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Climate Policy, Financial Risks, and Sustainable Development: A Bibliometric Perspective

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ABSTRACT:
The critical nature of climate change has made sustainable policies essential in financial risk management, requiring a unified strategy for economic and environmental resilience. This research performs a bibliometric evaluation of 213 academic articles (2016–2024) from the Dimensions database to analyze research patterns, principal contributors, and thematic areas in climate finance. After the Paris Agreement, studies on climate-finance have increased. Main themes revealed by the analysis include climate stress testing, ESG ratings, and transition risk management. Distinguished researchers, such as Irene Monasterolo and Stefano Battiston, are associated with top schools like Boston University and the Vienna University of Economics & Business. China lags far behind the United States. The study discloses significant discrepancies in publication amount and citations count. It emphasizes the need for unified climate risk management, better ESG adherence and finance geared to moderate-income growth the paper reconciles climate finance with Sustainable Development Goals of 2019, providing vital material for policy makers and banks.

Keywords: Bibliometric analysis, Climate stress testing, ESG frameworks, financial risks, sustainable climate policies, systemic risk modeling, transition risk management.

1. Introduction

The financial sector increasingly recognizes climate change as a systemic risk, requiring immediate action. beyond environmental concerns to long-term economic stability (Dwivedi et al., 2022; Kinley et al., 2021; Suprayitno et al., 2024). Climate policies are now essential for financial risk management, as governments and financial institutions integrate sustainability criteria to mitigate economic vulnerabilities (Battiston et al., 2021; Ozili and Iorember, 2023). Moreover, research has shown that policies targeting climate change can drastically and fundamentally significantly alter poverty levels, economic development, and the growth trajectories of nations (Abbass et al., 2022; L. Sun et al., 2022).

However, a significant challenge persists: although advanced economies have incorporated climate-related risks into their financial regulatory frameworks, many emerging markets are lacking systematic policies intended to tackle the financial risks brought about by climate change. To bridge this gap, international financial institutions such as the World Bank, the International Monetary Fund (IMF), and the Green Climate Fund play a crucial role in facilitating access to climate finance. These entities can deliver specialized funding mechanisms, provide technical assistance, and offer regulatory support to aid developing economies in incorporating sustainability into their financial risk

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management practices. Furthermore, the harmonization of policies on a global scale is imperative to ensure that climate-related financial risks are evaluated and mitigated uniformly across varied economic environments.

However, despite increasing global attention, significant gaps remain in understanding the financial implications of climate policies across different economic contexts. Climate policies are not limited to simply managing carbon emissions and experimenting with different economic models to cope with the risk. International agreements, such as the UNFCCC, the Paris Agreement and the Kyoto Protocol, largely shape climate policies. The Paris Agreement, in particular, has made financial markets around the world focused on sustainable development by encouraging plans for reduction targets and climate neutrality (Lamb et al., 2022; Stechemesser et al., 2024). In addition, financial regulators are now introducing rules that will guide financial currents towards climate-resilient investment. The Climate-Related Financial Disclosures Task Force (TCFD) has formulated directives to embed environmental risk considerations into corporate financial documentation. At the same time, the European regulatory framework, including the Sustainable Finance Disclosure Regulation (SFDR) and the EU Taxonomy for Sustainable Investments, is introducing enhanced transparency requirements for financial markets. (Chenet, 2019; Zhai et al., 2024). Nevertheless, this distribution is not smooth across different regions, and so there are inconsistencies between sustainability evaluations and the management of financial risks.

In promoting sustainable finance, large-scale investment entities have emerged as key influencers by moving capital into socially responsible investments most closely linked to a framework centered on environmental, social, and corporate governance (ESG) principles. More and more, investment firms, retirement funds, and state-owned investment pools are prioritizing climate-conscious portfolios that incorporate sustainability factors (Khan and Iqbal, 2024; Matos, 2020). Instruments of sustainable finance such as green bonds, sustainability-linked loans and climate risk insurance are becoming more and more popular, reflecting an orientation towards financial products that incorporate climate considerations (Antoniuk and Leirvik, 2024; Feyen et al., 2021). Institutional investors are also shareholders ' activists, pushing corporations to reveal climate-related risks and adopt sustainable business practices (B. Wu et al., 2023). However, problems still abound in the industry; greenwashing (a term meaning false claims about sustainable practices by companies) is a major issue calling for stricter regulation.

Although developed countries have been making some inroads into sustainable financing, the problem is formidable in emerging market and developing country economies. Many low-income countries are highly vulnerable to financial shocks arising from the climate owing to their lack of access to climate finance, immature institutions and heavy reliance upon carbon based industries (Cormack and Shrimali, 2024; Guerrieri et al., 2022). In contrast to advanced economies with deep capital markets and green finance offerings, developing countries have trouble securing investment for their climate adaptation and mitigation projects (L. Sun et al., 2022). The extent of financial risks in these areas is further heightened by severe weather events, soaring insurance costs, and the reluctance of global investors to enter high-risk markets. Overcoming such differences requires that international financial institutions, governments, and the private sector all pool resources and ability into climate resilience funding and ensure that there is a fair

transition towards low-carbon economies. Similarly, monetary authorities and financial oversight bodies are committing to integrating environmental risks factors into their financial stability assessments. Stress testing methodologies and scenario analysis methods are increasingly and in greater detail being used to examine the robustness of banking entities and other financial entities in the face of environmental threats (Battiston et al., 2021; Cormack and Shrimali, 2024). For instance, the NGFS (Network for Greening the Financial System) is a global alliance of central monetary authorities supporting stronger integration into the UK Monetary and Regulatory Policy of more prudent climate risk assessment (Feyen et al., 2021). In the meantime, they are obliged to start factoring climate considerations into their scrutiny frameworks for financial institutions (Arndt et al., 2023). However, regulatory fragmentation across different financial systems remains a challenge, highlighting the need for greater policy coordination and harmonization of sustainability reporting standards.

The economic threats posed by climate shifts are typically categorized into physical, transition, and liability-related risks (Battiston et al., 2021; D'Orazio, 2023). Physical risks arise due to the growing occurrence and intensity of weather-related disasters like hurricanes, floods or wildfires. Asset devaluation leads to economic losses. Transition risks come from changes in policy that shape the direction of similarly low-carbon industries such as carbon pricing mechanisms, increased enforcement of environmental standards and rising profitability in oil/gas dependent sectors (Challoumis and Eriotis, 2024). Liability risks involve legal actions against corporations and governments for failing to mitigate climate damage, as seen in the rising number of climate-related lawsuits globally (Wei and Chengshu, 2024). Understanding these risk categories is crucial for financial institutions, policymakers, and investors to formulate responsive approaches that harmonize economic expansion with ecological preservation.

Despite the increasing influence of climate-related financial policies on investment markets, knowledge of their systemic effects on financial risks remains incomplete. The research literature on financial risk from climate policies is heavily biased towards economically robust, developed countries, while the vulnerability conditions in emerging markets are insufficiently investigated. In addition, the lack of a unified global framework for environmental regulation complicates efforts to determine climate risks and leads to a situation in which the policies from various countries do not harmonize. Moreover, financial tools like sustainability-linked bonds and climate risk coverage are playing a growing role in daily life, yet their effectiveness in ensuring financial sector stability remains underexplored in research. A systematic bibliometric analysis is required to address these gaps. This approach could clarify trends in research, provide clues about future directions and throw light on the developing relationship between climate policies and financial risks.

Given the accelerating momentum of climate-aligned finance and the dynamic landscape of modern climate policy embodied in literature, it is imperative to take a structured look at the intellectual development of this field. Bibliometric provides an organized set of methods for mapping major trends in research, identifying key authors, and clustering topics within published works. This paper studies how vulnerability is created when climate policies converge operationally with financial dependency and which scholars have led research in these areas. Bibliometric research into this emerging field can give academics, political decision-makers and finance practitioners a few clues on getting

their bearings right. The bibliometric methodology offer a comprehensive understanding of both climate policies and where major financial risks lie between 2016 and 2024. In addition, this paper will try to bridge gaps on how financial markets react to climatic dangers and which regulations are leading in such a direction. This potentiality future investigation found would be in line with these findings, determining which concepts are linked closely together. The results have implications for policy, investment decisions and future research. They will also help move forward the transition to a global financial system that is both resilient and sustainable.

