

Investigations of Climate Risk Exposure in Corporate Finance Implications: A Bibliometric Analysis and Future Research Directions

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ABSTRACT

This study utilizes the Scopus database to examine research developments on climate risk exposure and its implications for corporate finance. The primary objectives are to identify dominant themes, map the intellectual structure of the field, and highlight prospective avenues for future inquiry. Employing bibliometric techniques and content analysis guided by the PRISMA protocol, the study applies strict inclusion-exclusion criteria to compile relevant publications. A total of 102 journal articles and reviews published between 2007 and 2025 were analyzed using R-Biblioshiny, VOSviewer, and Harzing's Publish or Perish. The findings reveal a notable expansion in scholarly output and uncover four core thematic clusters: (1) climate change and financial market dynamics, (2) climate risk exposure within corporate activities, (3) sustainable development and financial system stability, and (4) risk management and strategic corporate responses to climate-related risks. These clusters underscore the multidimensional nature of climate risk, spanning issues such as market volatility, asset pricing, credit and default risk, sustainability transitions, and firm-level adaptation mechanisms. The study synthesizes major contributions within each thematic area and proposes future research priorities, including enhanced climate risk quantification, cross-country comparative assessments, the integration of climate science into financial modeling, and deeper investigation of firm-level responses to climate threats. To the best of the authors' knowledge, relatively few studies have employed a comprehensive Scopus-based bibliometric and content analysis to examine climate risk within the corporate finance literature. This study contributes to the field by systematically mapping its intellectual structure, thematic evolution, and emerging research directions, thereby providing a foundation for future theoretical and practical developments.

Keywords: Bibliometric Analysis, Climate Risk Exposure, Corporate Finance, Environmental Risk, Sustainable Development.

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INTRODUCTION

Environmental dynamics reflect the uncertainty and rapid market changes, requiring companies to be adaptive and innovative in responding to constantly evolving external conditions. One crucial environmental dynamic today is climate change (Trinh *et al.*, 2024), which not only impacts a company's physical and operational conditions but also influences government policies, consumer preferences, and stakeholder expectations (Li *et al.*, 2024; Naseer *et al.*, 2025; Yildiz and Temiz, 2024). Based on data from the WMO (2024), in 2024, the global mean temperature reached 1.55°C, which is 0.13°C higher than the 1850-1990

baseline period commonly used to represent Earth's natural climate conditions before substantial human influence. This temperature increase illustrates the ongoing impact of global climate change, driven by factors such as rising greenhouse gas emissions and deforestation particularly the large-scale removal of trees which further accelerates global warming.

Physical losses due to extreme weather and climate change, such as flooding, fire, or damage, make future cash flows uncertain or at risk (Yildiz and Temiz, 2024) thus becoming more familiar with climate risk. Climate risk may influence the availability of natural resources and raw materials essential for production processes, and it can also damage critical facilities or infrastructure. Such disruptions can hinder a company's operational continuity, particularly within its supply chain (Alves *et al.*, 2017). Furthermore, climate change can create financial challenges for firms. Companies exposed to climate risk often struggle to secure external financing, as investors and lenders are wary of potential losses or operational disruptions arising from natural



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disasters or evolving environmental regulations. In response, firms may be compelled to adopt greater risk-taking behaviours such as pursuing new investments or engaging in riskier strategic decisions to mitigate or compensate for the impacts of climate change (Li *et al.*, 2024).

Climate risk exposure functions not only as a communication mechanism through which firms inform stakeholders about the risks they encounter, but also as a strategic instrument that guides them in implementing concrete actions to reduce carbon emissions. Such disclosures attract oversight and support from investors, regulators, and the broader public, thereby motivating companies to design and execute more measurable and efficient carbon-emission reduction strategies. Clearly, concisely, and informatively communicating a firm's risk factors is essential, as it enables investors to more accurately evaluate the company's stock performance and overall risk profile (Healy and Palepu, 2001). Among the various types of risks disclosed in financial statements, disclosure of risks due to climate change is crucial. Meanwhile, the nature and orientation of equity investors and creditors toward long-term risks and opportunities differ (Jin and Gan, 2025). Positive disclosures regarding climate-related opportunities such as improvements in energy efficiency, the development of green products, and the transition toward clean energy serve as indicators of greater future value for equity investors. In contrast, creditors tend to adopt a more conservative stance, emphasizing short-term liquidity risks. Consequently, climate risk exposure conveys distinct signals to equity investors, often functioning as a positive indicator of a firm's forward-looking potential, positive (Cepni *et al.*, 2024; Naseer *et al.*, 2025; Yildiz and Temiz, 2024) and negative (Jin and Gan, 2025).

Despite the rapid growth of the literature on climate risk exposure, existing studies have predominantly employed empirical approaches to examine its effects on firm value (Naseer *et al.*, 2025), financial performance (Zheng *et al.*, 2025), investment decisions (Roncoroni *et al.*, 2025), financing costs (Cepni *et al.*, 2024; Yildiz and Temiz, 2024), and corporate sustainability (Trinh *et al.*, 2024). While these studies have generated valuable insights, they generally focus on isolated relationships, offering only a fragmented understanding of the field's overall development. Existing review studies are largely narrative in nature or confined to specific dimensions of climate-related finance, leaving the broader intellectual landscape insufficiently explored. More importantly, comprehensive Scopus-based bibliometric studies that systematically map the evolution of publications, collaboration networks, intellectual influence, and the thematic knowledge structure of climate risk exposure within the corporate finance literature remain scarce. The absence of such a holistic synthesis limits researchers' ability to identify dominant research streams, emerging themes, influential contributors, and underexplored areas that warrant further investigation. To address this gap, the present study conducts a comprehensive bibliometric analysis to

map the evolution of climate risk exposure research in corporate finance, uncover its underlying knowledge structure, and propose future research directions that can advance both theoretical development and practical applications. Based on these aims, the following three research questions are proposed:

RQ1. How has research related to climate risk exposure in corporate finance evolved, in terms of publication trends, geographic distribution, institutional collaborations, and intellectual influence?

RQ2. What thematic clusters and knowledge structures have emerged in the literature on climate risk exposure and corporate finance?

RQ3. What key research gaps remain unaddressed, and how can future research directions strengthen theoretical and practical understanding of climate risk exposure in corporate finance?

This paper is structured as follows. Section 2 describes the methods used, while Section 3 presents the research results. Section 4 discusses the findings, including theme clusters and future research directions. Section 5 presents the conclusions and implications of the study. Finally, Section 6 outlines the limitations of this study.

METHODOLOGY

Research Design

This study adopts a quantitative approach by combining bibliometric analysis using the Scopus database with content analysis to generate deeper insights. A similar methodological design was applied by (Baas *et al.*, 2020) to synthesize research streams in Scopus-indexed publications from 2007 to 2025. Scopus was selected over other databases for two primary reasons. First, a systematic review of climate risk exposure in corporate finance based on Web of Science (WoS) has already been conducted by (Nazli *et al.*, 2025). Second, WoS offers relatively limited coverage and exhibits substantial overlap with Scopus, as many journals are indexed in both (Baas *et al.*, 2020). Moreover, Scopus provides broader citation coverage compared to WoS (Wube and Atwal, 2024), making it a more comprehensive and suitable source for bibliometric analysis.

