Research trends related to climate change risks in financial and economic sectors: A bibliometric analysis

SEDKAOUI Soraya

University of Khemis Miliana (Algeria),

s.sedkaoui@univ-dbkm.dz

Abstract:

This paper aims to analyze climate risk research trends in finance and economics domain through a bibliometric analysis of 2360 Scopus documents from 2010-2023. Performance and co-occurrence analyses are conducted using VOSviewer. Results show an exponential rise in publications after 2015, led by the US and Europe. Four conceptual clusters are identified: climate risks and investment/financing, macroeconomic impacts and adaptation, microeconomic effects and corporate sustainability, and environmental risk management. The central cluster on climate risks highlights the growing focus on uncertainties and investment. Main trends emphasize climate finance, risk management, adaptation, and environmental, social, and governance factors.

Keywords: climate risk, finance institutions, economic sector, sustainability, environmental risk.

JEL Classification Codes : G32, G38, Q54, Q56

_____

*Corresponding author: Soraya Sedkaoui, **e-mail:** s.sedkaoui@univ-dbkm.dz.*

1. INTRODUCTION

The IPCC[1] underlined the pressing necessity to address climate-related concerns and undertake comprehensive measures to reduce and adapt to the evolving environment. Climate change poses significant concerns to the financial and commercial sectors due to both physical and transitional challenges. Physical risks, including catastrophic weather occurrences and increasing sea levels, can damage infrastructure, supply networks, and economic activity. Transition risks, connected with the change towards a low-carbon economy, can dramatically damage industries largely reliant on fossil fuels and carbon-intensive processes.

Climate change works as a systemic risk multiplier, amplifying existing risk factors and engendering cascading systemic risks across the financial sector. The report gives a complete assessment of present and anticipated trends in climate change risk literature in financial and economic sectors, highlighting significant study areas, notable authors, and prominent journals. By undertaking a bibliometric analysis on researches published between 2010 and 2023 in Scopus database (through SNDL website), using VOSviewer software, this study intends to give insight on the evolution of research themes, cooperation among scholars, and the larger intellectual structure of the subject.

Bibliometric analysis has developed as a significant technique for examining the changing patterns of scientific works and spotting emergent research trends. The technique involves the statistical evaluation of bibliographic data to reveal patterns, linkages, and insights that may not be readily evident from a standard literature review. By evaluating publication trends, co-citation networks, and analyzing keywords, bibliometric studies offer a thorough insight of a particular research subject. To fulfill the research purpose, this study explores these particular research questions:

What are the important research themes and developing trends in research regarding climate change risks in the finance and economic sectors? How have research changed over time, and what are the important research networks in this field?

---

[1] Intergovernmental Panel on Climate Change

By assessing important bibliometric variables, this study will characterize the growth and maturity of climate risk research in finance and economic and highlight current research foci and gaps to advise future research orientations. In particular, this study will provide insights into:

- The rise of publications on climate risk in finance and economy over time, suggesting rising scholarly attention.
- The geographic distribution of climate risk research across different countries, highlighting the importance of global perspectives in this area.
- The conceptual structure of the literature via co-occurrence analysis of terms, highlighting research concentrations and networks.

This study supports the expanding body of research on climate change risks in the economic and financial sectors by offering a complete overview of the existing literature. The conclusions of this study will guide policymakers, financial regulators, and industry practitioners about the latest research advancements and developing trends in this vital sector. Additionally, the identification of research gaps and future directions will lead researchers in their pursuit of creative and impactful studies that can further advance the understanding and management of climate-related risks.

The remaining parts of this work have been designed as follows. Section 2 tackles the main theorical concepts and literature review related to climate change risks. Section 3 provides an explanation of the data and the methodology that have been used. Section 4 highlights the Performance analysis and scientific mapping. Section 5 gives results of the bibliometric analysis addressing trends and conceptual structure based on co-occurrence mapping. Conclusion summarizes the main findings, implications, and future directions.

2. Theorical background and literature review

According to the IPCC, the transition to net zero carbon emissions poses risks to consumers, businesses, and the financial sector. The financial sector is crucial in carrying out global initiatives such as the Paris Agreement, which aim to reduce greenhouse gas emissions, fund low-carbon transitions, and redistribute vital resources (Lang et al., 2023).