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2. Literature review

2.1 Overview of sustainable climate policies

In addressing the issue of global warming, sustainable climate policies have meanwhile become a cornerstone of international measures to promote economic stability. These policies, now removed from their original environmental contexts, have seeped deep into all financial and economic systems -- both national and global. Scholarly research emphasizes that governments the world over have adopted a variety of tools--from carbon taxes and trading systems in emissions to incentives for renewable energy. All these are part of an overall attempt to harmonize environmental realities with financial stability (Lamb et al., 2022; Stechemesser et al., 2024), undergoing transformations. Global agreements, including the Kyoto Protocol and more recently the Paris Agreement, have significantly influenced climate governance, with the former being especially pivotal in shaping early policy frameworks. The latter in particular has brought a significant change to climate governance; it focuses on less imposition of legally binding emissions reductions and is more about helping countries find ways for flexible commitments--led from within themselves (Babu et al., 2023; Zahar, 2019). In addition, climate policies have increasingly influenced financial regulations, prompting authorities to incorporate climate-related risk considerations into financial policymaking and economic strategies (Bolton et al., 2022; European Commission. Joint Research Centre., 2020). The Climate-Related Financial Disclosures Task Force (TCFD) along with the EU's Sustainable Finance Disclosure Regulation (SFDR) have also set the new standards of reporting requiring corporations and financial institutions to socially account for any potential hazards related to climate change (Chenet, 2019; Zhai et al., 2024).

Nonetheless, implementation is still uneven among regions. Developed countries have smoothly adapted to these systems whereas it is common for underdeveloped ones that struggle because of the lack of money or organization (Cormack and Shrimali, 2024). Growth in one climate finance policy therefore will not bring about the same growth elsewhere, as how money enters and spreads through the markets can be different. The uneven distribution of this means that access to climate finance is not available to everyone, leading to worries about the global financial system and equitable economics. While some countries have thence been forced to put down tight regulation policies that legislate for enterprises to publish sustainability reports and vigorously punish industries high in pollution, others take a more relaxed outlook: they use the cap-and-trade and investment incentive technique as well (Guerrieri et al., 2022). Scholars contend that the success of such policies is heavily influenced by the national economic structures and

regulatory environments, making climate finance a complex and heterogeneous field (L. Sun et al., 2022).

2.2 Financial risks in the context of climate change

Climate change brings with it significant financial risks, and these are now becoming part of economic frameworks according to much more recent research papers (Battiston et al., 2021; D'Orazio, 2023). Academic literature identifies these risks in different categories but all interrelated and bleed into financial markets as well as general stability on the world stage. Physical hazards stem from severe meteorological events and gradual shifts in climate patterns, causing direct economic losses asset devaluation and disruption of supply chains (X. Sun and Lei, 2021). Risk is particularly acute in industries such as agriculture, property development and the insurance, where exposure to natural disasters has led to unstable finances (Arndt et al., 2023). Scholars point out that the rising global temperatures, encroaching seas and worsening natural disasters lead to heavy financial burdens (e.g., Feyen et al., 2021).

Transition risks arise both from the global transition to low-carbon economies— which entails changes in consumer preferences and technology breakthroughs on one hand or running regulations on the other (Challoumis and Eriotis, 2024)—and thus naturally bring instability in markets As increasingly stringent policies are adopted to decarbonize energy high-emissions industry bears the brunt of a financial squeeze. The areas mainly hit will be asset devaluation and market volatility (Chenet, 2019; In et al., 2020). The potential for unviable assets, especially within the fossil fuel industry, has become a critical concern for investors (Battiston et al., 2017). When policies change abruptly in response to climatic events and industries heavily dependent one way or another on carbon suffer sudden losses, then though they may be less severe in the short term to areas that were not so affected in this way (Fritsch et al., 2023). Additionally, this has not brought systemic coordination yet (B. Wu et al., 2023).

Liabilities present a new dimension of financial risk for corporations and governments who resist or fail to disclose climate-derived financial threats over anterior purposeful decisions (Wei and Chengshu, 2024). Extensively documented in the literature, the increase in climate litigation has brought corporations to increasingly find themselves in court for environmental harm and insufficient climate action (Zhai et al., 2024). Such litigation is changing corporate governance practices: As businesses become more environmentally responsible, they must incorporate sustainability factors into their planning in order to achieve financial returns (Feyen et al., 2021).

There are still gaps in the capacity of developed countries to model financial risks related to climate change, but progress has been made (World Economic Forum, 2025). Climate change stress testing and scenario analysis are becoming mandatory in developed economies. However, many third world countries lack the resources to implement these good practices (Cormack and Shrimali, 2024).

To remediate this issue, the formulation of universally accepted methodologies for climate risk assessment is of paramount importance. Global regulatory efforts, exemplified by the Network for Greening the Financial System (NGFS) and the Task Force on Climate-related Financial Disclosures (TCFD), are establishing criteria for the incorporation of climate-related risks into financial infrastructures. Nevertheless, their application in

developing countries is hampered by the lack of institutional capacity and technical expertise. In view of this, the only way for emerging markets and their institutions to create climate-risk assessment tools is through a structured approach involving regional regulatory frameworks, the transfer of knowledge and financial incentives. Lacking such a framework, financial institutions located in those vulnerable economies may find themselves incapable of effectively mitigating climate-induced financial risks.
Lack of standardized methodologies for identifying climate change-related financial risks has led to different outcomes among the world's financial systems (Guerrieri et al., 2022). Both researchers and policymakers believe that stronger international cooperation is urgently needed or else national economies may struggle to manage the uncertainties spawned by climate shifts in the future (Stechemesser et al., 2024).

2.3 Relationship between sustainable climate policies and financial risks

Sustainable climate policies and financial risks nexus is complex and multidimensional (D'Orazio, 2023). Scholars debate whether proactive climate policies stabilize financial markets by reducing long-term risks or introduce short-term instability by imposing regulatory constraints (Park and Jang, 2021). Some studies suggest that climate policy, when well designed, can bring economic resilience. It sets up stable investment environments, helps green sectors flourish and also encourages financial players to incorporate sustainability into their long-term strategies (Antoniuk and Leirvik, 2024; Luqman et al., 2024). However, others worry that sudden regulatory change, muddled government policy, and vagueness about what sustainable business means in practice can bring financial instability (Challoumis and Eriotis, 2024; Chen et al., 2023). For fossil fuel dependent economies, carbon pricing mechanisms bring emissions reductions but also entailed economic disruptions (Battiston et al., 2017). Sectors with less well-defined transition pathways are where the volatility seen in climate policies especially finds expression (Naseer et al., 2024). On the whole, the literature suggests that the financial sphere needs clearer policy signals so as to manage risk arising from unclear regulation (Feyen et al., 2021).

2.4 Identified Research Gaps and Need for a Bibliometric Review

Inversely, with ample literature in place, research still lags in teasing out developing economies climate finance, particularly regulatory disparities therein as well how different financial innovations actually make successful inroads. This study uses bibliometric to piece together a systematic analysis of literature on climate policy and the risks associated with finance, identifying intellectual clusters and assessing the trajectory of research to suggest potential new areas for both academic theory and policy discussions.

3. Data and methodology

The study consequently did a bibliometric investigation to look at where financial risk and sustainable climate policy cross paths. That is why utilizing bibliometric analysis could give a systematic, quantitative approach to scrutinize academic works on all aspects of the subject, such as research trends as well as contributions from across different authors. With this logical categorization as a base, this study aims to clarify the medium-

term trend as well as the intellectual structure of this area for new research thrust. Bibliometric analysis is particularly well suited for this type of investigation.

3.1 Data source choice and justification

This analysis relies on the Dimensions database as the main data source, selected because of its extensive coverage of scholarly publications across diverse disciplines, such as environmental sciences, finance, and policymaking, to best situate the option for conducting this analysis within its interdisciplinary nature. Dimensions pulls in citations, affiliations, funders, authorships, and other pertinent data into the base upon which bibliometric analysis is built. While traditional bibliographic databases concentrate on high-impact journals publications, Dimensions covers a wider spectrum of literature including policy documents and papers, making it suitable for mapping both scholarly and policy-driven perspectives on climate finance.