Search strategy, criteria and data collection

For the data collection process, this study adopted the PRISMA guidelines for systematic reviews and meta-analyses as described by (Kunisch *et al.*, 2023).

Figure 1 presents the PRISMA flowchart used in this research. Data were retrieved from the Scopus database on 18 November 2025 using the following search query: TITLE-ABS-KEY ("climate change risk" OR "climate risk" OR "physical risk" OR "transition risk" OR "carbon risk" OR "climate disclosure" OR "carbon emission"). The search was conducted across all publication

years available in the Scopus database up to the retrieval date (18 November 2025). To ensure consistency and relevance, the search was refined using the following filters: document type = Article, source type = Journal, and language = English. The initial search yielded 109 records. Subsequently, the titles, abstracts, and author keywords of the retrieved articles were screened to ensure their relevance to the topic of climate risk exposure within the corporate finance context. Following the initial search, 109 records were retrieved from the Scopus database. The screening process was conducted in accordance with the PRISMA framework to ensure the relevance and quality of the dataset. First, duplicate records were checked; however, no duplicates were identified because the data were retrieved from a single database. Next, the titles, abstracts, and author keywords of all records were screened against the predefined eligibility criteria. Articles were included if they (1) were written in English, (2) were published as peer-reviewed journal articles, (3) addressed climate risk exposure within the context of corporate finance, and (4) provided a clear focus on financial, corporate, investment, or market-related implications of climate risk. Records were excluded if they (1) were conference papers, book chapters, books, editorials, notes, or other non-peer-reviewed publications; (2) focused primarily on climate science, environmental engineering, agriculture, or natural sciences without a corporate finance perspective; or (3) did not provide sufficient relevance to climate risk exposure in corporate finance based on their title, abstract, or keywords. Following this screening process, seven records were excluded because they did not satisfy the eligibility criteria, resulting in a final dataset of 102 articles for bibliometric and content analyses. Following this screening process, seven records were excluded, resulting in a final dataset of 102 journal articles, which served as the basis for the descriptive analysis, bibliometric mapping, and content analysis conducted in this study.

Tools and data analysis

To accomplish its objectives, this study utilizes a combination of analytical tools. R-Biblioshiny (Aria and Cuccurullo, 2017) and VOSviewer (Van Eck and Waltman, 2019) are employed to map bibliometric networks, visualize keyword relationships, and examine collaboration patterns among authors, institutions, and publication outlets. Harzing's Publish or Perish (PoP) software (Harzing, 2011) is used to compute citation metrics and identify the most influential works. By integrating bibliometric methods with content analysis, this study establishes a systematic framework for exploring climate risk exposure within the corporate finance domain. This approach highlights major trends, including publication growth, leading countries and institutions, core journals, prominent scholars, keyword co-occurrence structures, collaboration networks, and emerging thematic directions.

RESULTS

Descriptive analysis

This section reviews publications from 2007 to 2025, with a primary focus on journal articles. The earliest study identified, conducted by (George *et al.*, 2007), examined climate risk exposure within the corporate finance domain, particularly in the insurance sector. A Scopus search yielded 102 relevant documents. Analysis of publication trends in this area shows an annual growth rate of 23.7%. On average, the literature receives 136 citations per year with 24.07 citations per article, and references 811 (Table 1).

Figure 2 illustrates the annual publication trend from 2007 to 2025, revealing a consistent upward trajectory. Although no Scopus-indexed studies addressing climate risk exposure in the corporate finance context were published between 2008 and 2016, the volume of publications began to rise notably thereafter, peaking at 46 publications in 2025. This pattern suggests that climate risk exposure within corporate finance has emerged as an increasingly significant topic of scholarly interest.

Research trend analysis

Figure 3 indicates that the fields most closely associated with this topic span Economics; Economics and Finance; Business, Management, and Accounting; as well as the Social Sciences.

The largest share of publications falls within Economics and Economics and Finance at 35.9%, followed by Business, Management, and Accounting at 20.7%, Environmental Sustainability at 12%, and Social Sciences at 11.4%. Figure 3 indicates that the largest proportion of publications is concentrated in Economics and Economics and Finance. This predominance reflects the growing recognition that climate risk has become a material financial risk with significant implications for asset pricing, corporate valuation, investment decisions, financial stability, and capital allocation. In recent years, climate-related risks have increasingly been integrated into mainstream economic and financial research because they influence both macroeconomic performance and firm-level financial outcomes. In addition, regulatory initiatives, sustainable finance frameworks, and the increasing demand from investors for climate-related disclosures have further accelerated research within the economics and finance disciplines. Consequently, scholars in these fields have focused extensively on assessing how physical and transition climate risks affect financial markets, corporate financing, banking stability, and investment behaviour, resulting in a higher volume of publications compared with other disciplines such as environmental sustainability and the social sciences (Battiston *et al.*, 2017; Roncoroni *et al.*, 2021; Bolton and Kacperczyk, 2021).

Table 2 further indicates that, among the ten journals with the highest number of publications on climate risk exposure in

corporate finance, *Finance Research Letters* ranks first with 6 publications (5.50%), followed by the *International Review of Financial Analysis* with 5 publications (4.59%). *Applied Economics* and *Energy Economics* each contributed 4 publications (3.67%). These results show that research on climate risk exposure in the corporate finance domain is predominantly published in leading Scopus Q1 journals, including *Finance Research Letters*, *International Review of Financial Analysis*, *Energy Economics*, *Journal of Environmental Management*, and *Accounting and Finance*. Overall, most studies in this area originate from top-tier Scopus outlets and reputable academic publishers.

However, from a local impact perspective, *Finance Research Letters* (67 citations), the *International Review of Financial Analysis* (58 citations), and the *Journal of Cleaner Production* (81 citations) exhibit the strongest influence, each with an h-index of 3 for this topic. The top ten journals ranked by local impact (h-index) are shown in Figure 4.

Most influential countries, affiliates, and productive authors

Table 3 reports the top ten contributing countries out of 68, with China leading at 39 publications (38.2%), followed by the United States with 20 publications (19.6%), the United Kingdom with 16 publications (15.7%), and Australia with 10 publications (9.8%). The majority of these countries are located in Asia, the Americas, and Europe, indicating a strong concentration of research activity in these regions. In contrast, contributions from West Asia remain relatively limited. This disparity underscores the need to strengthen cross-regional research collaboration on climate

risk exposure in corporate finance, particularly by encouraging greater participation from regions with lower publication activity.

Furthermore, research contributions on climate risk exposure in corporate finance are largely driven by institutions in Asia and Europe. As shown in Figure 5, the Capital University of Economics and Business leads with 6 publications (5.9%), highlighting its prominent role in advancing studies on climate risk and climate policy uncertainty in relation to corporate strategies, financial

Table 1: Descriptive information.

