GREEN FINANCE RESEARCH TRENDS IN THE GREEN TRANSITION CONTEXT: A BIOGRAPHY ANALYSIS OF SCOPUS DATA (2015-2024)

The 13th International Conference on Emerging Challenges: Business Dynamics in Disruptive Economy

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Abstract

The green transition has emerged as a global strategic imperative, positioning green finance as a central mechanism for channelling capital into environmentally sustainable initiatives. Instruments that promote green finance encompass green bonds, green credits, and green investments, among others. These instruments not only direct capital toward environmentally friendly activities but also bring financial benefits to firms and enterprises. This study offers an exhaustive overview of the subject based on a bibliometric analysis of 128 papers indexed in Scopus from 2015 to 2024. The result illustrates a remarkable increase in literature publications since 2021, with China leading in both productivity and scholarly impact. Energy Economics is the most influential journal, with the high-impact publication being, "Can the green credit policy stimulate green innovation in heavily polluting enterprises?" Evidence from a quasi-natural experiment in China" by Hu, G.; Wang, X.; and Wang, Y. Keywords with high occurrence, which represent the core themes of the topic, include "green finance", "green innovation", "financial constraint", and "green credit policy". From the clustering of keywords, four primary research streams are identified: (i) foundations of green finance, (ii) policy implications, (iii) effects of green credit, and (iv) China's green financial pathways. Future research should further examine the role of green credit in advancing green transformation, strengthening environmental regulation, fostering green innovation, and alleviating financial constraints. While the study provides valuable insights, its scope is constrained by reliance on the Scopus database, English-language sources, and an emphasis on development trends considered through the lens of the green transition.

Keywords: green finance, green credit policy, green bonds, green transition, sustainable development, bibliometrics.

1. INTRODUCTION

Financial markets are undergoing a dramatic shift toward sustainable development as climate change accelerates and environmental concerns reshape economic priorities (Zhang et al. 2021). Within this context, green finance is considered a "credit intermediary of environmental protection capital flows" (Wang and Zhi 2016), which means market mechanisms will mobilize and allocate funds for green projects while helping investors access appropriate capital sources. This field encompasses various cross-cutting concepts and has evolved in response to global events, resulting in current regulatory frameworks and international organizational involvement (Bhattacharyya, 2021).

The green finance market includes a diverse range of securities and financial products, with recent investment trends indicating significant growth; however, challenges persist for its stability in contemporary financial landscapes (Berrou, Dessertine, and Migliorelli 2019). Beyond mobilizing capital, green finance plays a pivotal role in environmental protection and sustainable development (Chin et al. 2024). Previous research highlights the significant impact of green finance in reducing carbon emissions by directing the flows of financial resources into renewable energy, energy efficiency, and sustainable infrastructure (Wang and Zhi 2016). Similarly, green finance enhances corporate environmental responsibility by incentivizing businesses to adopt eco-friendly practices and align their operations with sustainability goals (Zhang et al. 2021). Moreover, recent research emphasizes the importance of policy frameworks and innovative financial instruments, such as green bonds, taxonomies, and sustainable investment funds, in accelerating the low-carbon transition (Zhu, Zhang, and Duan 2023). Taken together, these studies suggest that green finance not only mitigates environmental risks but also fosters long-term economic stability and social well-being.

In parallel, there is an increasing public interest in finance, particularly in green investing, socially responsible investing,

and social impact investing, which are gradually expanding. Since 2017, the publication of papers on green finance has shown a consistent upward trend, with estimates indicating that over 100 scientific papers are published each year (Mohanty et al. 2023). Recent studies tend to focus on the role of green finance in addressing climate change and promoting sustainable development (Hua et al., 2024; Lee, 2020; Y. Wang & Zhi, 2016). Moreover, much research attempted to find a definition for the term "green finance" (Lazaro et al., 2023; Lindenberg, 2014). Another attractive perspective is the relationship between green finance and energy, such as in M. Wang et al., (2021) and Rasoulinezhad & Taghizadeh-Hesary (2022). Researchers have focused their studies on the impact of green finance in specific sectors such as banking (Akomea-Frimpong et al. 2022). Furthermore, the existing literature firmly establishes a close, bidirectional, and evolving relationship where green finance is essential for enabling agricultural green development, and in return, agricultural green development creates new demands and opportunities that reinforce green finance (Han et al. 2023). Therefore, it is evident that green finance is an interdisciplinary field that demonstrates a close relationship with other industries.

Green finance is also fundamentally reshaping traditional business models and market dynamics. By introducing new financial instruments, altering risk and return profiles, and driving innovation in both financial and non-financial sectors (Radhakrishnan et al. 2025). Consequently, this shift accelerates stranded asset risks in fossil fuel-based industries and enhances the competitiveness of renewable and circular economy enterprises (van der Ploeg and Rezai 2019). Investor expectations and ESG criteria are reshaping valuation metrics, forcing firms to integrate sustainability into governance and operations to maintain access to capital and market trust (Giese et al. 2019). Meanwhile, financial innovations such as green bonds and green credits continue channeling funds into sustainable projects, while regulatory frameworks such as taxonomies and mandatory disclosures redefine compliance (Tolliver, Keeley, and Managi 2019).