There are many reasons for favoring Dimensions over alternative databases such as Scopus or Web of Science. First, Dimensions provides research outputs across disciplines, such as climate science, environmental economics, and financial risk management, which aligns precisely with the focus of this research. Second, Dimensions offers a rich set of metadata such as information regarding funders, thus enabling wider analysis. Third, Dimensions covers a wider array of document types than other databases, given that policy reports and preprints are important for capturing emerging trends. Finally, by utilizing advanced filtering options, paring down the raw dataset covers different types of climate policy to give a closer look only at sustainable financial risks. This depth along with flexibility made Dimensions a natural selection for the present study.

3.2 Data collection

By December 8, 2024, a carefully written Boolean query was used to identify relevant literature: "Impact AND Green OR Sustainable Climate Policies AND Financial Risks." From the Dimensions database, the search yielded an initial dataset of 1,077 publications. A battery of filters was applied to ensure that the dataset was relevant and focused on the subject. First, only the documents published between 2016 and 2024 were included. The Paris Agreement came into effect in late 2015, which justified the start of the investigation. Second, a subset of 670 articles in the area of "Climate Action" was selected. After this focus, 213 items were entered in the Banking/Finance/Investment field. Given that academic rigor was a priority, only studies published in peer-reviewed journals or officially endorsed government policy documents were included in the selection process. At the next stage, any duplicate records were eliminated in order to slim down the database. A manual check was done on all of them to make sure that each document met its target-scope for research.

Regardless of this systematic approach, the dataset was sufficiently broad yet relevant to the aim of this research. In addition, the study followed a structured approach to ensure that the dataset would be both comprehensive and valid for the study objectives. This systematic approach ensured that the dataset was relevant to the aims of the study and had a wide scope. Furthermore, the inclusion of interdisciplinary sources ensures a holistic representation of climate finance research, spanning regulatory, economic, and environmental dimensions.

3.3 Data analysis techniques

The analysis uses several bibliometric techniques to identify patterns and trends within the data. Adjusted for publication output, an author analysis was conducted and this identified the key contributors to the field, their publication output and citation affect of their work; Citation analysis provided insights into foundational articles and journals and the evolution of those articles over time, bringing to the fore that contributions in the literature matter. Generative models who take into account this type of networks, by the way, have been used to study co-authorship networks and in particular, may be used to explore the dynamics of collaboration: bottom and top clusters or parts of the network may indicate scientific communities that are working together much more than others. The inclusion of network analysis allows for the identification of central authors and institutions driving research in climate finance, highlighting key influencers and thematic collaborations.

Thus, bibliometric-coupling analysis was utilized in order to identify whether there are any thematic complementarities between articles, investigating commonalities of citations and hence revealing intellectual clusters within the literature. In empirical identification of thematic concentration in research, a co-occurrence analysis on key words can display co-located terms. In this way, insights into the developing issues, new areas of focus hive become evident. These analyses were supplemented by visualizations produced in VOSviewer -a software tool to create intuitive network maps that improves the perception of co-authorship and thematic clusters. By adopting a multidimensional approach our study is able to not only locate major research themes, but also obtain the changing character of research over time.

3.4 Validation, robustness checks, limitations

To ensure that the results were reliable and robust, the validation steps were incorporated into the analyses. We thoroughly cleaned the dataset to remove duplicates and irrelevant items and to retain good quality relevant literature. Minimum citation and co-authorship thresholds focused on the data's most impactful contributions and prevented dilution by the less influential works. In addition, a portion of the data was cross-referenced with more recent databases (eg, Scopus and Web of Science) for coverage and quality of the material, in addition to some other limitations being acknowledged. Cross-verification with alternative bibliometric sources ensured that key contributions were not overlooked and provided an additional layer of validation to the dataset selection. Indeed, as this database is interdisciplinary, it might also be implicitly biased in domains where "gray" literature is poorly represented or in cases that are dramatically cut in that particular field. Using citation networks could favor older contributions while marginalizing the impact of more recent research. Furthermore, sectoral reorganization could represent a different national bias since the rules of the dataset mainly record the contributions of endowed countries, but this does not systematically reflect the attitudes of underdeveloped countries. This study is however positive in its scope and it therefore stands to reason that it can only provide a better understanding of how sustainable climate policies are linked to financial risks as future research should consider including more diversified sources of finance and information in general in the database. In this regard, special attention could be paid to a good use not only of policy reports, but also of financial

market analyses of emerging economies, in order to mitigate the sectoral reorganization bias and ensure that the whole world is fairly represented.

4. Results

4.1 Overview of research categories, fields, subfields and temporal trends in publications

The selection of the Boolean terms "Impact AND Green OR Sustainable Climate Policies AND Financial Risks" initially retrieved 1,077 documents. After refining the search to the period between 2016 and 2024, 949 documents remained (Figure 1). This reflects the growing academic interest in the nexus between climate policies and financial risk over the past decade.

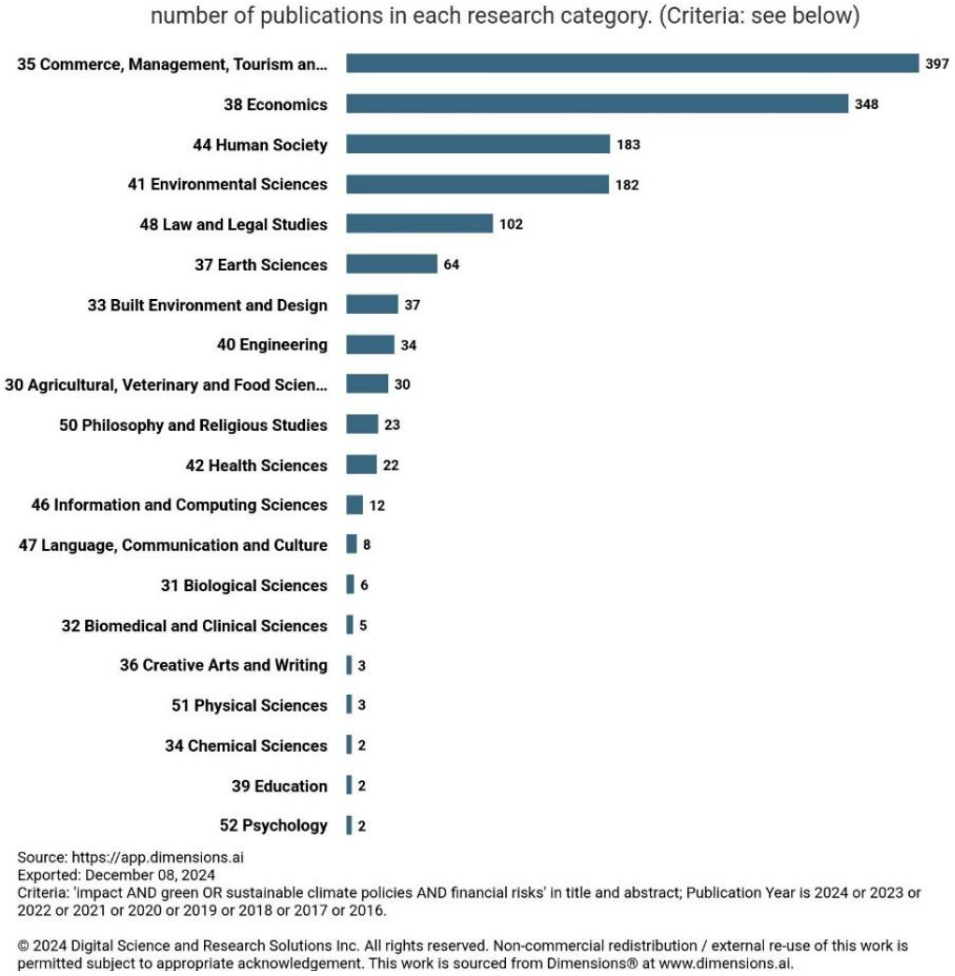

Figure 1: Key areas influenced by sustainable climate policies in relation to financial risks during the 2016-2024 timeframe.

