the extent of international and institutional partnerships. This provides insight into how knowledge production in this domain is socially organized and which actors play central roles in advancing the literature.

Figure 4 below shows a visual representation of the co-authorship network. In such a network, the authors form the nodes while the edges show the collaborations between different authors. Figure 4 shows clearly how scholarly interactions occur in the field of finance for climate change adaptation. The coloring is done based on various collaboration groups identified by the level of connectivity among various authorship networks.

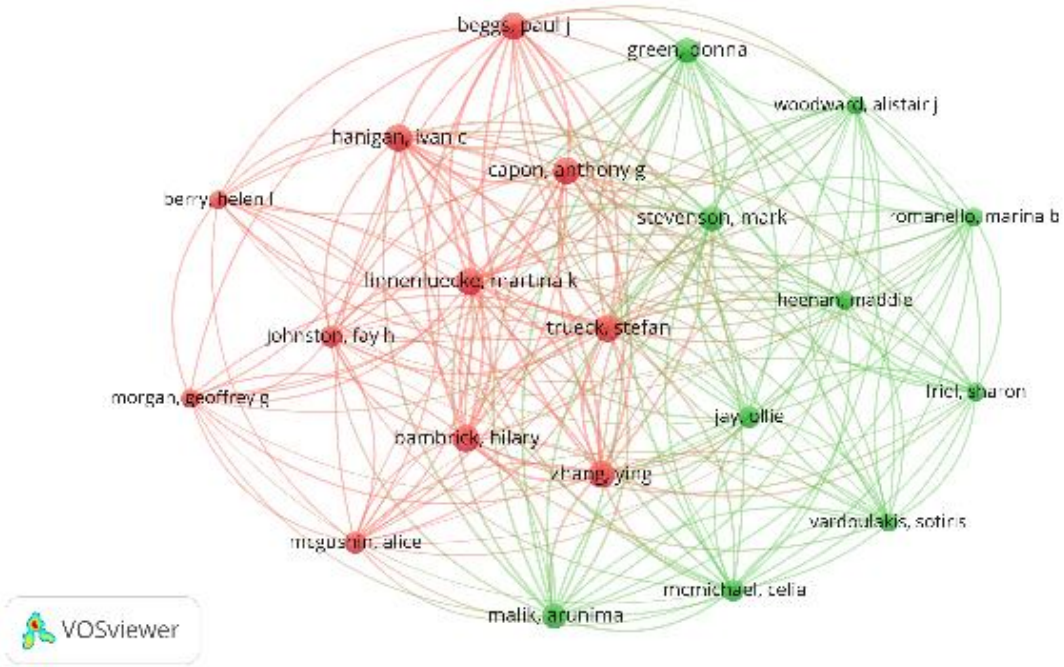

Figure 4. Author-level Visualization
Source: Data Analysis

The network is made up of two major clusters, represented in red and green colors, respectively, demonstrating that there are two major collaboration networks in this field. The red cluster looks dense with many links between researchers like Capon Anthony G., Trucco P., Johnson Fay H., and others, implying that the researchers have developed a very tight network of collaboration. On the other hand, the green cluster shows some level of connectivity but looks somewhat dispersed, signifying that the researchers have a wider network collaborating on related themes.

The associations within the red and green clusters indicate that there is somewhat moderate cross-group cooperation in place; however, the fragmentation within the research community is evident in the structure shown. It is quite possible that some of the authors who are located at the intersection of both the clusters act as intermediaries between two or more groups for transferring knowledge among them.

The institutional co-authorship network illustrates the nature of collaboration between institutions that have been involved in conducting research related to climate change adaptation financing. In this case, the nodes are institutions while the links are the collaborative ties between institutions based on co-authored articles. The visualization helps us understand how institutions collaborate, which institutions are prominent, and whether research efforts are focused or decentralized.