Notably, a large body of recent research emphasizes the role of regulatory frameworks in shaping the effectiveness of green finance. For example, China's green credit guidelines have been extensively studied by some of the most influential authors in the field as a quasi-natural experiment. Research has shown that green credit policies create incentives for green innovation (Hu, Wang, and Wang 2021). By strengthening financial constraints and supporting corporate debt, green finance policies have a strong impact on promoting green innovation by heavily polluting companies (Lu et al. 2022). In contrast, the European Union has proposed a series of policies, regulations, and projects to promote green finance, such as the European Sustainable Finance Strategy, the Taxonomy Regulation, and the European Green Deal (Brühl 2021). Moreover, green finance is the primary driver of green technological innovation (GTI). Existing studies indicate that the GTI of enterprises can be enhanced by green bonds and green credit. The green financial system is described as inseparable from Foreign Direct Investment (FDI) in its ability to drive GTI (Yan et al. 2025). Another study showed that venture capital reduces financing barriers for environmentally friendly firms while incentivizing polluting industries to adopt cleaner technologies (Wei, Yuguo, and Jiaping 2015).

Recent bibliometric studies have enhanced the understanding of green finance from various perspectives. For instance, Zhang et al. (2022) analyzed the intersection of green finance and carbon emission reduction, identifying a concentration of research outputs in advanced economies with limited collaboration networks. Similarly, some scholars employed complex network and machine learning methods to map the field, revealing thematic clusters around climate finance distribution, green bonds, and financial risk management (Maria, Ballini, and Souza 2023). Other scholars examined green finance within supply chain management, highlighting the emergence of topics such as green credit and investment, although integration across industries remains limited (Fahim and Mahadi 2022). A group of researchers mapped the relationship between green finance and banking performance, showing the influence of China and European nations in promoting this research agenda (Bikram Khadka et al. 2024). Meanwhile, another research expanded the scope by linking fintech innovations with green finance, underscoring their combined role in promoting sustainable economic development (Dar, Badwan, and Kumar 2024). Despite these advances, most bibliometric studies remain confined to specific domains such as banking, carbon finance, or supply chains. Systematic literature reviews reveal growing research interest in green finance applications and green economy transition, identifying key trends and research gaps in economy and business-related studies (Fotova Čiković, Keček, and Cvetkoska 2024)**.** To address this gap, this research employs a method known as bibliometric analysis. This methodology provides a systematic and comprehensive overview of knowledge in any field, the evolution of the field, identification of research groups, emerging trends, and relationships between the key concepts in the field (Aria and Cuccurullo 2017; Kraus, Bouncken, and Yela Aránega 2024; Mukherjee et al. 2022). Through a bibliometric analysis, this thesis will outline the trends in green finance, identify its subdisciplines, and examine the contributions of authors and regions to green finance research. The findings of this study will highlight the current state of green finance and future directions for researchers to explore further.

Based on bibliometric analysis, this study seeks to address the following core research questions:

RQ1: Which groups of countries demonstrate the most significant interest and engagement in this field?

RQ2: Which publications are considered the most prominent and influential in green finance research?

RQ3: Which academic journals exhibit the highest productivity in the area of green finance?

RQ4: What are the most frequently discussed topics in relation to green finance trends?

The primary motivation for this study arises from the increasing importance of green finance in addressing global environmental challenges. Furthermore, the findings of this research are expected to provide valuable insights for enterprises and organizations when making investment decisions in green projects. Beyond contributing to the academic understanding and raising awareness of the significance of green finance, this study also offers practical implications by assisting financial institutions in identifying the factors that drive effective green investments and in formulating strategies aligned with the Sustainable Development Goals (SDGs).

2. METHODOLOGY

Bibliometric analysis is a quantitative method that has been widely applied in recent years to explore the development of knowledge in Sustainable Development Goals (Kirby 2023). This method enables the identification of research trends, influential scientists, emerging research topics, and the relationships between scientific works through the analysis of publication and citation data (Broadus, 1987; Ellegaard & Wallin, 2015). In the context of the increasing interest in green finance in global academic and policy research, bibliometric analysis plays a vital role in systematizing and visualizing the development of this field, as well as guiding future research.

Bibliometric analysis can highlight contemporary trends through assessing the number of publications, collaboration networks, and the frequency of occurrence of related keywords. For example, previous studies show that green finance is a rapidly growing topic, with active participation from countries such as China, the United States, and European countries (Zhang et al., 2019). By analyzing the co-citation and co-occurrence networks, this method also contributes to recognizing central research topics and potential for future development.

The analysis was conducted according to a systematic process, in compliance with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines, to ensure transparency and rigor in document selection (Page et al., 2021). The process includes the following steps: defining the research question, establishing a search strategy, filtering the data, and performing quantitative analysis.