The financial system aids in the transition of the economy towards sustainability by shifting investments from harmful to eco-friendly activities and creating instruments like loans, bonds, funds, and indices that prioritize sustainability (Baker et al., 2022). According to Azmi et al (2021), this is consistent with financial system's role of channeling savings into investment.

The heightened financial concerns linked to climate change can potentially endanger financial stability. Financial institutions face exposure to climate risks, which can impact them directly through reduced business profitability or asset devaluation, as well as indirectly through lower economic growth or macro-financial shifts. According to European Central Bank (ECB, 2022), these risks can be categorized into physical and transition risks.

Physical risks arise from the impacts of changes in the climate and damage to the environment. As claimed by the Bank of International Settlements (2021a), these risks can be broadly categorized into two types. Acute climatic disasters result in immediate and temporary damage, whereas chronic climate trends have enduring effects on financial institutions.

The European Union, as shown in Figure 1, estimates 56.6 billion euros in economic losses due to these natural phenomena in 2021. Countries affected by extreme climate events face worse debt conditions and financial access.

Fig.1. EU Economic losses from extreme events in € Billions (2000-2022)
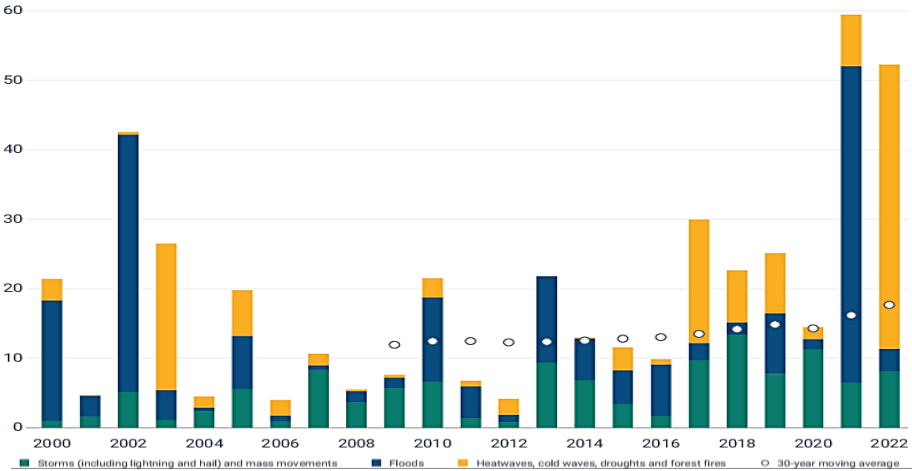
Source: European Environment Agency, 2023

Transition risks refer to the social and financial costs or losses resulting from an entity's transition towards a low-carbon or decarbonized economy, which can be divided into three forms.

- *Climate regulation and policies:* the Paris agreement aims to maintain global warming to levels min 2ºC, involving fiscal, trade, resource conservation, and public subsidies.
- *Changes in technology:* new policies require the replacement of old energy sources with greener, more sustainable ones, requiring substantial prices.
- *Market sentiment:* changes in investor and consumer attitudes towards sustainable economic solutions impact asset valuations. Financial institutions are incorporating initiatives with environmental impact into their portfolios.

Transition risks create stranded assets that cannot adapt to a decarbonized economy due to their core activities, similar to fossil fuels' situation (Sedkaoui and Khelfaoui, 2020). The Bank for International Settlements (BIS, 2021) highlighted how physical and transition concerns can cause financial problems.

The Bank of International Settlements identifies macro and microeconomic transmission mechanisms for climate risks, illustrating how these variables impact entities, assets, and economies. It also categorizes

financial risks into micro and macroeconomic effects. Table 1 table illustrates how climate risks are carried through micro and macroeconomic channels in each of these traditional threats.

Climate risks have varying impacts on economies and financial firms, with three types of variability: spatial, amplifying, and mitigating heterogeneity (Lang et al., 2023). Geographic heterogeneity suggests differences in economic, social, and location policies may generate disparities in the economic impact of climate risk variables. Climate risk significantly influences the availability of bank financing (Li and Wu, 2023), but can be mitigated through government action. Financial institutions with lower deposit levels and located in coastal regions see a greater impact. Bonds issued by US States vulnerable to climate risk require greater returns than those from states with a reduced probability of natural disasters. Bank size also affects climate change differently, with larger banks having more resources and supervision.