The analysis was further refined by narrowing the scope to publications categorized under field 13, Climate Action, which yielded 670 articles. Subsequently, the focus was limited to subfield 3502- Banking, Finance, and Investment- resulting in the extraction of 213 articles (Figure 2). This progression underscores the essential function of financial institutions in addressing risks linked to climate policies.

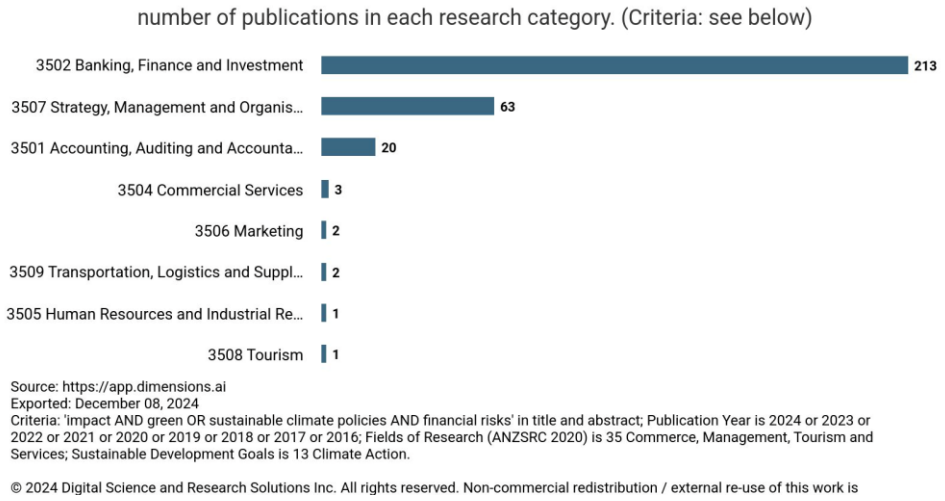

Figure 2: Fields of the impact of sustainable climate policies on financial risks

Temporal trends in document production from 2016 to 2024 (Figure 3) showed a consistent increase, with notable surges in 2020 and 2023. This pattern coincides aligned with major worldwide milestones, including the rollout of the Paris Agreement and subsequent climate-focused policy developments worldwide.

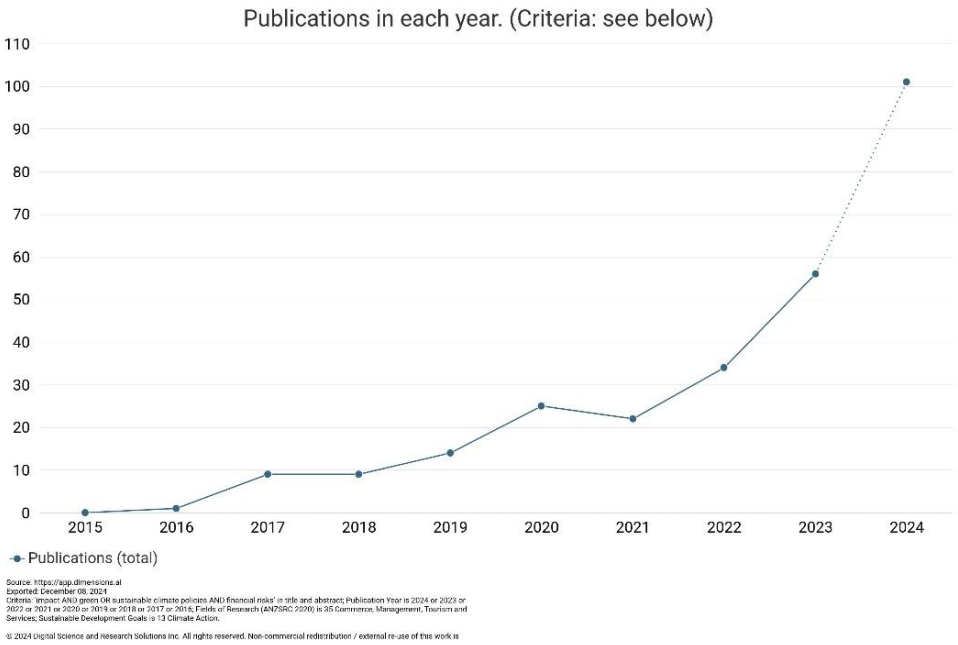

Figure 3: Trends in document publication examining the influence of sustainable climate policies on financial risks from 2016 to 2024.

4.2 Authors contribution and collaboration

Five hundred and seven authors have contributed to this topic. Eight prominent authors were selected using a threshold of 300 citations per author across documents (Table 1). Notably, Irene Monasterolo has emerged as the most prolific and highly cited author, with significant contributions to stress-testing financial systems for climate risks.

Table 1: Most documented and cited authors

Rank	Author	Documents	Citations
1	Monasterolo, Irene	12	918
2	Battiston, Stefano	6	762
3	Mandel, Antoine	3	715
4	Huang, Henry He	3	453
5	Kerstein, Joseph	3	453
6	Wang, Chong	3	453
7	Schütze, Franziska	1	678
8	Visentin, Gabriele	1	678

The authors' collaboration analysis was performed using a minimum threshold of two documents. 14 authors who collaborate were selected. The results identified four collaborative clusters (Figure 4) emphasizing a multidisciplinary approach.

- The red cluster includes E. Ccampiglio, Y. Dafermos, J. Ryan-Collins, M. Tanaka, and F. Van Lerven.
- The green cluster contained N. Dunz, R. Gourdel, A. Mazzocchetti, and M. Raberto.
- The blue cluster comprise S. Battiston, G. Bressan, and I. Monasterolo.
- The yellow cluster groups J. Hinkel and A. Mandel.

The red cluster, led by Campiglio and Van Lerven, focuses on policy-oriented financial stability. The blue cluster, including I. Monasterolo, highlights quantitative approaches to financial risk modeling. The yellow cluster shows the impact of climate-related risks on firm performance. These clusters embody the integration of different kinds of expertise, ranging from economics, finance, and environmental sciences, to deal with the complexities of climate risks. These interdisciplinary group collaborations bring in bodies with holistic perspectives and new ideas to address the questions.

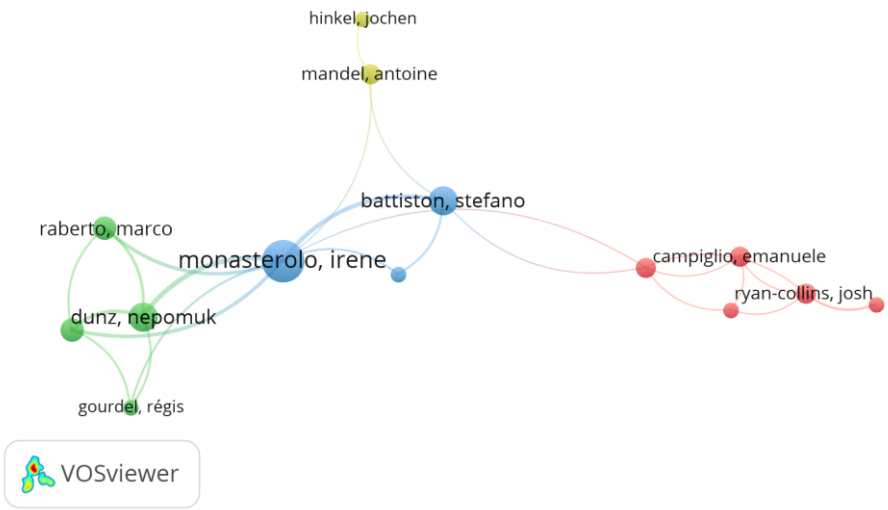

Figure 4: Co-authorship by authors

A bibliographic coupling analysis (Figure 5) applied with a minimum threshold of three documents revealed three collaborative clusters. Irene Monasterolo again stood out as the most cited author, reaffirming her influence on the field.