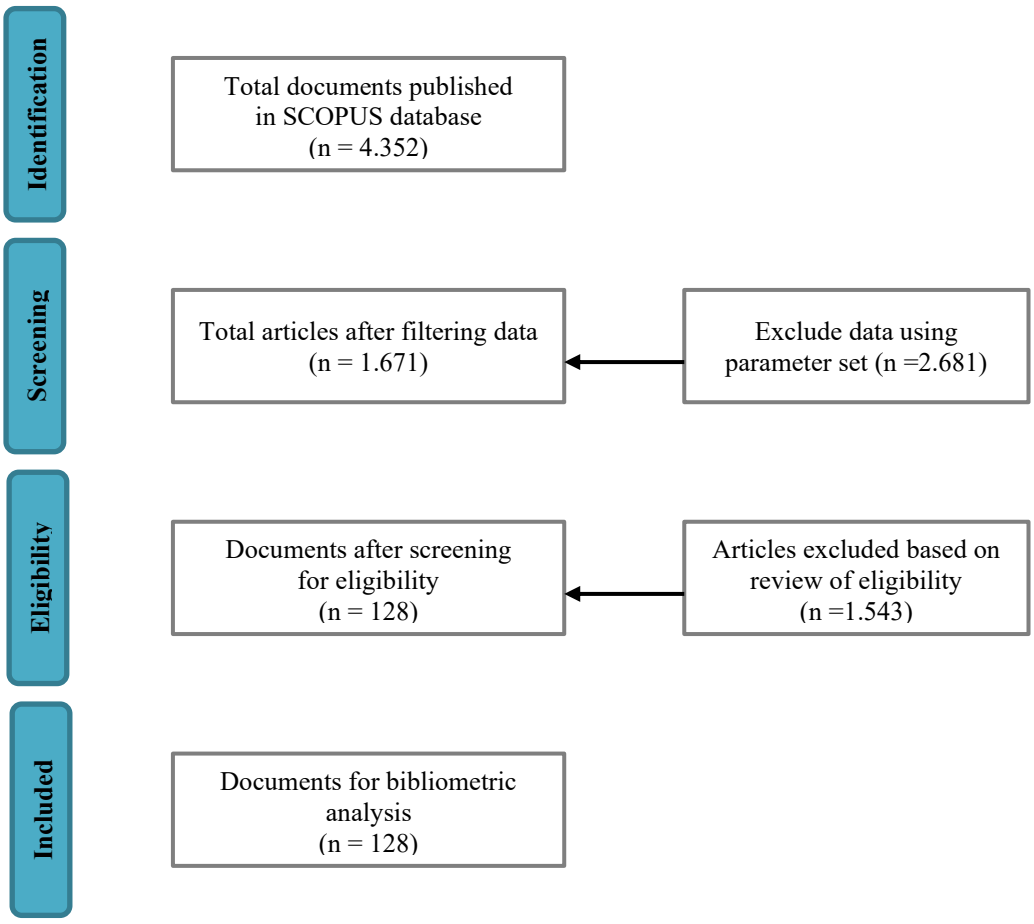


Fig 1. PRISMA guide to data searching

The topic of this study is “green finance” with a focus on research developments in the context of green transition. The

keywords used in the query include “Green transformation” and “Green transition”. While the PRISMA protocol was rigorously applied to ensure transparency and replicability, the search strategy focused on those two. This narrow focus enhances relevance to the green-transition context but may omit a broader body of green finance literature that employs alternative terms (e.g., *green finance*, *sustainable finance*, *climate finance*, *low-carbon finance*). As a result, the findings should be interpreted as a targeted mapping of studies explicitly situated within the green transition discourse rather than an exhaustive review of all green finance research. In order to improve coverage, related variants were included in the search strategy. The search was limited to English publications, including scientific articles and conference papers. The data were extracted in February 2025, without any year of publication restriction. However, the time limit for data updates on the Scopus database is set to the end of December 2024.

The query syntax on the Scopus database is as follows:

TITLE-ABS-KEY ("Green transformation*" OR "Green Transition*") AND (EXCLUDE (PUBYEAR , 2025)) AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (LANGUAGE , "English")) AND (LIMIT-TO (SUBJAREA , "SOCI") OR LIMIT-TO (SUBJAREA , "ECON") OR LIMIT-TO (SUBJAREA , "BUSI") OR LIMIT-TO (SUBJAREA , "DECI") OR LIMIT-TO (SUBJAREA , "MULT") OR LIMIT-TO (SUBJAREA , "ARTS") OR LIMIT-TO (SUBJAREA , "PSYC"))

Using “Green transformation” or “Green Transition” as the main keyword, the initial research returned a total of 1671 publications found through the query. After the deduplication step and checking the content for relevance to the research objectives, three core themes were classified: carbon emissions, green finance, and leadership in green transformation. Articles related to green finance were identified based on their title, abstract, and author keywords; when unclear, the full text was reviewed for confirmation. In total, 128 relevant articles published between 2015 and 2024 were selected. After full-text assessment, a total of 128 pieces of literature (articles) were retained for bibliometric analysis. The cleaned data was processed using VOSviewer software to visualize the co-author network, keywords, publication trends, countries, and leading journals. The use of VOSviewer helps to create a knowledge map of the green finance field and identify key research directions and remaining gaps.