Table 1: How climate change influences financial stability

Financial Risks	Influences
Credit Risk	Extreme weather events can cause significant capital loss or damage, reducing loan repayment ability and asset value. Gradual clim atic phenomena, like desertification, can also lead to loss of payment capacity and guarantee value. Exposure to climate risks affects the credit solvency of loans and bonds issued by entities.
Market risk	Changes in economic agent preferences can cause p rice disturbances and increased market volatility.
Operational risk	Changes in human and institutional behaviors, rapid economic changes, and direct physical impacts.
Liquidity risk	Directly affects bank ' ability to raise funds or liquidate assets. Indirectly affects liquidity through customers ' demands.

Source: Author's elaboration

The economic and financial effects linked with climate change can lead to large current and future losses for banking institutions (BIS, 2021). In reality, the results of the stress test boosted the overall losses due to

credit and market risk to 70 billion euros within three years (ECB, 2022). This is why financial institutions are increasingly worried with assessing and recognizing the exposure of their assets to the climate risks discussed in the previous sections.

It is crucial to know the measurement procedures that banks and supervisory entities are now using or developing with the purpose of quantifying the implications of climate risk on their portfolios.

Common risk metrics can be expanded to evaluate financial risk associated with climate change, as per Bank for International Settlements' 2021 document on measurement methodologies:

- *Climate risk scores and scenario analysis* are methods used to assess the exposure of assets, companies, or countries to climate risks. They combine risk classification and rating criteria, based on qualitative or quantitative factors.
- *Climate VaR assessments* use the VaR paradigm to evaluate the impact of climate change on the balance sheets of financial institutions, quantifying the monetary worth of assets under specific climatic scenarios.
- *Natural capital analysis* evaluates the negative impact of natural degradation on financial institutions, assessing their portfolio-level dependencies on natural capital assets.
- *Sensitivity analysis* is a subset of sensitivity analysis used in estimating the impact of a factor on economic results by changing a parameter over multiple scenarios.
- *Stress testing* assesses financial institution's short-term economic shock resilience, often aiming for capital adequacy.

In addition, sustainable finance policies have been established at the institutional level, with the United Nations' 2015 ratification of 17 Goals as a component of the 2030 Roadmap towards Sustainable Development (Sedkaoui and Khelfaoui, 2020). These goals aim to alleviate poverty, safeguard the earth, and promote prosperity for all. To accomplish these targets, financial and economic resources must be mobilized to mitigate climate change. Large-scale mobilization of public and private resources is

expected to be required, with a projected allocation of 6 billion dollars annually.
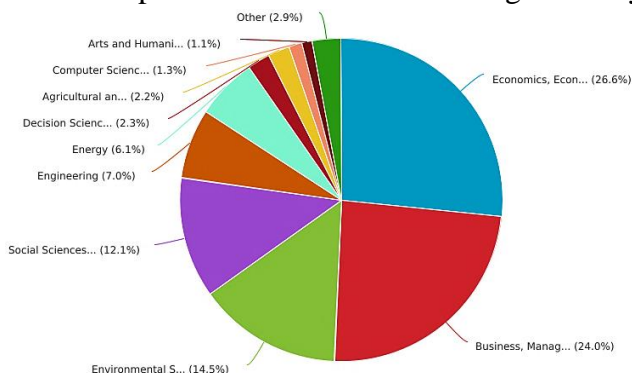
3. Data and methodology

Climate change poses significant environmental, economic, and societal risks globally, causing uncertainty and long-term financial risks for all entities, sectors, and economies. (IPCC, 2022). Banks with increased exposure to climate risks have worse balance sheets due to intensified traditional risks such as credit, market, liquidity, operational, reputational, and legal risks. These elevated risks make access to finance more difficult and expensive, as investors demand higher premiums for these risks (Azmi et al., 2021). Clients are also more reluctant to deposit assets in businesses whose reputation is harmed. Climate change negatively affects company liquidity, bond prices, and loan expansion. Between 40-54% of global financial assets are directly or indirectly vulnerable to climate risks (Calvet et al., 2022).