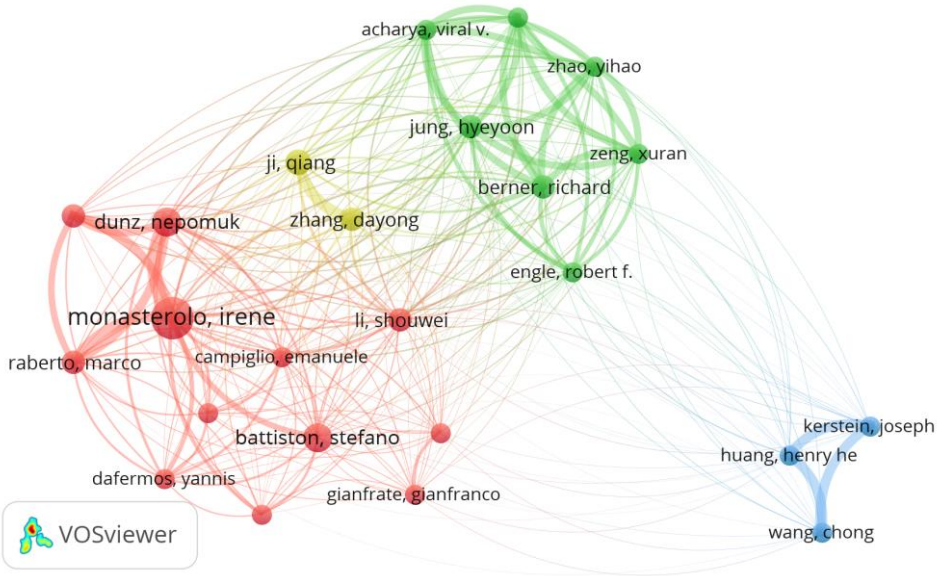

Figure 5: *Bibliographic coupling by authors*

4.3 Documents and sources production and collaboration

Among the 213 documents, the top 10 most cited articles filtered by a minimum of 75 citations are presented in Table 2. Noteworthy contributions include Battiston's (2017) climate stress test methodology and Huang's (2017) international comparison of climate risk. These studies set a benchmark for empirical analysis of climate finance, offering critical insights into systemic vulnerabilities and firm-level dynamics.

Table 2: Most cited documents

Rank	First Author	Document Title	Source Name	Citations
1	Battiston (2017)	A climate stress-test of the financial system	Nature Climate Change	678
2	Huang (2017)	The impact of climate risk on firm performance and financing choices: An international comparison	Journal of International Business Studies	362
3	Bartram (2022)	Real effects of climate policy: Financial constraints and spillovers	Journal of Financial Economics	270
4	Semieniuk (2020)	Low-carbon transition risks for finance	Wiley Interdisciplinary Reviews Climate Change	267
5	Batten (2016)	Let's Talk About the Weather: The Impact of Climate Change on Central Banks	SSRN Electronic Journal	231

6	Liang (2022)	Climate policy uncertainty and world renewable energy index volatility forecasting	Technological Forecasting and Social Change	203
7	Lamperti (2021)	Three green financial policies t o address climate risks	Journal of Financial Stability	141
8	Dunz (2021)	Climate sentiments, transition risk, and financial stability in a stock-flow consistent model	Journal of Financial Stability	107
9	Huang (2022)	Firm climate risk, risk manage ment, and bank loan financing	Strategic Management Journal	90
10	Secinaro (2020)	Impact of climate change mitigation policies on corporate financial performance: Evidence-based on European publicly listed firms	Corporate Social Responsibility and Environmental Management	78

Using a minimum threshold of two documents and 35 citations, the analysis of 103 sources identified 20 highly impactful journals, with SSRN Electronic Journal leading in both documentation (51) and citations (556). Specialized journals, such as Nature Climate Change and the Journal of Financial Stability, also ranked prominently (Table 3). These results highlight the essential importance of open-access platforms and high-impact journals in disseminating knowledge across the academic and policy domains.

Table 3: Most documented and cited journals

Rank	Source	Documents	Citations
1	Ssrn Electronic Journal	51	556
2	International Review Of Financial Analysis	7	69
3	Sustainability	6	63
4	Journal Of Financial Stability	4	375
5	Energy Economics	4	55
6	Finance Research Letters	4	27
7	Nature Climate Change	2	678
8	Sustainable Development	3	12
9	Ebi Studies In Banking And Capital Markets Law	3	4
10	Reference Module In Social Sciences	3	2
11	Wiley Interdisciplinary Reviews Climate Change	2	314
12	Technological Forecasting And Social Change	2	204
13	Journal Of Economic Surveys	2	51
14	Journal Of International Money And Finance	2	41
15	Pacific-Basin Finance Journal	2	33
16	Sustainability Accounting Management And Policy Journal	2	23
17	Journal Of Climate Finance	2	16
18	Economic Change And Restructuring	2	15
19	Palgrave Macmillan Studies In Banking And Financial Institutions	2	8
20	Palgrave Studies In Impact Finance	2	8

Three hundred organizations contributed to publication production. Using a threshold of a minimum of five publications by institution, the top 10 universities were visualized (Table 4). Although Vienna University was the leader in output (12 documents), Boston University (Table 5) excelled in impact (910 citations).

Table 4: Most documented universities

Rank	Organization	Documents
1	Vienna University Of Economics And Business	12
2	Boston University	9
3	Southeast University	6
4	Southwestern University Of Finance And Economics	6
5	University Of Zurich	5
6	Federal Reserve Bank Of New York	5
7	World Bank	5
8	Ca' Foscari University Of Venice	5
9	Institutes Of Science And Development	5
10	University Of Chinese Academy Of Sciences	5

Table 5: Most cited universities

Rank	Organization	Citations
1	Boston University	910
2	Global Climate Forum	760
3	University Of Zurich	754
4	Centre D'économie De La Sorbonne	678
5	Vienna University Of Economics And Bus.	507
6	Hong Kong Polytechnic University	453
7	Yeshiva University	453
8	Soas University Of London	349
9	University Of Warwick	287
10	The Ohio State University	285
11	University Of Florida	285
12	University Of Cambridge	277

Regarding collaboration between organizations with a minimum of four documents (Figure 6), the results identified three main clusters:

- The red cluster includes Vienna University, Boston University, Ca' Foscari University of Venice, and the World Bank.
- The green cluster comprises the University of Zurich, the Utrecht University, and the Global Climate Forum.
- The blue cluster regroups University College London and the Affiliation not provided to SSRN.

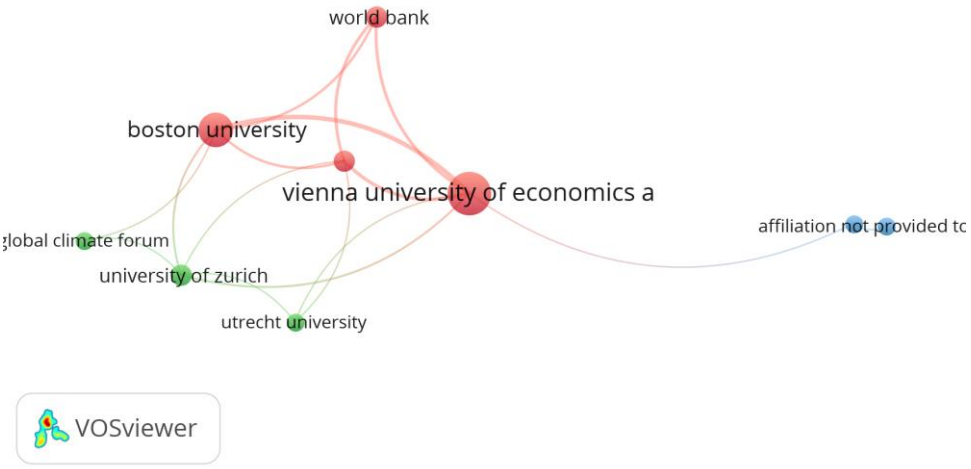

Figure 6: Organizations co authorship network visualization

With at least five common references, the bibliographic coupling of organizations (Figure 7) identified 10 institutions within two main clusters.