Description (metrics)	Result (data)
Publication years (period)	2007 - 2025
Total documents	102
Number of citations	2455
Citation Years	18 (2007 - 2025)
Citations per Year	136.39
Average citation per Paper	24.07
h_index	21
g index	48
Author keyword	331
Author	102
Sources	67
Authors of single-authored docs	7
International co-authorship	37.25%
References	811
Co-author pe doc	2.58
Annual growth rate	23.7%

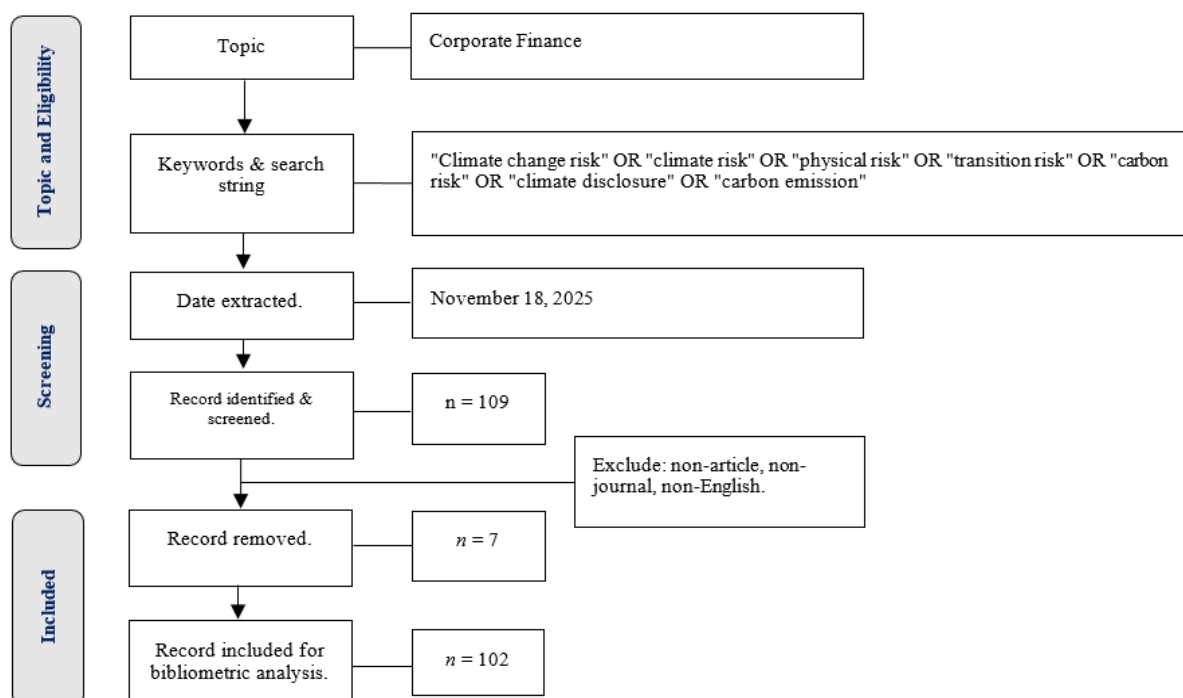


Figure 1: Data processing and search strategy.

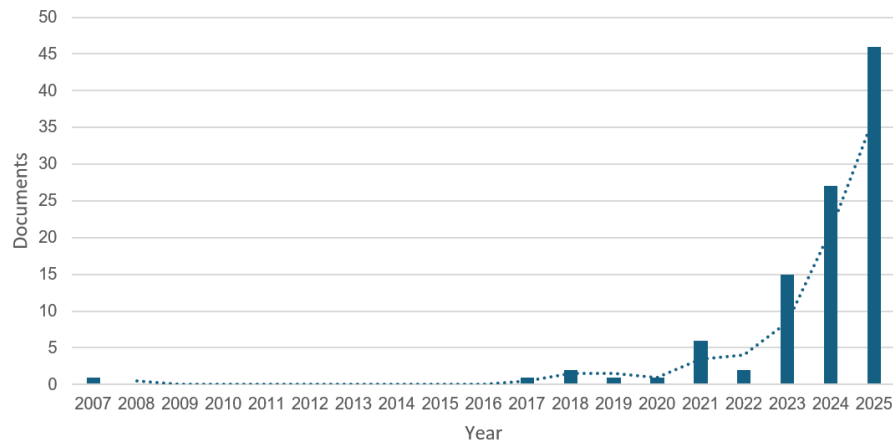


Figure 2: Number of publications per year.

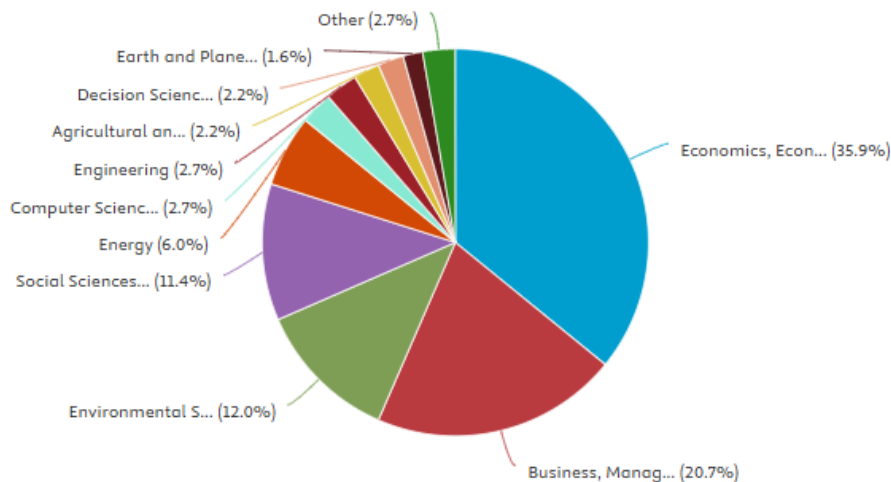


Figure 3: Subject area.

decisions, and firm-level exposure. Xiamen University follows with 4 publications (3.9%), while The University of Manchester ranks third with 3 publications (2.9%). Five additional institutions also contributed 3 publications each (2.9%). Overall, these findings indicate that Asian institutions particularly those in China play a major role in supporting scientific output and knowledge development on climate risk exposure within the corporate finance domain.

The findings of this study (Table 4) indicate that research on climate risk exposure in corporate finance has expanded substantially over the past two decades. The most highly cited works consistently emphasize the critical role of climate risk in shaping financial decisions and mitigation strategies Engle's (2020). Influential article, with 628 citations, underscores the significant impact of mitigation approaches on climate-related financial risk. Subsequent contributions by scholars such as Javadi (2021) from the United States and Huang (2022) from Hong Kong further advance the field by examining how firms' climate risk exposure and geographic vulnerability affect banks'

lending decisions, as well as how corporate climate risk and risk management practices interact with bank credit financing.

Collectively, these studies demonstrate that climate-related issues extend beyond the domains of energy and environmental science and are now firmly embedded within corporate finance. Accordingly, this study contributes to broadening scholarly understanding of the evolution of climate risk and the emerging opportunities for policy interventions in corporate finance. The reviewed literature is theoretically significant and offers practical insights for financial instrument development, portfolio management, and broader financial education. This reaffirms that climate risk constitutes a strategic area essential to supporting a more resilient and adaptive corporate finance system.