Climate change and its associated risks are crucial for the financial and economic sectors, as they can divert investment flows towards clean operations, mobilize resources, and establish sustainable financial products (Sharifi, 2021). The financial and economic sectors are vital in combating climate change through redirecting investment towards environmentally friendly activities and creating financial products that promote sustainability. Nevertheless, there is a lack of research investigating the consequences of climate change upon the financial and economic domains. Although there are multiple methods employed to measure the influence of financial risks, there remains a deficiency of standardization on a global scale (BIS, 2021).

These two sectors are increasingly concerned regarding the consequences of climate change, which is anticipated to become a prominent subject in scientific literature in the near future. However, quantifying banking exposure to climate risks, lack of homogeneous standards, and recent regulations and initiatives have led to a relatively preliminary approach by the academy, especially in economic, business and management fields (as illustrated in Figure 2).

Fig.2. Research publications on climate change risks by field

Economics, Econ... (26.6%)
Business, Manag... (24.0%)
Environmental S... (14.5%)
Social Sciences... (12.1%)
Engineering (7.0%)
Energy (6.1%)
Decision Scienc... (2.3%)
Agricultural an... (2.2%)
Computer Scienc... (1.3%)
Arts and Humani... (1.1%)
Other (2.9%)

Source: Author's elaboration based on Scopus database (2010-2023)

This paper presents significant challenges in the research field but also offers potential for meaningful contribution to the literature. A bibliometric analysis is conducted to evaluate the structure of different fields, identify current trends, and detect gaps in the literature. This analysis serves as a guide for the author to begin a doctoral thesis on this topic.

Bibliometrics is a quantitative research method that uses statistical and mathematical methods to study texts, documents, or authors (Garg et al., 2020; Baker et al., 2022). It is widely used across various disciplines and has gained popularity due to easy access to data sources like Scopus, Web of Science, and PubMed, as well as advances in bibliometric software like VOSviewer, Gephi, and Bibliometrix. Bibliometric analysis allows for the management of large volumes of data, deciphering scientific information, and significantly impacting research by studying existing linkages in research, such as countries, authors, institutions, or topics.

The bibliometric procedure involves four steps: defining study objectives, choosing appropriate bibliometric techniques, collecting data, and executing the analysis. The study's objectives are defined in the theoretical framework, and performance analysis and co-occurrence analysis are used. Data collection is defined, including the database, time horizon, and search keywords. The results are observed and reported, ensuring a comprehensive and effective bibliometric approach.

Data was collected in January 2024, through an exhaustive exploration of Scopus database using the SNDL (Systeme National de Documentation

en Ligne) website. The search topics were chosen based on previous literature reviews. Scopus (https://www-scopus-com.sndl1.arn.dz/) was chosen due to its provision of reliable literature, data, metrics, and analytical tools from diverse disciplines.

The search included: "climate risk, green risk, environmental risk, climate finance, and climate transition". The results showed 52.644 documents. To ensure the combination of search terms with at least one study includes all relevant topics, 'OR' is used.

The initial search was refined to include articles in economics, finance, management, and business fields, using Scopus categories. After eliminating redundant and inaccurate samples, the resulting sample includes 2360 documents from January 2010 to December 2023. The search was limited to articles, chapters of books, and reviews published in English with titles, abstracts, or keywords following the query procedure outlined in the table.

Table 2: Sample characteristics

Main information		Results
Database		Scopus
Link		https://www-scopus-com.sndl1.arn.dz/
Time period		Jan 2010 – Dec 2023
Types of documents	*Articles*	1853
	Review	405
	Book chapters	102
Annual growth rate %		29.6
Citation average per document		5
Sources		802
References		113452
Keywords		9713
Authors		6542

Source: Author's elaboration

As illustrated in Table 2, the database contains 2360 documents published between January 2010 and December 2023, with 1853 articles, 405 reviews, and 102 chapters in books. The articles received an average of

5 citations per article. They were published in 802 sources and involved 6766 authors. The articles used 9.870 references and 9207 keywords, with an average 48.07 and 4.11 per document, respectively. The database has 6542 authors.