3. RESULTS AND DISCUSSION

3.1. Publication productivity on green finance in the context of green transition

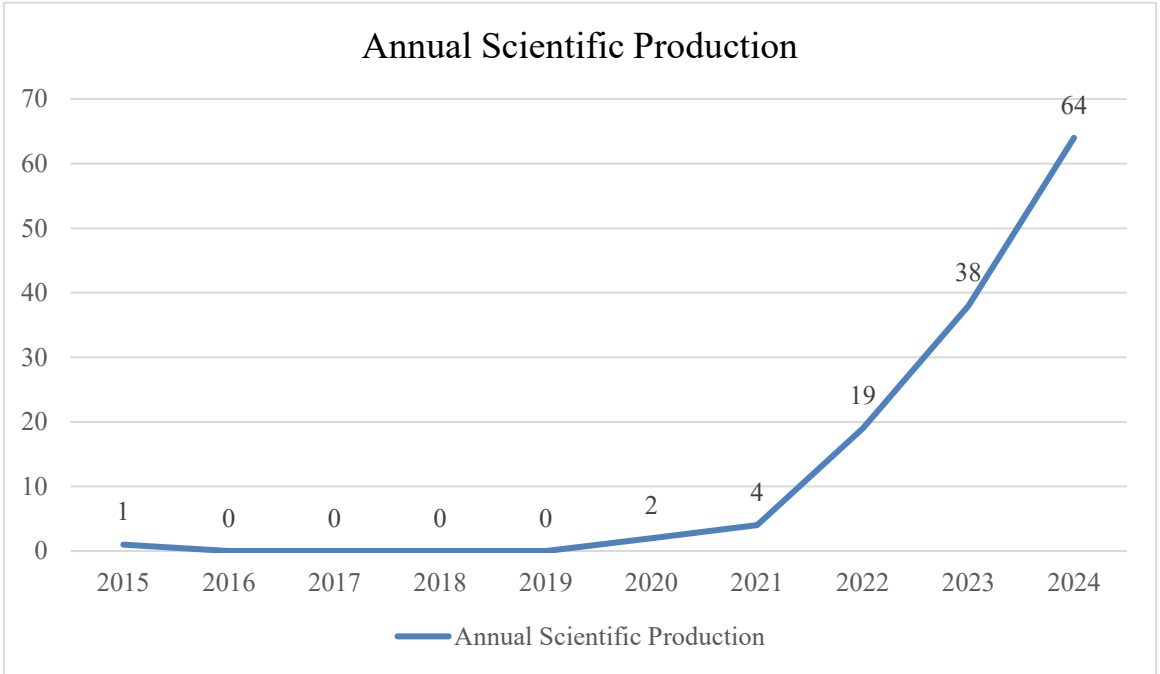


Fig 2. The evolution of publications yearly from 2015 to 2024.

Figure 2 illustrates the volume of articles published annually in a period starting in 2015 and ending in 2024. Overall, it is evident that the distribution of papers showed an upward trend, with one paper published in 2015, no publications from 2016 to 2019, and then a surge in the last five years of the period.

Two primary phases can be observed. The first phase, which spanned from 2015 to 2020, saw the development of the principles of green finance. The first study was established in 2015, but there was no annual output for the next four years, and only two documents published in 2020 indicate that this topic was not influential or widely discussed at that time. The emergence of three articles in this initial phase made a significant contribution to the core of green finance theory

and practice. The earliest paper explores how transforming traditional venture capital into green venture capital can effectively fund green innovation in China's manufacturing and industrial sectors, emphasizing policy and market incentives (Wei et al. 2015). The next paper analyses how the UK Treasury's fiscal dominance constrained public green finance mechanisms, particularly through the containment and privatization of the Green Investment Bank (Craig, 2020). Using a game-theoretic model, the last paper shows how government subsidies influence corporate decisions to adopt green logistics, factoring in cost, emissions, and policy effectiveness (Huang and Fu 2020).

The next phase is from 2021 to 2024, when this field will have been explored deeply by scholars worldwide. The number of articles experienced a substantial surge after 2021, reaching 64 by the end of 2024. The database documents 128 published papers related to green finance, with a significant 51.6% published solely in 2024. This suggests that the field has received increasing attention and discussion from scholars in the last three years and is increasingly becoming an emerging hotspot recently. This can be explained by the fact that, in 2015, the United Nations announced an assortment of Sustainable Development Goals to direct global development toward 2030.

The period from 2015 to 2024 is particularly relevant for studying green finance in the context of the green transition since it captures a decisive decade of global policy and financial transformation. The Paris Agreement and the adoption of the UN Sustainable Development Goals in 2015 established finance as a central mechanism for advancing climate and sustainability objectives. Following this, green financial instruments such as green bonds and loans expanded rapidly, with global issuance rising from $42 billion in 2015 to over $500 billion by 2021 (Berrou et al. 2019). At the same time, the EU's 2018 Action Plan on Sustainable Finance reshaped market practices, while academic research on green finance surged significantly (Chandran and Chandran MC 2024). The years after 2020 also reflect the influence of pandemic recovery packages and policy incentives in OECD countries such as the U.S. Inflation Reduction Act, which reshaped capital flows toward clean energy (Bistline et al. 2023). Extending the analysis to 2024 allows the inclusion of recent developments in ESG integration, regulation, and ongoing debates over greenwashing, making this timeframe essential for understanding the evolution of green finance in the global green transition.

Notably, the peaks in publication output during this period do not merely reflect academic trends but are closely tied to major policy milestones, highlighting a causal link between policy developments and research surges. For example, the issuance of China's Green Credit Guidelines in 2012 triggered waves of studies using difference-in-differences methods (Lu et al. 2022), while the Paris Agreement and the SDGs legitimized green finance as a research domain, leading to sharp increases in publications worldwide (Berrou et al. 2019). In this sense, the research growth from 2015 to 2024 can be understood as both a response to and a reinforcement of global policy transformations.