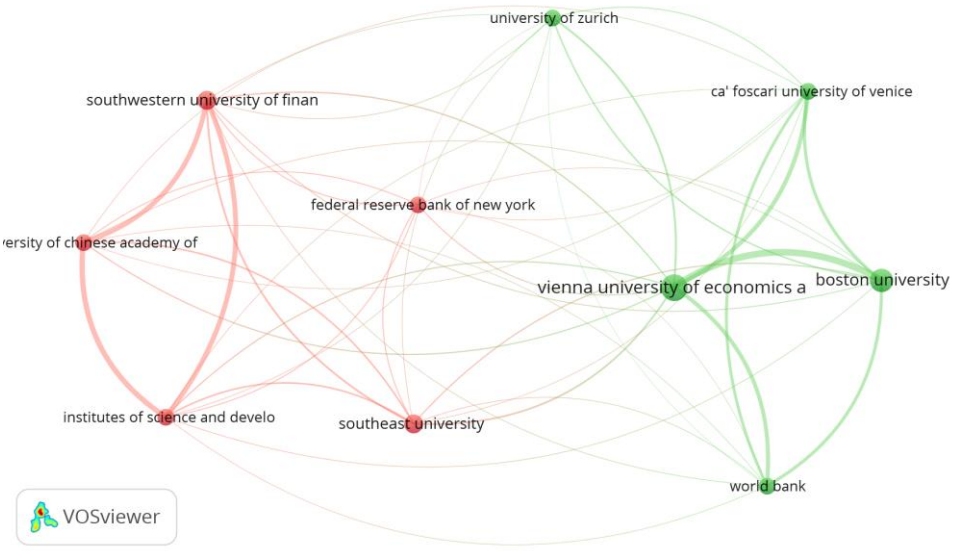

Figure 7: Bibliographic coupling of the organizations

Co-authorship networks (Figure 6) and bibliographic coupling of organizations (Figure 7) underscored strong regional collaborations, particularly between Europe and North America.

4.4 Countries' production and collaboration

Out of the 44 contributing countries, with a minimum threshold of five documents per country, China published the most documents (48), while the United States had the highest number of citations (2,009). Europe exhibited strong contributions, with the United Kingdom and Germany being particularly influential (Figures 8 and 9).

However, while climate finance is gaining prominence, most research is still taking place in advanced economies. As a result, many emerging markets are not actively participating in the debate. This limited participation can result in policy frameworks that are disproportionately tailored to the financial stability concerns of advanced economies, neglecting the specific challenges facing developing nations. To foster a more inclusive global research environment, cross-regional academic partnerships should be encouraged, particularly between institutions in developed and developing economies. In addition, financial institutions and international organizations should prioritize research funding in low-income countries. Open access platforms can also help disseminate this information. They will ensure that financial risk management strategies are on par with those around the world and can transcend economic contexts.

These results underscore the domination of developed economies in financing climate research while lessening the participation of developing countries makes for a more inclusive engagement in world academic forums. The limited representation of emerging economies in climate finance research may lead to policy frameworks that are skewed towards the challenges faced by advanced economies. This highlights the urgent need for capacity-building initiatives to enhance research contributions from vulnerable regions and ensure that climate finance strategies are globally inclusive.

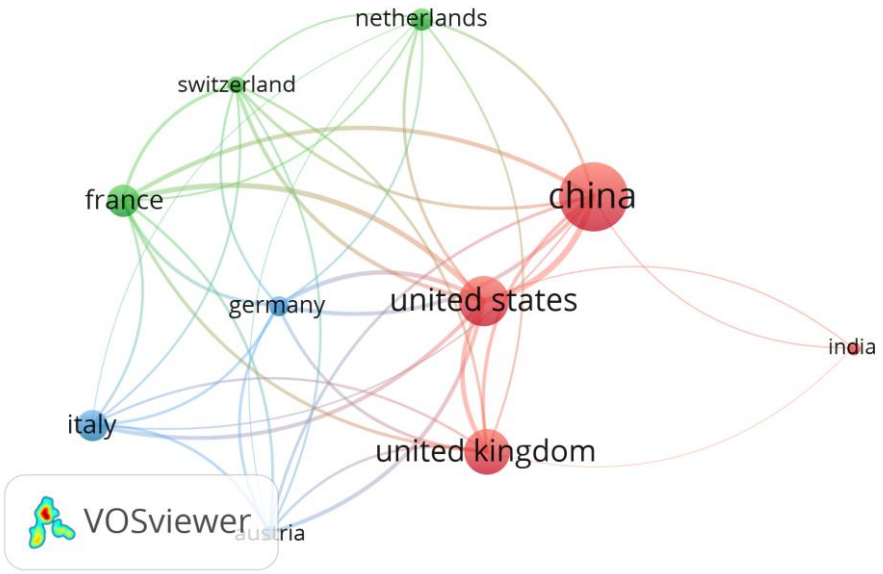

Figure 8: Top 10 of most document publishing countries

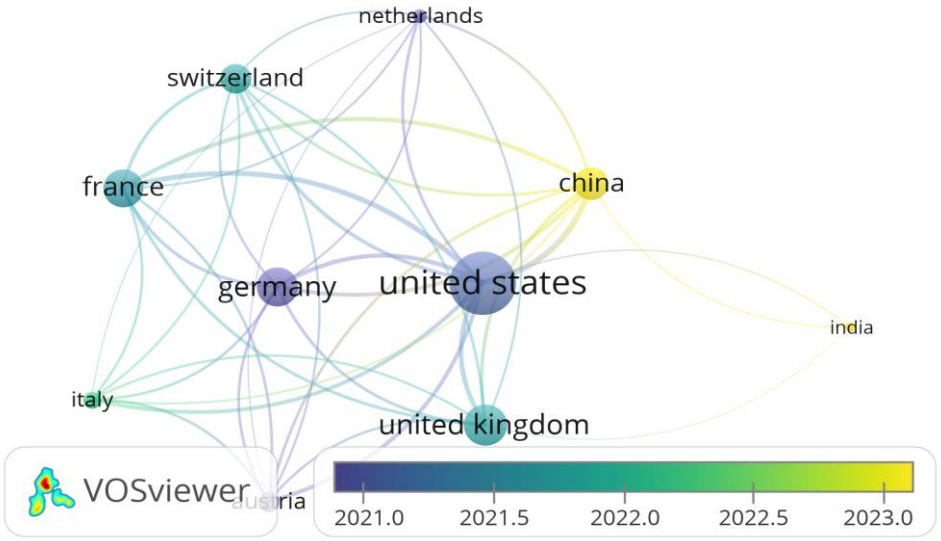

Figure 9: Most cited countries

4.5 Main themes and keywords

4.5.1 Authors' co-citation analysis

Using a minimum threshold of 32 citations per author, co-citation analysis identified 27 influential authors (Figure 10) that were grouped into two main clusters:

- The red cluster mainly comprised S. Battiston, Y. Dafermos, A. Mandel, I. Monasterolo, F. Schütze, and G. Visentin.
- The green cluster mainly included P. Bolton, S. Giglio, Z. Sautner, and J. Stroebel.

The clusters represent heterogeneous yet intertwined research priorities. The emphasis of the red cluster on financial modeling for climate risks highlights the growing need for quantitative frameworks to assess and mitigate systemic vulnerabilities. Green cluster studies where corporate strategies, mainly those aligned with ESG principles, meet financial markets, with concrete implications for practitioners. This bifurcation suggests a broader academic trend where one stream of research focuses on systemic risk assessment at the macroeconomic level, while another emphasizes firm-level responses to climate policies. These complementary perspectives are essential .for a comprehensive grasp of financial stability amid climate-related challenges.

After a qualitative examination of each cluster, the red cluster emphasizes financial modeling for climate risks, whereas the green cluster focuses on the intersection of finance and corporate climate strategies. Together, these clusters highlight the dual importance of macroeconomic policy design and microeconomic corporate strategies for achieving sustainable financial resilience.