4. Performance analysis and scientific mapping

This section presents bibliometric analysis results, organized into analyzing the performance and creation of scientific maps. Performance analysis examines, in this study, existing scientific contributions in a specific research field, specifically in the economic and financial field of climate risk. The performance analysis is a method used to comprehend the relevance and impact of a topic, focusing on the most relevant authors, institutions, or scientific publications (Donthu et al., 2021). It provides results in categories such as publications by years, journal analysis, and citation analysis.

This study explores the evolution of this topic over time, including the volume of articles, number of authors, average appointments per year, reference authors, leading institutions and nations, and the most relevant scientific publications in this field. The study's first Scopus-recorded publications on the topics were from 1978 (Cohen, 1978). However, the number of articles published before 2010 was deemed insufficient, for this we decided to not cover these years to avoid distorting the time horizon.

The literature on climate risk in the economic and financial fields has experienced exponential growth in recent years, as illustrated in Figure 3.

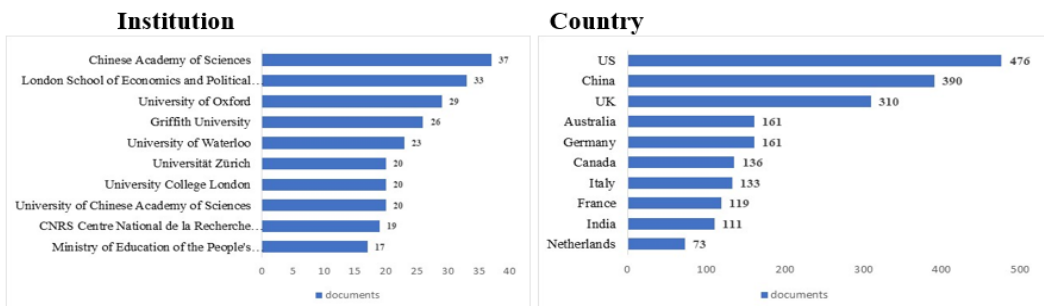**Fig.3.** Evolution of research production related to climate risks
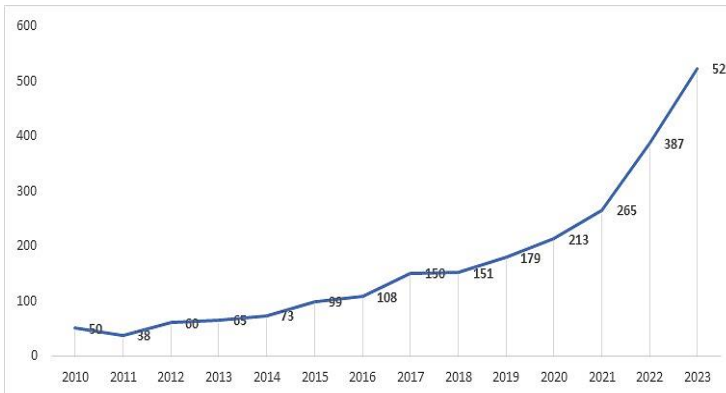
Source: Author's elaboration based on Scopus database

Between 1978 and 2009, only 312 articles were published on climate change, accounting for 11.53% of total scientific publications. From 2016 to 2023, 72.98% of articles were published, indicating a growing interest in climate risks from an economic-financial perspective. The completion of the ratification of the Paris Agreement has expedited endeavors to execute its provisions. In addition, the primary objective of the 2020 Climate Action Summit was to expedite endeavors to address climate change, resulting in the establishment of global initiatives such as the Action Plan on Climate Change to be implemented by 2025.

The subject's importance is apparent from the release of 37 documents during the initial week of January 2024, surpassing the numbers from previous years. If the current trend continues, it is expected to exceed the number of documents published. The Scopus citation report revealed that 2360 documents, based on search criteria, received a total of 375 citations between 2015 and 2023.

Numerous articles discuss the impact of climate risks on property prices, how lenders are incorporating these risks into mortgages, and the success of portfolios hedging climate risk among investors (Rendón et al., 2022; Duan and Li, 2024). Figure 4 shows the top 10 institutions leading research on this topic, including From China: like the Chinese Academy of Sciences, and from Europe: we mention London School of Economics and Political Science.

Fig.4. Publications by institution and by country

Source: Author's elaboration

The figure also ranks countries with at least 70 publications, with the US leading with 476, followed by China and the UK with 390 and 310 documents, respectively.