3.2. Top 5 important journals in the field of research

Table 1. Top 5 impact journals

Rank	Source	TC	NP	Year_start	Main research topic
1	Sustainability (Switzerland)	131	26	2022	- Environmental Policy and Governance - Sustainable Supply Chain & Logistics - SDG Implementation
2	Journal of Cleaner Production	451	14	2021	- Environmental Policy and Governance - Green Finance & Investment Strategies - Carbon neutrality and climate change mitigation
3	Energy Economics	677	6	2021	- Governance policy - Carbon reduction - Green investment
4	Resources Policy	103	6	2023	- Natural Resource Governance and Policy
5	PLoS One	33	5	2020	- Government Policy - Green credit efficiency - Sustainable Investment

Publication numbers are a valuable metric of academic interest in and activism towards green finance, reflecting both a commitment to advancing knowledge and a broader engagement with the subject. This section examines the diffusion of peer-reviewed articles within the green finance literature, measuring their impact by citation numbers and article volume. Table 1 contains information about the top five scientific journals based on the number of publications in green finance from 2015 to 2024. The Sustainable Finance journal of Switzerland is the most productive in publishing during this timeframe, with 26 papers, and it ranks fourth in total citations. The Journal of Cleaner Production, with 14 published

papers, follows closely, garnering significant attention due to its second-highest total citation count of 451. Notably, Energy Economics received the highest number of citations (677) despite publishing only six articles in this period. Despite starting publication in 2023, the energy policy has 6 articles with 103 citations until now. The opposite is true for PLoS ONE, as it has only 5 documents with 33 citations in the four years.

These results indicate that these journals have an outstandingly high average number of citations per article, indicating their recognition and influence in the field of green finance. Green finance's influence extends beyond the financial sector and has a cross-disciplinary impact. The top five publications in Table 1 primarily concentrate on sustainable development, environmental policy, and resource economics. Or PLoS One is a multidisciplinary journal, and there is only one newspaper whose main theme is finance. Previous studies (Kumar et al., 2024; Zhang et al., 2019) corroborate this result.

Recent publications in this field in Sustainability (Switzerland), Journal of Cleaner Production, Energy Economics, and Technological Forecasting and Social Change have focused on the promotion of green credit policy or green finance policy in a green transition background. “Resources Policy” is a journal that aims to promote and disseminate knowledge on the relationship between green finance and natural resources governance policy.

3.3. Top 10 influential articles in green finance

Table 2. Top 10 impact articles

Rank	Article	Authors	Journal	TC	Year
1	Can the green credit policy stimulate green innovation in heavily polluting enterprises? Evidence from a quasi-natural experiment in China	Hu G.; Wang X.; Wang Y.	Energy Economics	496	2021
2	Can the green finance policy force the green transformation of high-polluting enterprises? A quasi-natural experiment based on “Green Credit Guidelines”	Lu Y.; Gao Y.; Zhang Y.; Wang J.	Energy Economics	136	2022
3	Exploring the impact of green credit policy on green transformation of heavy polluting industries	Tian C.; Li X.; Xiao L.; Zhu B.	Journal of Cleaner Production	116	2022
4	Green innovation effect of pilot zones for green finance reform: Evidence of quasi natural experiment	Liu S.; Wang Y.	Technological Forecasting and Social Change	114	2023
5	Greenization of venture capital and Green innovation of Chinese entity industry	Wei Z.; Yuguo J.; Jiaping W.	Ecological Indicators	67	2015
6	How green growth affects carbon emissions in China: the role of green finance	Zhao J.; Taghizadeh-Hesary F.; Dong K.; Dong X.	Economic Research-Ekonomska Istrazivanja	62	2023
7	The spatial spillover effects and impact paths of financial agglomeration on green development: Evidence from 285 prefecture-level cities in China	Feng Y.; Zou L.; Yuan H.; Dai L.	Journal of Cleaner Production	58	2022
8	Impact of green finance on total factor productivity of heavily polluting enterprises: Evidence from green finance reform and innovation pilot zone	Zhao L.; Wang D.; Wang X.; Zhang Z.	Economic Analysis and Policy	57	2023
9	Order financing for promoting green transition	Wang C.; Li X.-W.; Wen H.-X.; Nie P.-Y.	Journal of Cleaner Production	55	2021
10	Does green credit really increase green technology innovation?	Lin T.; Wu W.; Du M.; Ren S.; Huang Y.; Cifuentes-Faura J.	Science Progress	52	2023

Table 2 summarized the top 10 most cited papers on green finance over the period 2015-2024. The number of citations is a useful measure of the impact of a paper on the field. In general, the papers cross a wide range of journals and were

mostly published in the last four years. The top four papers consistently receive over 100 citations, with none receiving fewer than 50. The most influential paper was published in 2021 in the journal Energy Economics, with 496 citations and an average of 124 citations per year. This is three times more than the next most influential paper by Lu Y.; Gao Y.; Zhang Y.; and Wang J., published in the same journal in 2022. It is closely followed by the documents with 116 and 114 citations, respectively. The paper ranked fifth with 67 citations but had the lowest average citations per year and was the earliest published in 2015.