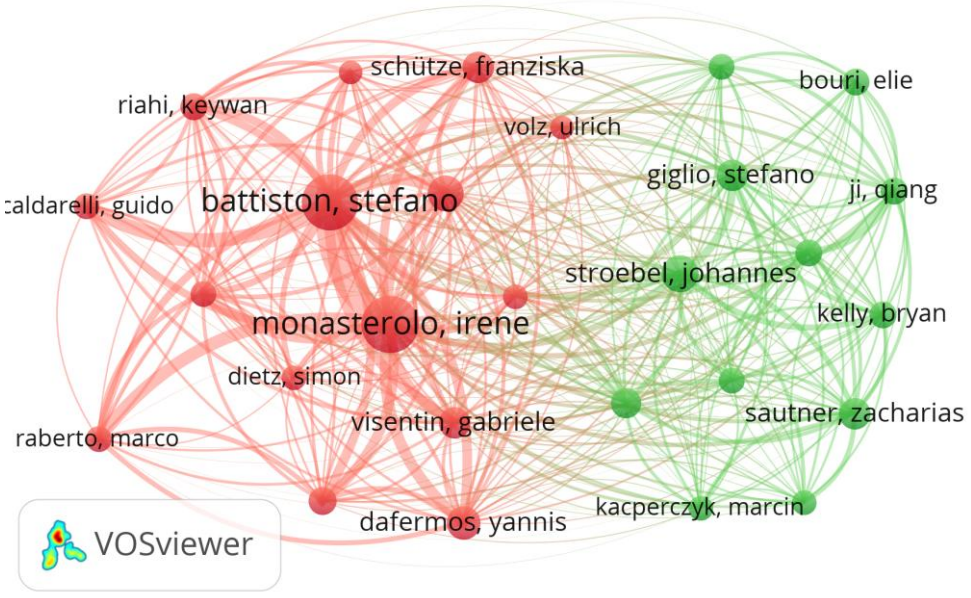

Figure 10: Co-citation network of authors

4.5.2 Keywords co-occurrence analysis

Among the 5,468 terms, the 20 most frequently occurring keywords were identified (Figure 11) after using a minimum threshold of 23 co-occurrences. Key themes included transition risk**,** sustainability strategies**,** and financial stability**,** underscoring the multi-faceted nature of this research domain. The concepts of "climate stress testing" and "transition risks" are linked to the adaptive capacity of a financial system to face any challenge due to climate change. However, "corporate sustainability" coming to the forefront also hints at the growing adoption of climate policies at the firm level..

The co-occurrence of keywords also indicates the emergence of areas of interest, such as the role of green finance in addressing transition risks, as well as employers' strategies for integrating risk management into corporate decision-making. Co-occurrence trends hint toward an approaching convergence between academic and practical efforts to deal with climate-related financial challenges.

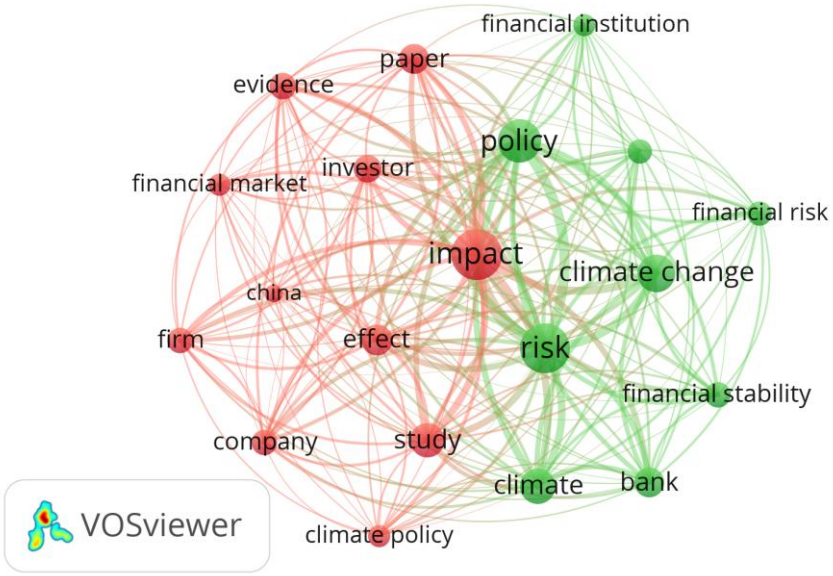

Figure 11: Keywords occurrences 2016-2024

4.5.3 Li king themes and keywords

The integration of co-citation and keyword analyses revealed three dominant themes:

1. Climate Stress Testing: Highlighting methodologies to assess systemic risks.
2. Transition Risk Management: Exploring strategies for adapting financial systems.
3. Corporate Sustainability: Examining firm-level financial performance under climate policies.

This brings out the multi-layered complexities of the process with regard to climate finance. Climate stress testing is used as a tool for analyzing systemic risks for policymakers

and institutions to anticipate any possible disruptions in the upcoming years. Transition risk management enables the extension of transitional policies to the financial system. Thus, corporate sustainability becomes the third pillar that ensures firm-level actions remain consistent with larger climate-related goals and that a synergetic relationship of economic prowess and environmental stewardship can exist.
In sum, the insights indicate a sector that is flexible and fast moving, in which academic research, policy frameworks, and corporate practices converge to tackle the most profound global challenge: the integration of climate into the finance system.

5. Discussion

The findings of this bibliometric analysis accord closely with the literature on climate policies and financial risks, re-embarking key concepts as systemic financial risk modelings, transition risk management, increasing roles of ESG frameworks in financial stability (e.g., Battiston et al., 2021; Chenet, 2019). The results validate previous studies on physical, transitional, and liability risks, emphasizing how financial institutions must integrate climate-related risk assessments into regulatory frameworks (e.g., Feyen et al., 2021). In the long term, the key challenge for regulators is to integrate sustainability into financial regulation, fostering economic resilience over time and at the same time preventing financial system risk. The mechanics of financial stability, for instance the European Union's Sustainable Finance Disclosure Regulation (SFDR) seek transparency in markets and so should mesh with any modern climate Risk Assessment framework. One result of this is that financial instruments like green bonds and sustainability-linked loans can offer regulatory benefits for companies to align their operations with the climate targets. One new feature is that financial stability assessments will have to do their own climate stress testing to assess systemic risks, and central banks need to fold climate risk considerations into monetary policies in order to avert economic disruptions tied to climate change itself.
This study expands upon earlier work by highlighting an emerging focus on corporate sustainability and the convergence of financial risk management with ESG principles, filling a gap in previous research that primarily concentrated on macroeconomic implications.

The results in Section 4 show that climate finance research has increased significantly since the Paris Agreement, a result which aligns with previous studies such as that of Jafari et al. (2021) which highlighted the increasing role of international climate policies in driving financial risk research.. At the same time, the main research groups are mainly focused on stress testing methodologies and transition risk assessment; this direction complements previous work (e.g., Battiston et al., 2017). Furthermore, the predominance of researchers like Monasterolo and Battiston in the co-citation networks confirms their central role in shaping financial risk methodologies, as documented in previous studies (e.g., Sun and Lei, 2021). Similarly, the predominance of authors such as Monasterolo and Battiston in the co-citation networks confirms their critical impact on shaping financial risk methodologies. A point also reflected to some extent in previous work (e.g., Sun and Lei, 2021).

The first major point of this study highlights the importance for financial sector regulation to introduce climate stress testing as a key tool to assess systemic vulnerabilities. In recent work, the contribution of sustainable financial reporting regulation to eliminating these greenwashing risks has been highlighted (Ding, 2023). This not only highlights that corporate commitment to sustainability must be ensured through strict compliance means, but also that it is urgent to introduce it now (B. Wu et al., 2023). In capital allocation, institutional investors play a central role. To this end, Antoniuk and Leirvik (2024) advocate sustainability commitments that can be transparently verified.

The findings not only reflect geographic disparities in climate finance research, but also show that developing economies, where most climate finance receives significant attention, are notably absent from the research. This has been suggested by previous research, which has highlighted the uneven distribution of knowledge and finance on climate risks across different regions of the world (e.g., Cormack and Shrimali, 2024). The lack of representation of developing economies in the climate finance literature indicates that financial risk models and policy design may be unfairly tailored to the problems faced by advanced markets. These imbalances will need to be addressed through international public-private partnerships, focusing efforts on vulnerable regions. Otherwise, financial stability initiatives may end up leaving behind economies most exposed to climate-related monetary crises.

Another key insight comes from the interplay between macro-level financial stability measures and firm-level sustainability strategies. Although traditionally these two areas of study were treated as separate, this research exposes how corporate ESG adoption increasingly coincides with systemic financial risk mitigation. In Section 4, keyword co-occurrence analysis further highlighted the appearance of themes related to corporate sustainability. This was a confirmation of what had already been discussed: firm-level strategies are now vital assets in a sustainable finance ecosystem. Firms that implement ESG criteria into their systems of risk management bolster not only their resistance against policy shifts but also make contributions toward the current overall stability of an economy (e.g., Naseer et al., 2024). Policymakers should incentivize such practices through tax benefits, preferential financing rates for sustainable investments, and the development of green finance instruments that align short-term corporate interests with long-term climate objectives.