5. Results and discussions

This section provides a comprehensive overview of climate change exposure research through a graphical visualization of keyword co-occurrence, highlighting key issues and research directions.

Co-word analysis is a method used to study the co-occurrences of two terms in in order to discern the conceptual and thematic framework a scientific field. calculates the quantity of documents within the texts, where the words appear together in titles, summaries, or keywords (Chen, et al., 2023; Donthu et al., 2021). The analysis unit is the words, and it is a quantitative technique that analyzes the substance of written works through the analysis relationships of co-words (Shang and Jin, 2023).

In this study, the analysis words are derived from the keywords of each document. VOSviewer software is used to graph the keyword network, which represents a network of elements with the total number of links and their intensities.

Fig.5. Simultaneous appearance among keywords

Source: VOSviewer outputs

The dimensions of circular shapes corresponding to each keyword is proportional to its relevance (van Eck and Waltman, 2009). VOSviewer's co-occurrence analysis initially considers all 11033 words of selected documents, but to ensure consistency and representativeness, only keywords repeated no less than 20 occasions are considered, making a sample with 103 elements.

A clustering approach was carried out applying co-occurrence analysis of terms to identify the most developed areas and research trends (Garg et al., 2020). Four clusters were identified, based on the number of keywords and the topic they address. The VOSviewer software generated these clusters, demonstrating 4 colors, as shown in Figure 5 and summarized in Table 3.

Table 3: Clusters identified in the co-occurrence analysis

Cluster	Color	Frequent keywords (>20)	Area
1	Red	Environmental risk, risk management, sustainable development, environmental performance, environmental risk management, renewable energy, corporate social responsibilities, financial performance, environment, sustainability, economic growth, and governance.	CSR, corporate sustainability and environmental management
2	Blue	Climate finance, sustainable finance, covid-19, green finance, development, climate change adaptation, ecosystem services, and unfecc.	Climate finance and development
3	Green	Climate change, adaptation, climate risks, mitigation, tourism, food security, resilience, extern weather, agriculture.	Climate change impacts and adaptation
4	Yellow	Climate risk, corporate governance, credit risk, climate transition risk, scenario analysis, systemic risk, and ESG.	Financial risk management and climate transition

Source: Author's elaboration

The red cluster, focuses on climate change risks in finance and economics, encompassing environmental management, corporate social responsibility, sustainable development, and economic growth. It also emphasizes the importance of governance and development, focusing on the wider societal and institutional frameworks in which these risks and responses take place.

The second cluster, indicated in blue color in the keywords map, focuses on examining the financial risks linked to climate change. It specifically underlines the vulnerability of financial institutions and markets to climate-related events. The concepts of sustainable finance, green finance, climate change adaptation, and UNFCC highlight the importance of incorporating strategies to reduce and mitigate the effects of climate change within the financial and economic industry. The term 'Covid-19' emphasizes the interconnectedness and broader societal consequences of climate change and related issues.

The green cluster prioritizes climate action and response, emphasizing solutions to minimize the effects of climate change, ensuring food security, building resilience, and managing extreme weather events. It also includes terms like agriculture and tourism, highlighting the broader environmental and societal implications of these actions.

The yellow cluster explores the social and governance aspects of climate change risks, using terms like ESG, climate transition risk, and scenario analysis to involve climate considerations in decision-making. The terms systemic risk highlights the interconnectedness and broader societal impacts of climate change and associated risks.

The bibliometric analysis identifies the risks and uncertainties associated with climate change and the investment in its fight, focusing on green and yellow clusters. These clusters are closely related to the blue cluster, which studies climate finance, focusing on local and global financing from both the public and private sectors (Sedkaoui and Khelfaoui 2020) for climate change adaptation and prevention strategies. The basic climate change cluster is related to its macroeconomic and microeconomic effects, while the red cluster focuses on environmental risk and the

traditional relationship between climate change and finance based on pollution and business management.

The study analyzed the temporal evolution of keywords to identify four clusters defining main search areas. Yellow indicates later keyword appearance in the study area (Shang and Jin, 2023), while purple indicates that the area was already being studied in 2018. This method helps in identifying the most relevant keywords for future research.