Between 2015 and 2020, discussions centered on foundational efforts and long-term policy development. The primary objective of the research during this period was to develop methodological foundations for green finance indicators and ESG evaluation frameworks. Although published in 2015, the article "Greenization of Venture Capital and Green Innovation of the Chinese Entity Industry" is regarded as one of the most influential scholarly works as of 2024. This research presents a theoretical framework and empirical validation for how venture capital can effectively promote green innovation in China's entity economy. Additionally, this article offers practical strategies for green finance transformation, influencing policies on venture capital regulation, ESG funding, and eco-industrial development. This period played a pivotal role in the green finance field by establishing a conceptual and analytical foundation for assessing the effectiveness of green finance, thereby shaping subsequent research on policy evaluation.

Moving to the period from 2021 to 2023, there are 9 out of 10 papers with the highest citation count. This period is notable for studies on policy, experimentation and empirical validation, as well as two important common goals. The first common goal is to evaluate Green Credit Guidelines and green finance pilots through quasi-natural experiments. Another shared goal of this period is focusing on enterprise green innovation and regional economic responses to green policy. The author presents three topics that align with the two goals. These are the empirical impacts of China's Green Credit principles (Hu et al. 2021; Lu et al. 2022; Tian et al. 2022) and the regional impact of pilot green finance zones (Liu and Wang 2023). This group emphasizes that green finance is an instrument for industrial transformation and stimulating innovation.

3.4. The development of a green finance research collaboration network

3.4.1 Co-authorship network

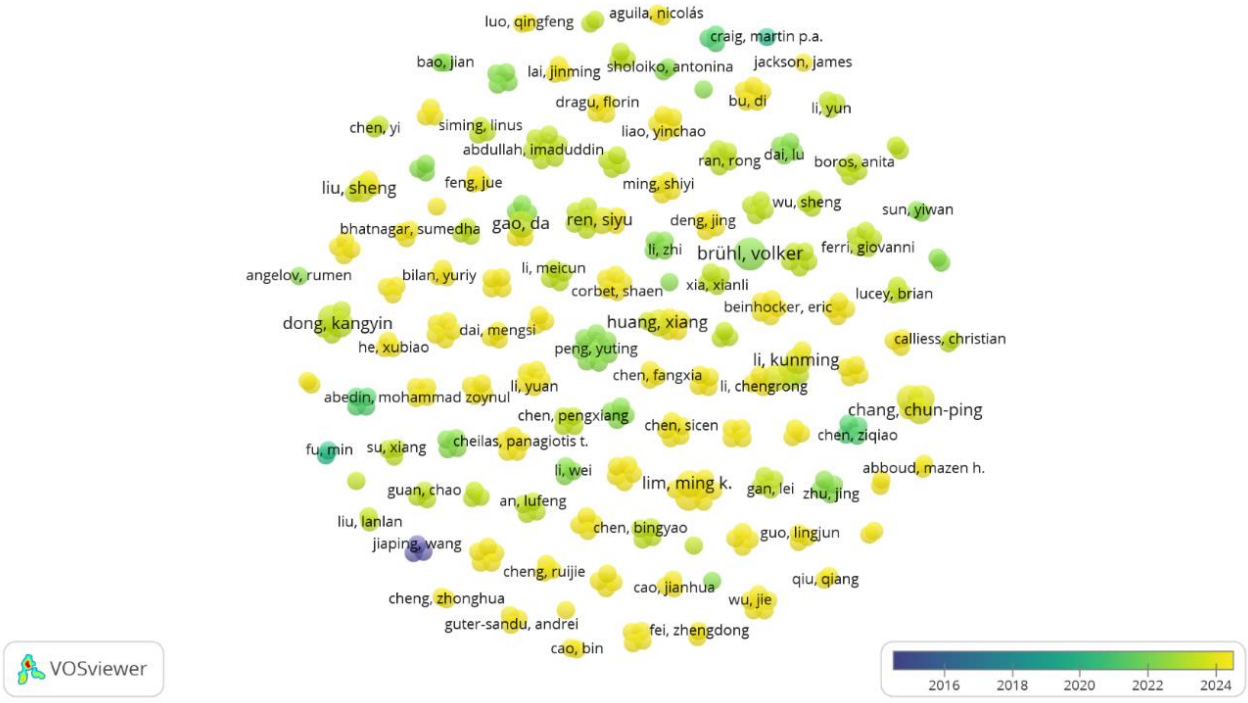


Fig. 3 Co-authorship among authors in green finance research with at least one article, 2015–2024.

Fig. 3 shows the co-authorship network in green finance with a minimum of one publication over the period. Each circle represents an author. The number of lines between circles indicates the degree of collaboration and the strength of their co-authorship relationships. Each circle's size shows the number of articles produced by that author. The distance between circles shows the co-authorship link's relatedness. The line thickness indicates the link strength. Each circle's color indicates the author's average publication year.