For financial practitioners, the requirement is for enhanced data analytics and risk assessment models created specifically to absorb climate-related financial shocks, in line with X. Sun and Lei (2021). he table of co-occurring words in section 4 tells us that financial stability and sustainability issues have become ever more connected. Financial institutions therefore need to invest in sophisticated climate modeling techniques; this will make it possible for banks to quantify better just how much risk there actually is when they lend money. They now also need to hedge against transition risks. More importantly, firms operating in high-carbon industries have to envisage business models that are adjusted to foresee regulatory changes and consumer preferences for sustainable products as indicated by Lamperti et al. (2021).

The effectiveness of promoting financial stability through the issuance of green bonds and sustainability-linked loans should be a topic for future research as some recent studies show (e.g., Stechemesser et al., 2024). Additionally, further empirical investigations

are needed to assess how regional disparities in climate finance accessibility impact global financial stability. Without addressing these issues, politicians and investors could find themselves caught between an old-fashioned financial system unable to take proper account of climate risks on the one hand and, on the other hand, financial arrangements that are too complex to be inclusive.

In short, the discussion returns to this theme: sustainable finance, as well as regulatory frameworks and corporate adaptation pathways. Mitigating the possible economic threats linked to climate change requires rigorous due diligence, in addition to city-level risk management and comprehensive global collaboration. Regulators, investors and businesses, as well as financial markets, provide protection against risks, acting together as climate stewards, or they will eventually disappear. With regulations so stringent that sustainability is embedded in decision-making at all levels of finance, putting this into practice will be a very difficult challenge.

6. Conclusion

6.1 Key Findings and Practical Implications

This study comprises a comprehensive bibliometric analysis of the changing conjunction between climate policies that are possible to sustain and financial risks. To bridge the gap between financial regulation and corporate sustainability goals, companies need risk assessment frameworks ESG-driven. Investors along with financiers are turning to companies, which comply with environmental society governance standards (ESG). In the meantime, Instruments of finance such green bonds and climate-related financial status have started to establish a place in the mainstream. Policymakers ought to implement regulatory incentives that promote corporate synergy with climate objectives, including tax advantages for investments in sustainability and preferential lending rates for businesses that comply with ESG standards. Furthermore, corporations should incorporate sustainability reporting frameworks into their financial strategies to bolster transparency and fortify their resilience in the face of regulatory changes.

By using bibliometric methods, it was possible for the authors to discern main research trends, the scholars who are exerting an influence and thematic clusters which together make up present-day climate finance. What is notable in these findings is the growing attention paid by academics at intervals to climate stress testing, transition risk management and corporate sustainability. The academic focus is in line with wider sustainability aims, including the UN' Sustainable Development Goals (SDGs). This insight comes at a time when climate risks are increasingly seen as systemic financial threats, leading to their inclusion into global financial stability frameworks.

The analysis found a clear geographic and institutional imbalance in climate finance investigations, with developed economies dominating the contributors although developing nations are underrepresented. Irene Monasterolo and Stefano Battiston, among the top five authors in influence, focus more on systemic risk modelling as well as stress test methods for financial systems. The institutions that rank in terms of both quantity and quality of published works are nearly equally split by their location--Boston University earns its spot with publications while the University of Vienna contributes significantly from Europe. In terms of the number of native articles, China leads all

countries; by contrast, the United States has most citations for such work showing its influence in climate finance research. Networked collaborations display a strong bias for European and North American institutions, while there is scarcely any representation from emerging economies. This underscores the urgency of making climate finance research clearly more inclusive. Funding agencies and research organizations must now give priority to international partnerships that cross regions--especially those currently not represented in order to achieve a more comprehensive coverage about climate finance.

In terms of practical implications, from a policy perspective, the findings suggest that there is a need to develop new laws and regulations that integrate climate-related financial risks into decision-making. With climate stress testing and transition risk modelling being the dominant themes, regulators should standardize these techniques in order to create a global market that does not differ too much from current markets. Policymakers should design named climate risk regulations to enable transparency in financial markets and comparison systems across jurisdictions. The increasing fusion of ESG principles in financial markets offers opportunities to mitigate systemic risks and attract investments towards sustainability. However, challenges such as greenwashing and inconsistent regulatory standards need to be addressed through increased transparency, standardized disclosure requirements and the expansion of climate-aligned financial instruments. This requires a multi-stakeholder approach. Governments, financial institutions and investors must act on common standards to enforce strict ESG compliance rules as soon as possible and align financial incentives with sustainability goals.

At the company level, companies need to integrate ESG (environmental, social, governance) considerations into their risk management frameworks. This is the condition of sustainability, which implies that business strategies must be aligned with sustainable goals. Companies are well suited structurally to act in favor of those goals through elimination of institutional barriers. The findings of this study indicate that companies, which integrate climate resilience into their financial planning, can not only reduce transition risks, but also gain long-term financial and competitive advantages. Companies ought to devise clearer measurements for keeping track of their performance along ESG lines and see that such means are continually applied. Society should expect corporate responsibility in this regard -- "pro-sustainability" behavior must become the rule rather than the exception Corporations need to improve their ESG reporting and adopt standards, which harmonize with global sustainability commitments. Policymakers should encourage the adoption of such practices through tax benefits, concessional investment terms and by means of greater monitoring to ensure that sustainability pledges at corporate level become tangible outcomes for communities and businesses.

6.2 Limitations, Future Research Directions, and Final Thoughts

While this study has contributed valuable insights into climate finance research, it also highlights certain limitations. One of them is that, for all its wide range in coverage, using the Dimensions database might introduce some bias. This could result in an underestimation of critical new research contributions or policy reports not indexed within its archives. A major challenge in climate finance research is the persistent gap between developed and developing economies. Limited funding, low institutional capacity and no access to global research networks cause emerging economies to have little influence over

the shaping of climate finance strategies. Addressing these imbalances requires international collaboration through targeted financial support, capacity-building programs, and knowledge-sharing initiatives. Otherwise, the framework for climate finance may end up closely resembling that of the so-called "advanced" economies, with the financial vulnerabilities faced by low-income countries overlooked entirely. The role of international financial institutions in alleviating these misconceptions is an important future research agenda to consider. Additionally, there is a need for future research to investigate why it is that emerging economies in climate finance research face particular problems. Does this have to do with funding, capacity within institutions, or limited access to global networks for research cooperation? Attention to such imbalances can help develop a picture situation of climate finance, which is more inclusive and worldwide in appeal.

This study is methodologically situated in bibliometric, and quantitative research methods are used to get an overview of the contents but without any qualitatively oriented interpretations about immediate impact on policy or market changes. Further research can use methods of mixed quantitative and qualitative analysis-treatment support from bibliometric, such as expert interviews or case studies-to discover how banking entities incorporate climate-related risk factors into their strategic decision-making.

Moreover, future research ought to examine the effectiveness of eco-friendly financial tools, including sustainability-linked loans and green bonds, in promoting sustainable investment activities and in cushioning financial instability. It is indispensable for empirical research to probe how financial regulation causes emerging markets to behave and get through, and how climate finance mechanisms affect long-term economic resilience. Yet as corporate sustainability gains increasing attention, future research should also focus on how environmentally, socially and governmentally tied shareholder activism has an impact on corporate climate policies and risks in the finance domain. Wedging open the hole through which social equity concerns flow into climate finance frameworks -this fresh research focus will be of great importance for balancing the needs of inclusiveness with those of development.

In conclusion, climate finance is a rapidly changing sector that calls for governments, financial institutions and corporate players at all levels another step together. Growing economic resilience amid climate-related challenges, this requires fitting in robust tools for risk assessment, a certain degree of alignment between different branches of law and corporate sustainability commitments. The way forward, in turn, implies that the globalism of the research field is overcome by a universal coordination of development policies and interdisciplinary approaches adopted for economic orientation, which must be in line with current global sustainability perspectives. In a sense, the financial sector can have a transformative impact on the global adjustment and longevity of our global economy through research data and guiding directions.

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