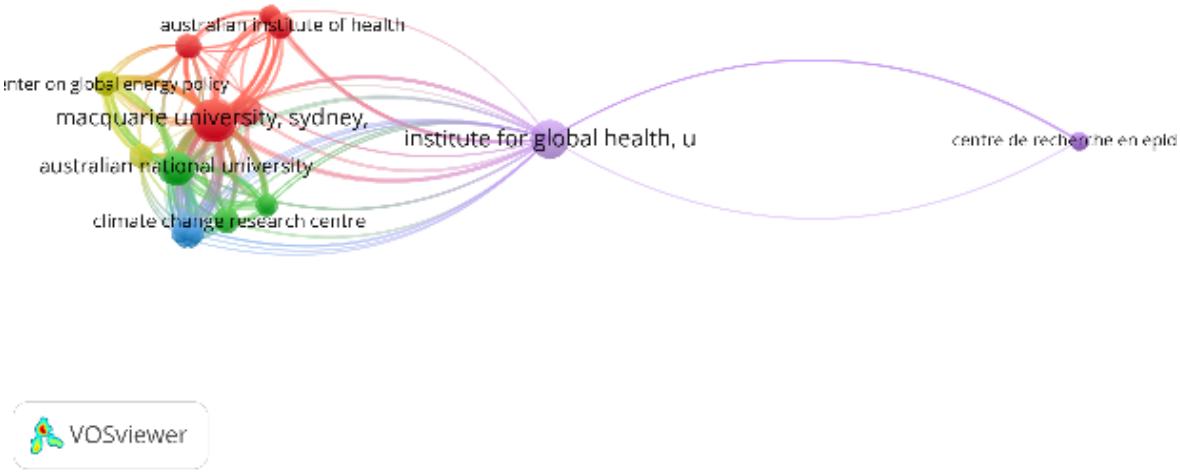

Figure 5. Institution-level Visualization

Source: Data Analysis

The network clearly exhibits clustering of collaborations among a relatively small number of organizations, namely Macquarie University, Sydney; Australian National University; Climate Change Research Centre; and the Australian Institute of Health. The clustering of these organizations reveals that they are well-integrated within the network, suggesting high frequency and intensity of collaboration within this cluster of institutions. The density of connections within the cluster implies that scientific production in this area is significantly influenced by a set of institutions that probably have common research interests and/or are located close to each other.

However, there is also an indication of a more insular institutional link, such as the Centre de Recherche en Épidémiologie, which connects with the main institutional cluster via only one elongated linkage. It implies that although there is no substantial international collaboration beyond the primary institutional affiliation, there still exists some degree of collaboration within the international sphere.

The co-authorship network for countries demonstrates the geographic distribution of research collaboration on climate change financing for adaptation. The nodes are the countries, while the lines connecting them show the collaborative publications between the two countries. The larger the node, the greater the contribution or importance of the country within the research community. The colors are indicative of clusters of collaborating countries.