Only one author has three articles, 12 out of 403 authors have two articles, and the remaining authors have only one article. From an overall perspective, this is a topic that has received the attention of many scholars, especially recently. It can also be seen that the research is predominantly done in groups; a few work independently. The darker blue represents

the authors who participated in research activities before 2016, the green is the authors active in the period 2020-2021, and the yellow is the authors who are active recently (2022-2024). Looking at the map, we see that yellow is the main color, showing that these are the authors who have been very active in research recently. The large and prominent groups of authors in this period are Lim, Ming K.; Li, Kunming; Li Chengrong; and Li Yuan. The appearance of green clusters suggests that the 2020-2021 period may be a research renaissance. The research groups that pioneered the return of green finance research are Peng, Yuting; Abdullah, Immaduddin; and Ferri Govanni. During this period, Bruh Volker, the senior author, conducted independent research and had up to 3 scientific articles related to this topic. The dark green cluster represents the authors who laid the initial foundation in the field of green transition, namely the group of Jiaping and Wang. The appearance of monochromatic research groups suggests that these are only research groups that collaborated on one article and then did not continue to research this topic. On the contrary, some author groups have inherited and continued research throughout the 2021-2024 period, such as the group of authors Gao, Da, and Huang, Xiang. In addition, there is not only group research with each other but also external collaborative research groups. For example, Huang Xiang's group cooperates with Huang Siyuan; the group led by Li, Kunming, cooperates with Li, Cherong's group. It is indicated that researchers in this field exhibit robust collaboration networks and collaborate extensively with other researchers, indicating their active involvement in the research community.

3.4.2 Co-citation network of authors with expertise in green finance

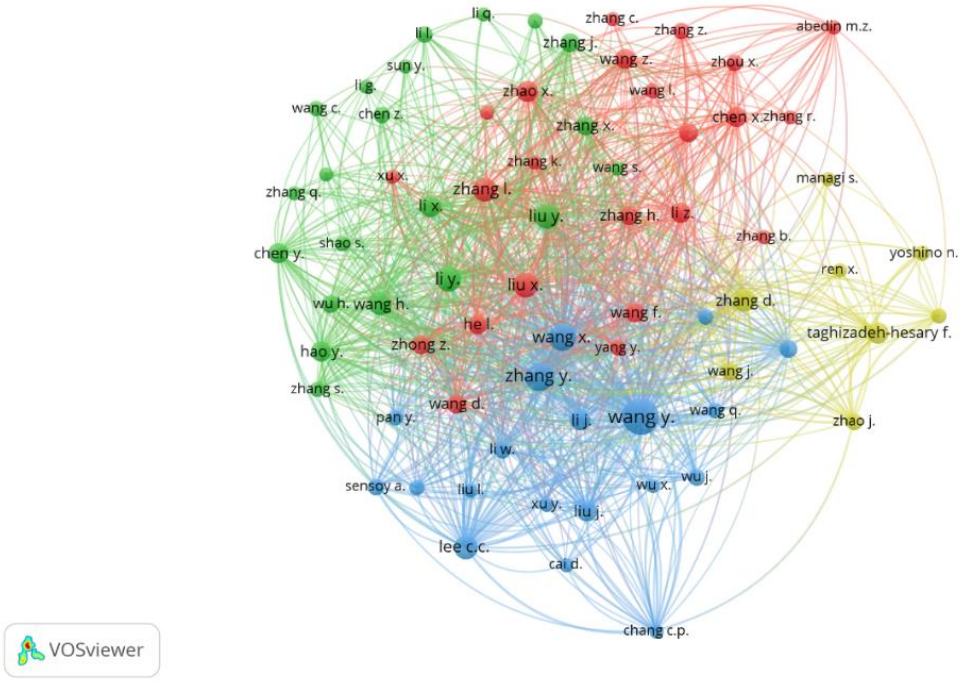


Fig 4. The collaboration between authors in green finance field

The co-authorship network map is divided into four clusters corresponding to four different color clusters, clearly separated by blue, green, red, and yellow. The four clusters represent four clusters of cross-collaboration. The red cluster includes authors such as Zhang L, Liu X, Zhao X, and Zhang H... This is the largest collaboration cluster with the most authors. This shows a strong research network and plays a central role in the research community on this topic. Most of the authors in this group are from China, which shows China's dominance in this field. The collaboration network of this collaboration cluster is relatively large, closely collaborating with many research papers, as shown by the size of the nodes and the connections between researchers. With the blue cluster including prominent authors such as Liu Y., Li J., Chang C.P., Wu X., and Wang Y. In terms of the green cluster, the remarkable authors are Zhang J., Zhao X., Sun Y., Li X., and Wang C. Prominent authors in the yellow cluster are Managi S., Taghizadeh-Hesary F., Yoshino N., and Ren X. These clusters are strongly connected. Especially, the author node in the red cluster is in the center, between the green, blue, and yellow clusters, indicating a high level of collaboration.

Regarding the influential authors, there are several authors with large node sizes; these are central authors with high influence. Wang Y., Liu Y., and Zhang L. have close connections to many clusters. Suggesting that they publish interdisciplinary or foundational work in many research fields. Wang Y. is the most connected author and plays the role of a hub in the network. Located near the center of the red cluster is Liu Y. Li Y. Zhang Y, Liu J. indicating that these are highly collaborative authors. Chen Y. S. and Sarstedt M., located in the blue cluster, are also influential authors. The close connections within and between clusters indicate a strong pattern of co-citation, reinforcing the idea that sustainability,

innovation, and finance are interdependent areas in contemporary academic discourse.