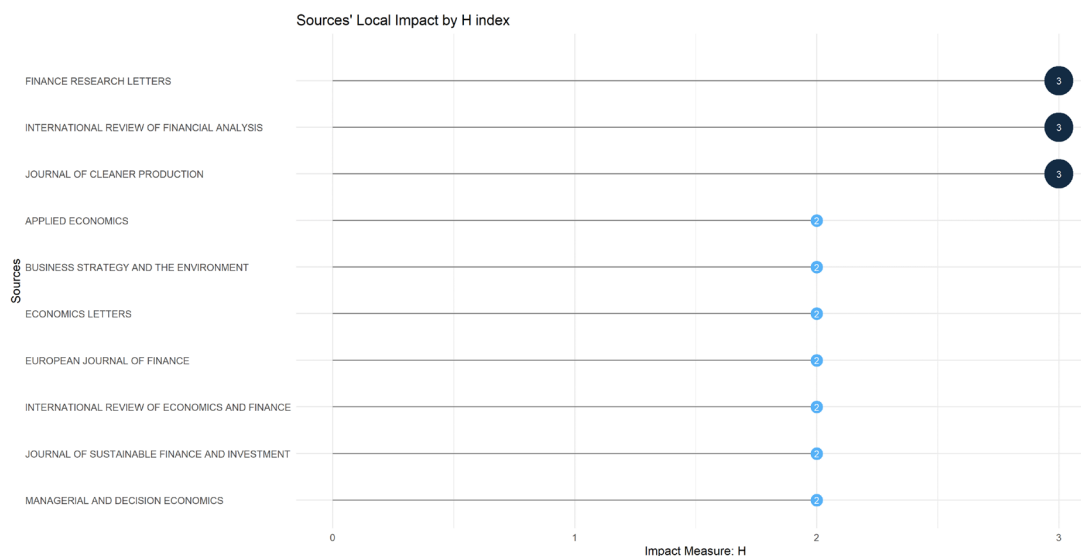
Keywords analysis

Table 5 presents the ten most frequently occurring keywords in the Scopus-indexed literature on climate risk exposure within the field of corporate finance. These keywords reflect the dominant

Table 2: The ten most popular journals.

Sl. No.	Source Title and Scopus Rank	Publisher	TP	%	TC	C/P	h	g
1.	<i>Finance Research Letters</i> (Q1)	Elsevier	6	5.50	67	11.17	3	6
2.	<i>International Review of Financial Analysis</i> (Q1)	Elsevier	5	4.59	58	11.60	3	5
3.	<i>Applied Economics</i> (Q2)	Taylor and Francis Ltd.,	4	3.67	30	7.50	2	4
4.	<i>Energy Economics</i> (Q1)	Elsevier	4	3.67	44	11.00	1	4
5.	<i>Journal of Environmental Management</i> (Q1)	Elsevier	3	2.75	3	1.00	1	1
6.	<i>Accounting and Finance</i> (Q1)	Wiley-Blackwell	3	2.75	11	3.67	1	3
7.	<i>Asia Pacific Journal of Financial Studies</i> (Q3)	John Wiley and Sons Ltd.,	3	2.75	4	1.33	1	1
8.	<i>Business Strategy and the Environment</i> (Q1)	John Wiley and Sons Ltd.,	3	2.75	107	35.67	2	3
9.	<i>Journal of Cleaner Production</i> (Q1)	Elsevier	3	2.75	81	27.00	3	3
10.	<i>Sustainability (Switzerland)</i> (Q2)	MDPI	3	2.75	1	0.33	1	1

Note(s): TP=total number of publications; TC=total citations; C/P=average citations per publication; and h=h-index; g=g-index.

**Figure 4:** Journal local impact related to the topic.

themes explored by scholars, encompassing climate change, climate risk, risk management, climate finance, financial stability, innovation, and adaptive management. Collectively, they illustrate the breadth of research focus and the nature of climate-related financial studies.

The analysis of keywords is further enriched through insights derived from the VOSviewer visualization, which identified 48 keywords that satisfied the minimum co-occurrence criterion of three. These keywords are grouped into four thematic clusters, as depicted in Figure 6. The visualization offers a conceptual mapping of the intellectual structure surrounding climate risk exposure within corporate finance, providing a deeper understanding of the principal themes and research directions represented in the literature.

Moreover, the thematic map presented in Figure 7 constructed using density and centrality measures identifies four

distinct quadrants. These insights were generated through a semi-automated algorithm that examined the titles of all references related to the research topic. The lower-left quadrant reflects emerging or declining themes, representing topics that have been long discussed but are currently experiencing upward or downward trends. The upper-right quadrant encompasses the motor themes, which are well-developed and central to the field, indicating their significance for future research advancement. Incorporating these themes is essential, as they represent widely addressed and foundational topics. Overall, this analysis provides a more nuanced understanding of the dominant themes explored in studies on climate risk exposure within corporate finance. Further details on the research stream analysis are summarized in Table 6.

Accordingly, Table 6 and Figure 5 illustrate four research clusters derived from keyword co-occurrence. Through cartographic analysis, we identified thematic groupings that represent the most

prominent topics in the climate risk exposure literature within corporate finance. Consistent with the approach of (Baas *et al.*, 2020), the first cluster encompasses studies centered on climate change. The second cluster highlights the linkage between climate change and corporate risk. The third cluster comprises broader discussions on sustainable development, while the fourth cluster focuses on risk management. Together, these clusters provide a structured overview of the dominant research themes in this field.

Co-citation analysis

The co-citation analysis reveals the intellectual foundations and seminal references that have shaped the development of research on climate risk exposure within the corporate finance literature.

As illustrated in Figure 8, the VOSviewer analysis identifies three major co-citation clusters, each representing a distinct but complementary research stream. The first cluster (red) comprises studies by (Acharya *et al.*, 2024; Bua *et al.*, 2024; Torricelli *et al.*, 2025; Zhu and Li 2024), which primarily examine whether physical climate risks, particularly heat exposure and heat stress, are incorporated into financial asset prices. These studies demonstrate that regions with higher exposure to extreme heat exhibit wider bond yield spreads and higher expected stock returns, suggesting that financial markets recognize and price physical climate risks (Olaniyan, 2025). From a corporate finance perspective, this cluster highlights how climate-related physical risks influence asset valuation, financing costs, and investors' risk assessments. The second cluster (green) is represented by (Allen *et al.*, 2018), who focus on climate transition risk by examining how

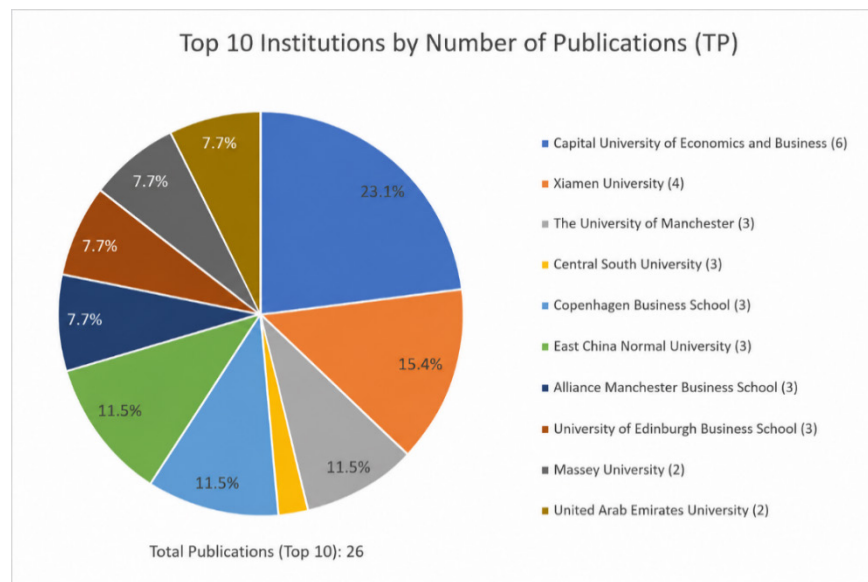


Figure 5: The top 10 institutions contributed to the publications.