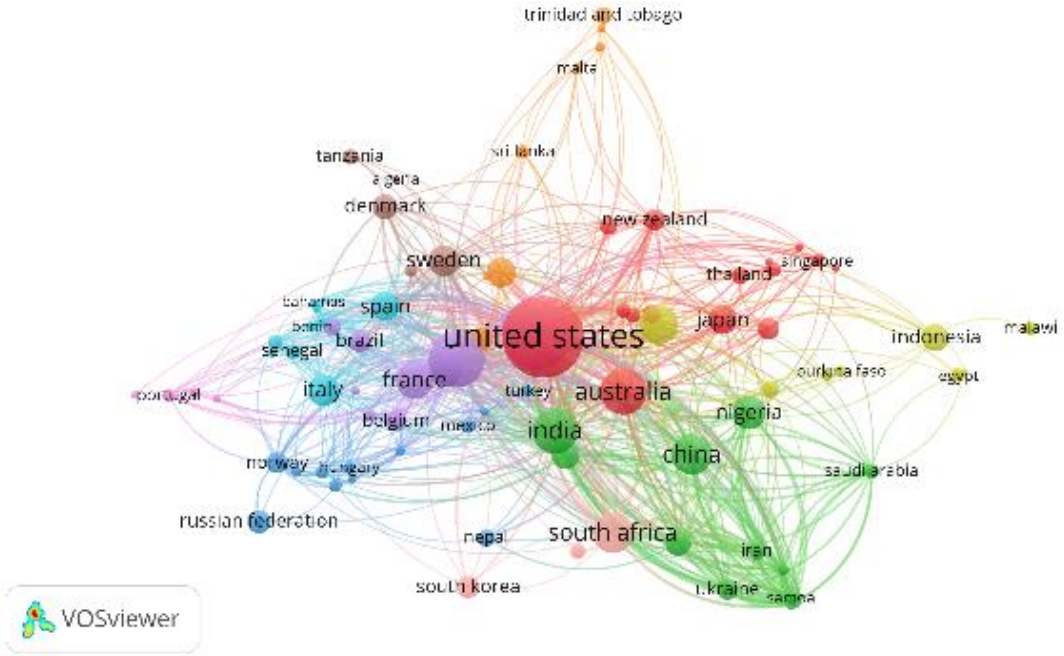

Figure 6. Country-level Visualization
Source: Data Analysis

As seen from the diagram, the United States holds the most central and prominent position in the network, which shows that it has made a great contribution to and has a lot of international cooperation in this area. It shares strong ties with other countries including Australia, India, France, Sweden, and South Africa, thereby showing that the study of climate change adaptation financing is influenced not only by developed nations but also by developing nations. The network further demonstrates some collaboration clusters based on region and themes. The countries like India, China, Nigeria, South Africa, and Saudi Arabia emerge to be strongly associated within the green cluster. This is due to the relevance of adaptation finance studies in the developing world and climatically vulnerable settings. On the other hand, some European nations like France, Belgium, Italy, and Spain constitute another collaboration cluster.

Discussion

The results from this bibliometric analysis suggest that studies on climate change adaptation financing are associated with an intellectual structure that is multidimensional and dynamic in nature. The prevalence of core keywords like climate change, adaptation, and finance suggests that the study area continues to be focused on climate issues but with increasing emphasis on finance. The co-occurrence and keyword densities highlight the fact that adaptation finance is not considered as a separate issue but more as an interdisciplinary subject that involves other concepts like risk management, sustainability, governance, and development economics.

From the perspective of the themes, there are evident clusters within the research streams, such as risk and resilience (risk assessment, disaster management), financial and economic aspects (climate finance, environmental economics), and governance and sustainability (adaptive management, vulnerability, nature-based solutions). These findings imply that the field of study has moved away from theoretical concepts and toward more specialized applications and themes. Indeed, the overlay analysis highlights the transition period during which the focus has shifted from basic concepts related to economics and policies to current

investments and adaptation measures for particular sectors.

The analysis of co-authorship emphasizes that fragmentation in the scientific community persists, as collaboration is focused on a limited number of dominating groups of authors and institutions. Although there is high collaboration internally in these clusters, interactions among the clusters have been moderate. It implies that some sort of siloing of knowledge production still occurs, which may be detrimental to gaining insight from various standpoints. As far as institutions are concerned, collaborations are highly focused on a select few academic institutions located predominantly in developed countries.

As can be seen from the analysis at the national level, the research of global finance of climate adaptation is largely determined by a few leading countries, in particular the United States, which is the center of the collaborative network. Nevertheless, the inclusion of countries like India, China, Nigeria, and South Africa proves the increasing participation of developing nations. This may be explained by the relevancy of adaptation financing in regions where vulnerability to climate change is highest. Nevertheless, the unequal distribution of collaboration means that there are still a significant number of vulnerable countries that lack representation in the world of research.

Implications from these findings indicate that although there has been progress in the domain of climate change adaptation financing, especially in building up theoretical foundations, as well as showing growing diversification in themes explored, there have been structural barriers related to cooperation and inclusiveness at a global level. This research suggests that future studies should pay attention to building up international and interdisciplinary cooperation, especially involving marginalized regions of the world. Moreover, efforts are needed to fill the gap between theoretical considerations and application through empirical research and evaluation of policies and adaptation financing models.

4. CONCLUSION

This study concludes that the literature on climate change adaptation financing has developed into a structured yet evolving research domain characterized by strong interdisciplinary linkages and increasing thematic sophistication. The bibliometric evidence demonstrates that while the field is anchored in core concepts such as climate change, adaptation, and finance, it has progressively expanded toward more applied areas including risk management, governance, sustainability, and investment strategies. At the same time, the collaboration patterns reveal a concentration of knowledge production among a limited group of authors, institutions, and countries, indicating both the presence of established research hubs and the need for broader global participation. The findings suggest that future research should prioritize greater international collaboration, inclusion of underrepresented regions, and a stronger focus on implementation-oriented studies to enhance the practical relevance of climate change adaptation financing in addressing real-world challenges.