The color gradient of themes indicates their evolution over time. Purple and blue clusters present established themes, while greener and yellower clusters indicate emerging ones. Green clusters focus on climate action and response, indicating a shift towards solution-oriented research. Yellow clusters emphasize social and governance aspects, highlighting the growing recognition of the broader societal context surrounding climate change risks.

Fig.6. Temporal analysis of evolution of keywords in the literature
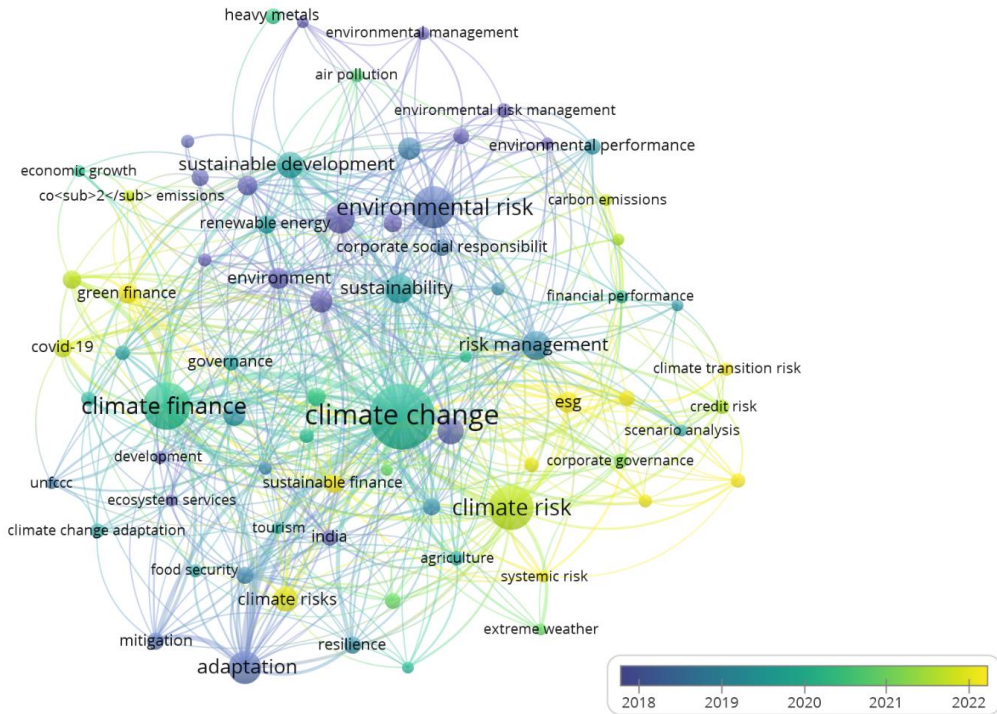
Source: VOSviewer outputs

Figure 6 shows clusters with unique relationships, with the green cluster being the foundational framework for understanding climate change

risks in finance and economics. The blue cluster highlights the interplay between financial risks and response strategies, while the yellow cluster emphasizes the importance of social and governance considerations in addressing both theoretical underpinnings and environmental impacts of climate change.

Numerous researches have been undertaken to investigate the correlation between environmental risks and debt, with Sharfman and Fernando (2008) stating that an improvement in environmental risk in companies leads to lower capital costs. This research topic, particularly those related to pollution, has been associated with the purple cluster. However, the perception of climate change as a risk has increased significantly, leading to a surge in studies in the yellow, blue, and green clusters, such as climate finance and climate change. Currently, studies focus on Climate risks, climate change, climate finance, risk management, financial performance, governance, sustainable finance, green finance, climate transition risk, and ESG, highlighting the growing importance of understanding and addressing environmental risks.

It should be mentioned that the research area is structured into several subdomains, including institutional, environmental, and economic aspects. The red and blue clusters focus on macro and microeconomic aspects, while the green cluster encompasses climate change investment and funding. The financial and economic sectors are a key channel for funds in combating climate change, impacting companies, sectors, and countries. The yellow cluster, on the other hand, focuses on environmental and pollution aspects, which may intensify with climate change but do not represent the entire essence of the issue. These clusters are more directly involved in the fight against climate change, with significant effects on companies, sectors, and countries.

6. CONCLUSION

The growing concern for the consequences of climate change on society and the economy., the risks faced by financial entities, and the increasing regulations imposed on the sector regarding sustainability, along with the shift in individuals' demand for green investments, has led to a surge in academic research on finance and climate risks.