Table 3: The top 10 Countries contributed to the literature.

Country	TP	(%)	TC	C/P	Continent
China	39	38.2%	458	11.7	Asia
United States	20	19.6%	1075	53.8	North America
United Kingdom	16	15.7%	410	25.6	Europe
Australia	10	9.8%	125	12.5	Australia
France	6	5.9%	40	6.7	Europe
Germany	4	3.9%	88	22.0	Europe
India	4	3.9%	3	0.8	Asia
Italy	4	3.9%	91	22.8	Europe
New Zealand	4	3.9%	85	21.3	Australia
South Korea	4	3.9%	12	3.0	Asia

Note(s): TP=total number of publications; TC=total citations; C/P=average citations per publication.

Table 4: Top ten most cited document.

Author(s)	Title	TC	C/Y	Source and Scopus rank
Engle <i>et al.</i> (2020)	Hedging climate change news	628	125.6	Review of Financial Studies (Q1)
Javadi and Masum (2021)	The impact of climate change on the cost of bank loans	305	76.25	Journal of Corporate Finance (Q1)
Huang (2022)	Firm climate risk management and bank loan financing	169	56.33	Strategic Management Journal (Q1)
Li <i>et al.</i> (2024)	Corporate Climate Risk: Measurements and Responses	144	144	Review of Financial Studies (Q1)
Cepni <i>et al.</i> (2022)	Hedging climate risks with green assets	111	37	Economics Letters (Q1)
Lin and Wu (2023)	Climate risk disclosure and stock price crash risk: The case of China	105	52.5	International Review of Economics and Finance (Q1)
Todaro (2021)	The influence of managers' awareness of climate change perceived climate risk exposure and risk tolerance on the adoption of corporate responses to climate change	90	22.5	Business Strategy and the Environment (Q1)
Cepni <i>et al.</i> (2023)	Climate uncertainty and information transmissions across the conventional and ESG assets	85	42.5	Journal of International Financial Markets Institutions and Money (Q1)
Bua <i>et al.</i> (2024)	Transition versus physical climate risk pricing in European financial markets: a text-based approach	71	71	European Journal of Finance (Q1)
Berkman <i>et al.</i> (2024)	Firm-specific climate risk and market valuation	56	56	Accounting Organizations and Society (Q1)

Note(s): TP=total number of citations; C/Y=citations per year.

policy changes, carbon pricing mechanisms, and the transition toward a low-carbon economy affect macroeconomic conditions, financial markets, and financial system stability. This stream emphasizes that transition-related climate risks have significant implications for capital allocation, investment decisions, and the stability of financial institutions, thereby reinforcing the growing importance of climate considerations in corporate finance. The third cluster (blue) includes of (Addoum 2021; Li and Yang 2025; Muyambo *et al.*, 2024; Parker *et al.*, 2025), who investigate the effects of climate uncertainty and extreme temperature shocks on firms and financial markets. Their findings show that unusually high or low temperatures reduce firm sales, earnings, and industry profitability, while greater climate uncertainty increases firms' cost of equity and financing costs. These studies demonstrate that climate-related uncertainty directly affects corporate financial performance, firm valuation, and investment decisions, positioning climate risk as a critical determinant of corporate financial resilience.

The co-citation patterns indicate that the intellectual foundation of climate risk exposure in corporate finance is built upon three complementary streams: the pricing of physical climate risks, the financial implications of climate transition policies,

and the influence of climate uncertainty on corporate financial performance and financing decisions. The frequent co-citation of these seminal studies demonstrates their collective contribution to advancing theoretical and empirical understanding of climate risk within the corporate finance literature.

Co-authorship analysis

The co-authorship analysis presented in Figure 9 illustrates the collaborative patterns among researchers in this field.

The VOSviewer visualization reveals that scholarly collaboration remains relatively fragmented, with only a few clusters of authors forming strong and cohesive networks. Researchers from China, the United Kingdom, and the United States exhibit the highest levels of connectivity, reflecting their central role in advancing work on climate risk exposure. Each of these countries contributes a distinct yet complementary perspective (Hou and Wu 2025; Zheng *et al.*, 2025), analyzes how firms' climate risk exposure and risk management practices shape bank lending decisions in China (Engle *et al.*, 2020); develops a financial market-based climate risk hedging framework in the (United Kingdom; and Javadi and Masum, 2021) in the United States examines how climate-related risks influence borrowing costs, particularly in high-risk regions.

DISCUSSION

Content analysis

To address RQ2, this study employed a content analysis to explore clusters of authors who examine climate risk exposure within the corporate finance literature. This analysis was further enriched through citation analysis, co-authorship networks, bibliographic coupling, and keyword co-occurrence mapping, as presented in Figures 5-9 and Table 7.

Cluster 1: Climate change on financial market dynamics

This cluster centers on climate change, encompassing terms such as *climate change exposure*, *climate effects*, *climate policy*, and *climate*

resilience. This cluster aligns with foundational studies by (Cepni *et al.*, 2022; Fang 2025; Rognone *et al.*, 2023) which analyze how shifting climate conditions and climate-related news influence financial market reactions (Engle *et al.*, 2020) provides a seminal contribution by developing a hedging approach that quantifies the effects of climate news on asset prices. Meanwhile, Rognone *et al.* (2023) and Cepni *et al.* (2022) examine how climate uncertainty and transition-related shocks generate financial instability and market volatility. Fang (2025) further supports this theme by highlighting how climate change processes interact with systemic financial risks. Overall, this cluster reflects research focusing on climate change as a macro-level driver of financial market dynamics. Future research within the climate change cluster should deepen the integration of climate science with financial

Table 5: Top 10 Keywords.

Sl. No.	Keywords	TP	%
1.	Climate change	32	31%
2.	Climate risk	31	30%
3.	Risk assessment	18	18%
4.	Risk management	7	7%
5.	Sustainability	7	7%
6.	Climate finance	4	4%
7.	Corporate climate risk exposure	4	4%
8.	Financial stability	4	4%
9.	Innovation	4	4%
10.	Adaptive management	3	3%

Note(s): TP=total number of publications.