REFERENCES

[1] Y. Dafermos, "Climate finance and global justice," *Clim. policy*, vol. 26, no. 1, pp. 48–64, 2026.
[2] A. Alonso-Robisco, J. Bas, J. M. Carbo, A. de Juan, and J. M. Marques, "Where and how machine learning plays a role in climate finance research," *J. Sustain. Financ. Invest.*, vol. 15, no. 2, pp. 456–497, 2025.
[3] L. D. Tyson and D. Weiss, "Climate Finance: Progress, challenges, and opportunities on the path to a sustainable planet," *Calif. Manage. Rev.*, vol. 67, no. 2, pp. 5–39, 2025.
[4] A. M. Kelly and L. N. Ndeffo, "Aid or sanction? Comparing the effectiveness of climate finance and environmental taxation in mitigating environmental degradation in Africa," *Innov. Green Dev.*, vol. 4, no. 3, p. 100241, 2025.
[5] A. Karg, J. Gupta, and Y. Chen, "Just energy transition partnerships: an inclusive climate finance approach?," *Energy Res. Soc. Sci.*, vol. 125, p. 104103, 2025.
[6] P. Mohan and D. Morris, "Climate finance and innovation with natural resource dependence thresholds," *J. Environ.*

Manage., vol. 377, p. 124683, 2025.

[7] P. Newell, "Towards a more transformative approach to climate finance," *Clim. Policy*, vol. 25, no. 2, pp. 257–268, 2025.

[8] V. R. Barros *et al.*, *Climate change 2014 impacts, adaptation, and vulnerability Part B: Regional aspects: Working group ii contribution to the fifth assessment report of the intergovernmental panel on climate change*. Centro de Investigaciones del Mary la Atmósfera, Universidad de Buenos Aires, Argentina: Cambridge University Press, 2014. doi: 10.1017/CBO9781107415386.

[9] N. Watts *et al.*, "The 2018 report of the Lancet Countdown on health and climate change: shaping the health of nations for centuries to come," *Lancet*, vol. 392, no. 10163, pp. 2479–2514, 2018, doi: 10.1016/S0140-6736(18)32594-7.

[10] B. Jongman *et al.*, "Increasing stress on disaster-risk finance due to large floods," *Nat. Clim. Chang.*, vol. 4, no. 4, pp. 264–268, 2014, doi: 10.1038/nclimate2124.

[11] N. Frantzeskaki *et al.*, "Nature-based solutions for urban climate change adaptation: Linking science, policy, and practice communities for evidence-based decision-making," *Bioscience*, vol. 69, no. 6, pp. 455–466, 2019, doi: 10.1093/biosci/biz042.

[12] H. Hong, G. A. Karolyi, and J. A. Scheinkman, "Climate finance," *Rev. Financ. Stud.*, vol. 33, no. 3, pp. 1011–1023, 2020, doi: 10.1093/rfs/hhz146.

[13] L. Wylie, A. E. Sutton-Grier, and A. Moore, "Keys to successful blue carbon projects: Lessons learned from global case studies," *Mar. Policy*, vol. 65, pp. 76–84, 2016, doi: 10.1016/j.marpol.2015.12.020.

[14] B. Biagini, R. Bierbaum, M. Stults, S. Dobardzic, and S. M. McNeeley, "A typology of adaptation actions: A global look at climate adaptation actions financed through the Global Environment Facility," *Glob. Environ. Chang.*, vol. 25, no. 1, pp. 97–108, 2014, doi: 10.1016/j.gloenvcha.2014.01.003.

[15] L. Berga, "The Role of Hydropower in Climate Change Mitigation and Adaptation: A Review," *Engineering*, vol. 2, no. 3, pp. 313–318, 2016, doi: 10.1016/J.ENG.2016.03.004.

[16] S. T. Partey, R. B. Zougmoré, M. Ouédraogo, and B. M. Campbell, "Developing climate-smart agriculture to face climate variability in West Africa: Challenges and lessons learnt," *J. Clean. Prod.*, vol. 187, pp. 285–295, 2018, doi: 10.1016/j.jclepro.2018.03.199.

[17] C.-C. Lee, X. Li, C.-H. Yu, and J. Zhao, "The contribution of climate finance toward environmental sustainability: New global evidence," *Energy Econ.*, vol. 111, 2022, doi: 10.1016/j.eneco.2022.106072.