This study analyzes climate risks in the financial sector through bibliometric analysis of 2360 Scopus publications from 2010-2023. The analysis focuses on topics, document types, scope of action, and time period, examining trends and patterns in climate risk in the financial and economic sectors. The analysis includes articles, book chapters, and reviews. The bibliometric analysis has identified the following main conclusions:

- The implementation of the agreement of Paris (2015) and the Climate Action Summit (2020) significantly increased the number of publications on climate change, with the US publishing the most (476 documents), with the majority of co-authors coming from European institutions.
- A scientific mapping using the VOSviewer tool has identified four main clusters: climate risks (investment and financing), macro impacts (adaptation, agriculture), microeconomic effects of climate change (CSR, corporate governance, sustainability), and environmental risk.
- The central cluster, most recent in time, consists of risks and uncertainties related to climate change, closely linked to investment and financing.

The analysis of existing studies reveals gaps in the literature, allowing for the proposal of new research lines. The first is to explore the consequences of climate risk on corporate bonds and loans. The Bank for International Settlements report highlights the need to investigate how climate change factors contribute to financial risks faced by banks. Another area of research is the analysis of the study carried out from Algerian scholars using ASJP databases. Studies focusing on economies like the Middle East could also be interesting.

6. Bibliography List

Azmi, W., Hassan, M.K., Houston, R. and Karim, M.S. (2021). ESG activities and banking performance: International evidence from emerging economies. *Journal of international financial markets*, 70, 101277.

Baker, H.K., Kumar, S., Pandey, N. and Kraus, S. (2022). Contemporary Accounting Research: A Retrospective between 1984 and 2021 Using Bibliometric Analysis. *Contemporary Accounting Research*

BIS report (2021). Climate-related risk drivers and their transmission channels. Basel Committee on Banking Supervision (April 2021)

Calvet, L., Gianfrate, G., and Uppal, R. (2022). The finance of climate change. *Journal of corporate finance*, 73, 102162

Chen, X., Yang, F., Cheng, S., and Yuan, S. (2023). Occupational health and safety in China: a systematic analysis of research trends and future perspectives. *Sustainability*, 15, 14061.

Donthu N., Kumar, S., Mukherjee, D., Pandey, N., and Lim, M.W. (2021). How to conduct a bibliometric analysis: An overview and guidelines. *Journal of business research*, 133, 285-296.

Duan, T., and Li, F-W. (2024). Climate change concerns and mortgage lending. Journal of empirical finance, 75, 101445.

ECB report (2022). 2022 Climate risk stress test. (July 2022)

Garg, K. C., Kumar, S., and Singh, R. K. (2020). Bibliometric study of the coverage and overlap of journals indexed by four abstracting and indexing services in library and information science. *The serials librarian*, 79(1-2), 118–130.

IPCC. (2022). Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, UK.

Lang, Q., Ma, F., Mirza., and Umar, M. (2023). The interaction of climate risk and bank liquidity: An emerging market perspective for transitions to low carbon energy. *Technological forecasting and social change*, 191.

Li, S., and Wu, X. (2023). How does climate risk affect bank loan supply? Empirical evidence from China. *Economic change and restructuring*, 56, 2169-2204

Rendón, O.R., Sandorf, E.D., Beaumont, N.J. (2022). Heterogeneity of values for coastal flood risk management with nature-based solutions. *Journal of environmental management*, 304, 114212.

Shang, Q. and Jin, X. (2023). A bibliometric analysis on climate finance: current status and future directions. *Environmental science and pollution research*, 30, 119711–119732.

Sharfman, M.P., and Fernando, C.S. (2008). Environmental risk management and the cost of capital. *Startegic management journal*, 29, 569- 592.

Sedkaoui, S., Khelfaoui, M. (2020). Sharing Economy and Big Data Analytics. London, UK: Wiley-ISTE

Sharifi, A. (2021). Urban sustainability assessment: an overview and bibliometric analysis. *Ecological indicators*, 121, 107102.

Van Eck, N. J., and Waltman, L. (2009). Software survey: VOSviewer, a computer program for Bibliometric mapping. *Scientometric*s, 84(2), 523–538.