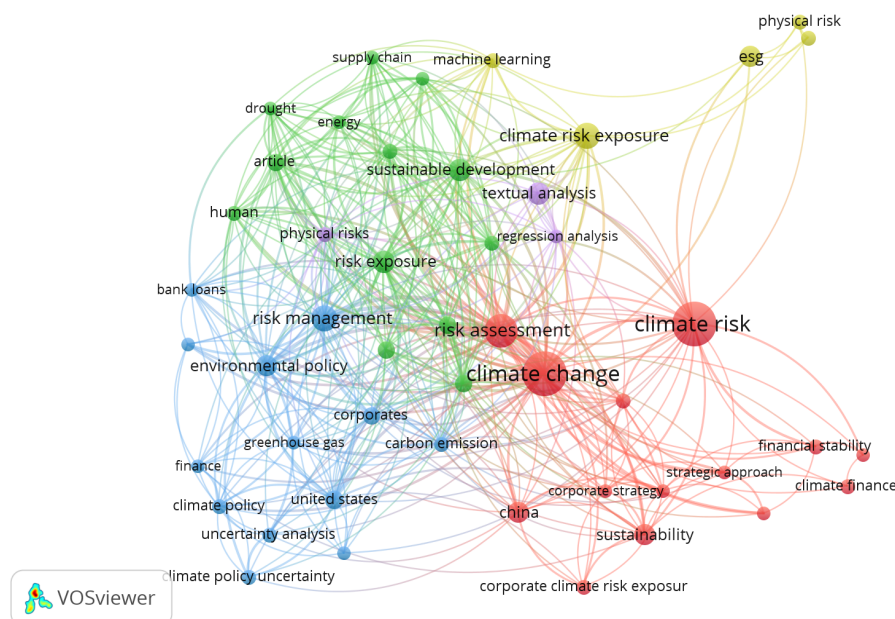


Figure 6: VOSviewer visualisation of a keywords co-occurrence.

Note(s): Unit of analysis = All keywords; Counting method: Full counting; co-occurrences of a keyword = 3; meet the threshold = 48.

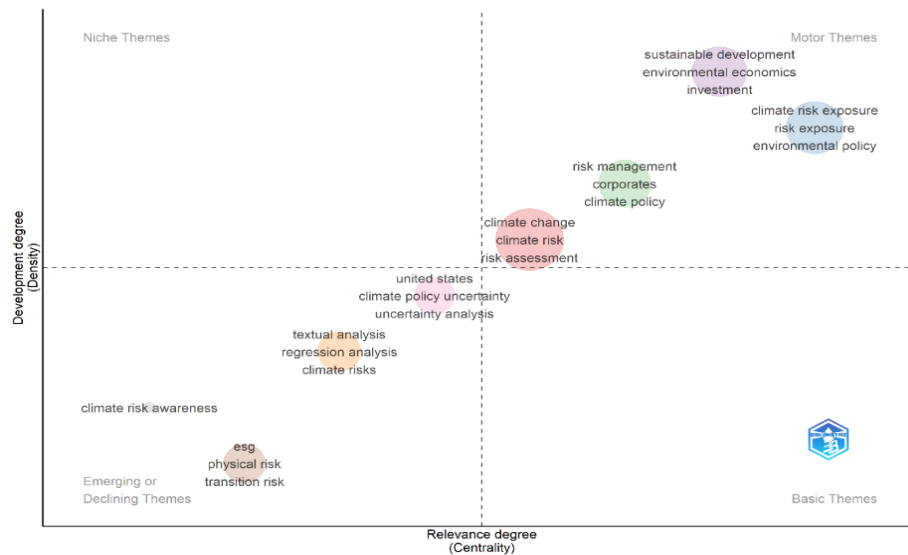


Figure 7: Thematic map based on the author's keyword.

modeling to better capture the dynamic and nonlinear impacts of climate change on market behavior. Scholars can enhance existing hedging and pricing frameworks by incorporating high-frequency climate news, climate sentiment indices derived from machine learning, and climate scenario simulations aligned with IPCC pathways. Cross-country comparative analyses are also needed to understand how regional climate policies, adaptation capacity, and institutional quality moderate the relationship between climate change and market volatility. Additionally, studies should explore spillover effects, especially how climate shocks propagate across global financial markets and influence interconnected asset classes. These avenues would strengthen the predictive accuracy of climate-related market risk assessments. From a corporate finance perspective, this cluster explains how climate-related information is incorporated into asset prices, market valuation, and investors' risk assessment, thereby influencing firms' cost of capital and access to financing.

Cluster 2: Climate risk exposure on corporate activities

This cluster groups keywords associated with climate risk, including *climate risk exposure*, *corporate climate risk exposure*, *credit risk*, *default risk*, and *physical risks*. This cluster captures the core literature on direct climate risk exposure within corporate finance, aligning partly with work in the red and blue clusters but with a stronger emphasis on risk quantification and assessment. Studies in this group including those by Hou and Wu (2025), Muyambo *et al.* (2024), Torricelli *et al.* (2025) measure how climate-related risks, such as physical hazards or transition pressures, translate into asset pricing distortions, credit risk premiums, and stock market fragility. The cluster's focus on risk assessment and systemic risk demonstrates that climate risk exposure is treated not merely as an environmental issue, but as a financial shock with credit, market, and operational

implications across corporate activities. Research in the climate risk exposure cluster should advance toward more granular and multidimensional measurements of climate risk, capturing physical, transition, and systemic dimensions simultaneously. Future studies could leverage geospatial climate data, satellite imaging, and firm-level environmental disclosures to construct more precise exposure metrics. There is also a pressing need to examine climate-related credit risk in emerging markets, where data availability and institutional responses differ significantly from developed economies. Moreover, integrating climate stress testing into corporate finance models would enable better understanding of how climate shocks affect credit spreads, default probabilities, and capital allocation. Finally, future work should investigate how climate risk interacts with other financial risks such as liquidity risk or cyber risk to create compound vulnerabilities within firms and financial systems. This cluster represents the core of corporate finance research, as it examines how climate risk exposure affects firms' financing decisions, creditworthiness, investment policies, and corporate financial performance.

Cluster 3: Sustainable development and financial system stability

This cluster highlights themes related to sustainability and sustainable development, including *corporate sustainability*, *green innovation*, *environmental policy*, *carbon emissions*, and *greenhouse gas*. This corresponds to the research stream led by Apergis (2024) and Srivastav and Kannadhasan (2025), which addresses macro-financial aspects of climate risk. Their studies examine how environmental policy shifts, carbon pricing mechanisms, temperature shocks, and regulatory transitions toward low-carbon economies reshape financial system stability, energy market behavior, and long-term economic resilience. This cluster thus represents a broader perspective in which

Table 6: Cluster of research streams.

Keywords	Items	Co-occurrence	Cluster/Theme
Cluster 1: Red			
Climate change	6	32	Climate change on financial market dynamics
Climate		3	
Climate effect		5	
Climate change exposure		3	
Climate policy		4	
Climate resilience		2	
Cluster 2: orange			
Climate risk	12	31	Climate risk exposure on corporate activities
Climate risk exposure		11	
Corporate climate risk exposure		4	
Risk exposure		8	
Risk assessment		18	
Systemic risk		3	
Default risk		2	
Credit risk		2	
Stock price crash risk		2	
Environmental exposure		2	
Environmental risk		4	
Physical risks		4	
Cluster 3: green			
Sustainability	14	7	Sustainable development and financial system stability
Corporate sustainability		2	
Green innovation		2	
Environmental policy		7	
Environmental protection		2	
Sustainable development		8	
Sustainable development goal		2	
Environmental economics		5	
Carbon emission		4	
Greenhouse gas		3	
Energy consumption		2	
Energy resource		2	
Investment		5	

Keywords	Items	Co-occurrence	Cluster/Theme
Human		4	
Cluster 4: blue			
Risk management	4	11	Risk management and strategic challenge
Climate risk management		2	
Risk		2	
Risk perception		2	

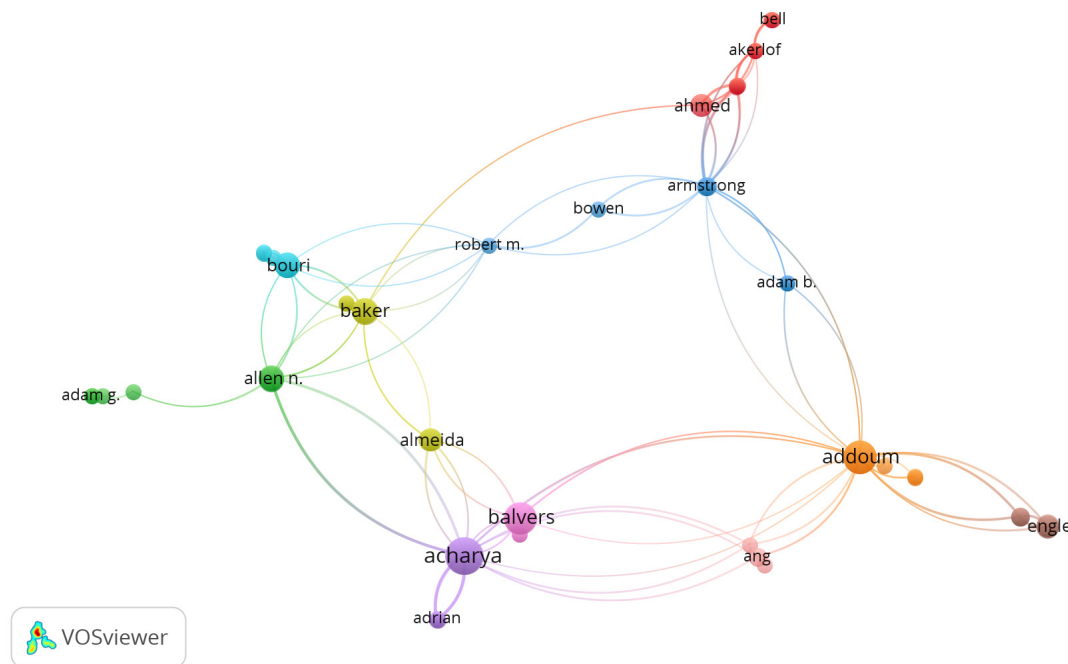


Figure 8: Co-citation network visualisation.

Note(s): Unit of analysis = cited author; Counting method: Full counting; minimum number of citations of an author = 3; meet the threshold = 52.

climate risk exposure is embedded within global sustainability agendas, linking corporate finance to environmental economics, innovation, and development objectives. Within the sustainable development cluster, future research should explore the interplay between environmental policy transitions, green innovation, and long-term corporate financial sustainability. Scholars could examine how policy uncertainty, carbon border adjustment mechanisms, and evolving ESG regulations influence corporate investment decisions and cost of capital. There is also an opportunity to investigate the effectiveness of green technologies and renewable energy investments in strengthening firm resilience to climate risks. Further, cross-country panel studies could test how national sustainability agendas, institutional governance, and carbon reduction commitments shape macro-financial stability. Research integrating environmental economics with corporate finance such as modelling the economic outcomes of carbon neutrality targets would significantly broaden the understanding

of sustainable financial systems. Within the corporate finance context, this cluster highlights that sustainability initiatives and environmental policies have become strategic determinants of firm value, long-term competitiveness, and financial system resilience.

Cluster 4: Risk management and strategic challenge

This cluster consists of keywords related to risk management, including *climate risk management*, *risk perception*, and *risk*. This thematic cluster aligns with studies by Allart *et al.* (2024), Chen *et al.* (2025), and Nazli *et al.* (2025), who investigate climate risk at the firm level, focusing on how companies manage exposure to climate-related hazards. Their contributions demonstrate how climate vulnerabilities such as environmental exposure, extreme temperatures, or regulatory uncertainty shape corporate financial performance, operational risks, and strategic adaptation. This cluster emphasizes organizational responses and

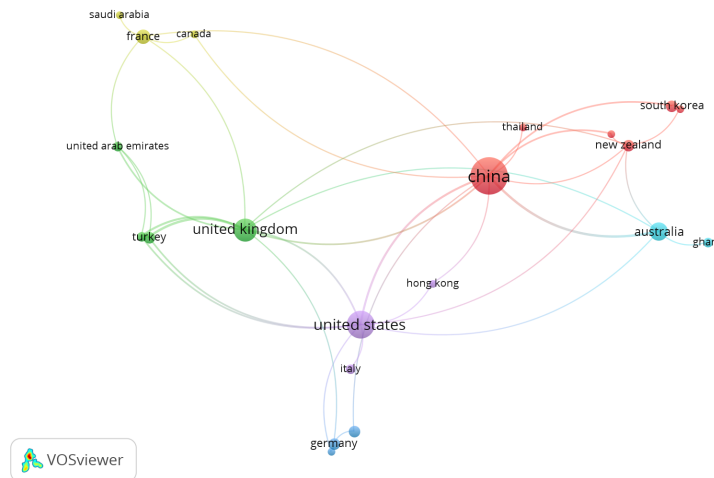


Figure 9: Co-authorship by countries.

Table 7: Potential Future research directions.

Cluster	Future Research Directions	References
Climate Change on Financial Market Dynamics	Examine heterogeneous climate impacts across sectors and regions to identify differential market responses.	(Brik, 2025)
	Investigate the long-term pricing of chronic climate risks such as sea-level rise and heat stress in bond and equity markets.	(Acharya <i>et al.</i> , 2024)
	Explore how climate-related news sentiment influences high-frequency trading behavior and market microstructure.	(Rognone <i>et al.</i> , 2023)
	Assess the moderating role of institutional quality and regulatory frameworks on climate-induced market volatility.	(Fang, 2025)
Climate Risk Exposure on Corporate Activities	Analyze how firms internalize climate risks into operational and strategic decisions, beyond financial indicators.	(Addoum, 2021)
	Investigate variations in climate risk exposure across supply chains and inter-firm networks.	(Allart <i>et al.</i> , 2024)
	Study climate risk spillover effects on credit rating transitions and loan contract structures.	(Javadi and Masum, 2021)
	Explore how transition risks influence firm innovation patterns, technology adoption, and carbon-reduction investments.	(Allen <i>et al.</i> , 2018)
Sustainable Development and Financial System Stability	Examine the transmission channels through which climate shocks propagate within the financial system.	(Apergis, 2024)
	Analyse how carbon pricing mechanisms and environmental regulations affect long-term financial stability.	(Apergis, 2024)
	Investigate the role of green innovation in mitigating macro-financial risks associated with climate change.	(Hou and Wu, 2025)
	Study cross-country differences in sustainable finance policies and their impact on economic resilience.	(Genin and Bu, 2025)
Risk Management and Strategic Challenge	Explore firm-level climate adaptation strategies and their effectiveness in reducing financial losses.	(Allart <i>et al.</i> , 2024)
	Investigate how climate risk perception shapes managerial decision-making and governance practices.	(Fang, 2025)
	Assess the integration of climate risk into enterprise risk management systems and financial planning.	(Hou and Wu, 2025)
	Evaluate the role of climate-related disclosures in strengthening corporate resilience and investor confidence.	(Alam <i>et al.</i> , 2025)

internal capabilities to mitigate climate-induced financial stress, showing that climate risk exposure is increasingly understood as a managerial and strategic challenge requiring robust risk governance practices. Research on climate risk management should increasingly incorporate behavioural and organizational perspectives to understand how firms perceive, interpret, and respond to climate threats. Future studies may examine how managerial cognition, risk perception, and organizational culture influence climate risk preparedness and adaptation strategies. Empirical work could identify which internal capabilities such as digital transformation, supply chain resilience, or climate governance structures most effectively mitigate climate-related financial stress. There is also room to develop integrated risk management frameworks that combine financial risk models with operational resilience tools, enabling firms to anticipate and absorb climate shocks more effectively. Lastly, researchers should assess the performance impact of adopting climate risk management practices, providing evidence for policymakers and corporate leaders on the strategic value of climate-focused governance. From a corporate finance perspective, effective climate risk management and governance enhance firms' ability to manage financial uncertainty, reduce risk exposure, and improve long-term shareholder value.

Future research directions

Bibliometric findings reveal several gaps that can inform future research directions. While substantial progress has been made in understanding how climate change affects market volatility, asset pricing, and risk exposure at the firm level, several important gaps remain across the four thematic clusters. First, previous studies have not fully addressed the heterogeneous impacts of climate change across sectors, regions, and institutional settings. Second, while credit risk, default risk, and exposure to climate hazards have been widely measured, there is limited evidence explaining how firms translate these risks into concrete operational and strategic decisions. Third, research linking climate risk to macro financial stability provides useful insights but remains unclear about how climate shocks propagate through the financial system and across interconnected markets. Finally, while firm-level climate risk management practices have been documented, the literature has yet to develop a comprehensive understanding of how firms design and implement effective long-term adaptation strategies. Overall, these gaps highlight the need for more integrated and multi-level research to capture the complex pathways through which climate risk impacts corporate finance and the broader economy. Thus, to address RQ3, the findings highlight several avenues for future research that remain underexplored. These potential directions, summarized in Table 7, offer opportunities for advancing the current understanding of climate risk exposure in corporate finance.

CONCLUSION

This study offers a valuable contribution by systematically mapping the evolution of climate risk exposure research and its implications for corporate finance using a comprehensive bibliometric approach. The results reveal a consistent increase in publications from 2007 to 2025, with significant contributions from scholars, institutions, and countries across Asia, the Americas, and Europe. Journals such as *Finance Research Letters*, *International Review of Financial Analysis*, *Applied Economics*, and *Energy Economics* emerge as the primary outlets for studies in this area. The thematic analysis identifies four major research streams that collectively define the intellectual structure of climate risk exposure in corporate finance. The first cluster, climate change and financial market dynamics, examines how climate change, climate-related news, and policy uncertainty influence asset pricing, market volatility, and systemic financial risks. The second cluster, climate risk exposure and corporate activities, focuses on how physical and transition climate risks affect corporate financial decisions, credit risk, operational performance, and capital allocation. The third cluster, sustainable development and financial system stability, emphasizes the role of sustainability, environmental policies, carbon emissions, and green innovation in promoting long-term financial resilience and supporting the transition to a low-carbon economy. The fourth cluster, risk management and strategic challenges, highlights organizational responses to climate-related risks, emphasizing climate risk governance, strategic adaptation, and corporate resilience. Together, these four clusters demonstrate that climate risk exposure has evolved from being viewed primarily as an environmental issue to becoming a multidimensional financial phenomenon that shapes financial markets, corporate behaviour, sustainability transitions, and strategic decision-making.

Theoretical and practical implications

The findings of this study broaden the understanding of how climate risk influences financial dynamics across multiple levels, from macro-level financial markets to firm-level decision-making. The identification of four thematic clusters demonstrates that climate risk can no longer be treated as separate from traditional financial theory; rather, it necessitates a deeper integration of climate science, environmental economics, and financial risk modelling. These findings encourage the development of new theoretical frameworks capable of capturing the nonlinear, interdependent, and multi-level nature of climate risk, particularly in relation to risk propagation, asset pricing mechanisms, and climate-related uncertainty. Furthermore, future research has the potential to enrich the corporate risk management literature by incorporating behavioural perspectives, governance considerations, and long-term adaptive capabilities, thereby enabling financial theory to more comprehensively explain how firms respond to evolving climate threats.

This study also provides a foundation for governments, investors, regulators, and firms to strengthen their strategies for mitigating and adapting to climate risk. For regulators and policymakers, the results highlight the need to enhance regulatory frameworks related to climate risk disclosure, implement climate stress testing, and align carbon policies to safeguard financial system stability. For market participants and investors, a clearer understanding of how climate news, regulations, and physical risks influence asset prices and market volatility can guide the development of more responsive portfolio strategies and hedging practices. Meanwhile, for corporations, the findings underscore the importance of integrating climate risk management into strategic planning, governance structures, and capital allocation, particularly through green innovation, enhanced operational sustainability, and greater transparency in risk reporting. Accordingly, the practical implications of this study help reinforce corporate resilience and financial market stability amid growing climate uncertainty.

LIMITATIONS

This study is subject to several limitations. First, the analysis draws exclusively on the Scopus database (as of November 2025), which means that relevant publications indexed in other databases or written in non-English languages may not have been captured. Second, the review includes only peer-reviewed journal articles in English, excluding books, dissertations, and conference proceedings; as a result, certain regional insights or emerging scholarly contributions may be underrepresented. Third, the selection of search keywords may not encompass all possible synonyms, term variations, or alternative spellings, potentially omitting some related studies. Fourth, citation metrics were not normalized for publication age or disciplinary differences, which may bias results toward older or more frequently cited research areas. Fifth, inconsistencies in metadata particularly in author names, affiliations, and institutional records could introduce inaccuracies in the analysis of collaboration networks. Sixth, although supported by algorithmic techniques, thematic clustering still requires interpretive judgment from researchers, making it partially subjective. Lastly, bibliometric methods are inherently descriptive and do not establish causal relationships; therefore, the findings should be interpreted primarily as a structured overview of the research landscape rather than definitive evidence of causal patterns.

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ABBREVIATIONS

AI: Artificial Intelligence; **C/P:** Citations per Publication; **ESG:** Environmental, Social, and Governance; **IPCC:** Intergovernmental Panel on Climate Change; **JEL:** Journal of Economic Literature; **PoP:** Publish or Perish; **PRISMA:** Preferred Reporting Items for Systematic Reviews and Meta-Analyses; **Q:** Quartile; **RQ:** Research Question; **TC:** Total Citations; **TP:** Total Publications; **VOSviewer:** Visualization of Similarities Viewer; **WMO:** World Meteorological Organization; **WoS:** Web of Science.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

AUTHORS CONTRIBUTION

The first author contributed to conceptualization, data collection, and manuscript drafting. The second author contributed to research design, data analysis, and supervision. The third author contributed to data processing, literature review, and interpretation of results.

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