3.5. The development of the research networks by countries

Table 3. Most productive countries

Rank	Regions	Documents
1	CHINA	89
2	UNITED KINGDOM	10
3	GERMANY	8
4	UNITED STATES	6
5	MALAYSIA	6
6	ITALY	6
7	TAIWAN	4
8	FRANCE	4
9	THAILAND	3
10	SOUTH KOREA	3

The table 3 depicts the publication output in green finance of the top 10 countries. What stands out in the table is the great disparity between the number of documents originating from China and that of other countries. Data shows that Chinese scholars are the key contributors in this field, with the largest number of articles, publishing 89 papers, accounting for 69.5% of the total documents. The papers related to green finance in China are approximately 9 times those of the UK, more than 10 times those of Germany, and nearly 15 times the total publications of the US, Malaysia, and Italy. Taiwan and France only have 4 papers that are devoted to this topic. In the top 9 and 10, with only three articles, Thailand and South Korea show less interest in green finance research over the period. The dominance of Chinese researchers in this field indicates that institutions, research agencies, and governments facilitate and encourage relevant research (Kumar et al. 2024). Recently, China has implemented numerous strategic initiatives, such as the 2012 Guidelines and a comprehensive framework for carbon neutrality by 2060, with significant progress expected by 2030. These findings suggest that while green finance is a global concern, research on this problem is concentrated in countries with strong governmental support and policy coordination. This disparity also presents an opportunity for greater international collaboration, particularly to bridge knowledge gaps and harmonize approaches to sustainable finance globally.

To determine the level of collaboration between countries in this field, this paper counts the number of articles in 42 countries. First, we visualize countries with more than three publications using the VOS viewer, and Fig 5 displays the science mapping. The map analyses scientific collaboration between countries over time, showing the level and trend of research collaboration between countries. Each node is a country with scientific publications; the size of the node shows the frequency of appearance. The more publications a country has, the larger the node. The line connecting the nodes shows the cooperative relationship between countries, and the color shows the topics of collaborative research. Purple is for the topics that have been researched early, on average before 2022; green is from 2022 to mid-2023; and yellow is for the topics with the latest research (late 2023–2024). China is the prominent country, represented by the largest light green node; it has many publications and is leading the trend in this topic. China has strong connections with other countries, such as the United Kingdom, Taiwan, France, Germany, Australia, and South Korea, showing that it is a major cooperation centre. The group of Western countries includes the United Kingdom, France, Germany, Italy, and Ireland. This group of countries has green to yellow nodes, indicating that they have begun researching this topic early and played an important role in the initial stages of developing the theory of green finance. The group has strong cooperation with other countries such as China, Australia, South Korea, and Malaysia. The emerging group includes India and Thailand, with light yellow to green illustrating that these countries have started participating in researching this topic in recent years. This group has close cooperation with China, showing that China is the centre supporting and leading scientific collaboration in the Asian region, as well as in the world.

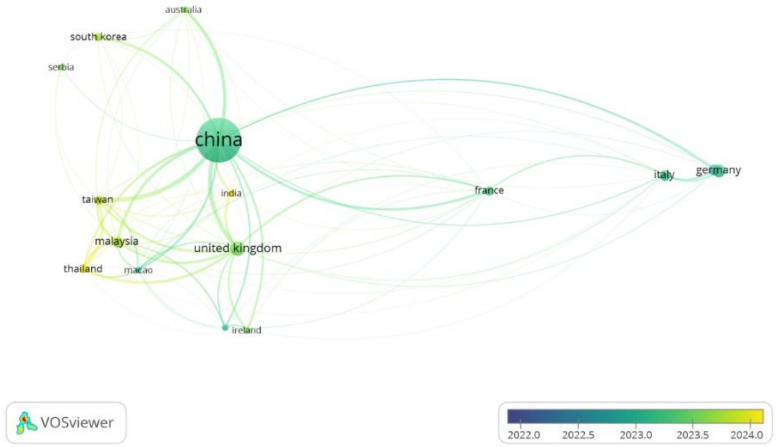


Fig 5. The co-authorship among countries in green finance from 2022 to 2024

Compared to the studies that use the same methodology, China, from a country with weak international cooperation in 2018-2021, has expanded its cooperation with other countries in and outside the region (Wang, Cui, and Hausken 2025). This finding suggests that China does research independently and extends its collaboration networks globally. It implies that countries are intensifying their research and development efforts in the green finance sector.

Green finance in China is characterized by strong state control, rapid policy rollout, and robust market growth, as demonstrated by the studies reviewed (Muganyi, Yan, and Sun 2021). China's dominance in Tables 2, 3, and Figure 5 underscores its sustained leadership in this field. A cornerstone of this trajectory was the issuance of the Green Credit Guidelines in 2012, which redirected financial flows toward environmentally friendly industries while restricting high-pollution sectors (Wu et al. 2023). Academic output on Chinese green finance subsequently grew steadily until 2024, reflecting rising scholarly and policy interest. Market expansion has been equally striking: the green bond market grew from zero to USD 37 billion in outstanding issuances between 2015 and 2017, making China the world's largest market by 2016 (Elliott and Zhang 2019). Policy development has remained closely aligned with national strategies, such as ecological civilization and carbon neutrality, while shifting toward more market-based and innovation-driven mechanisms (Larsen 2023). Comparative analyses highlight a key distinction: China's top-down, state-led model contrasts with the European Union's consultative, standard-setting framework, emphasizing selective international engagement and signalling divergent pathways to global green finance leadership (Larsen 2023).

3.6. Key research topics in green finance

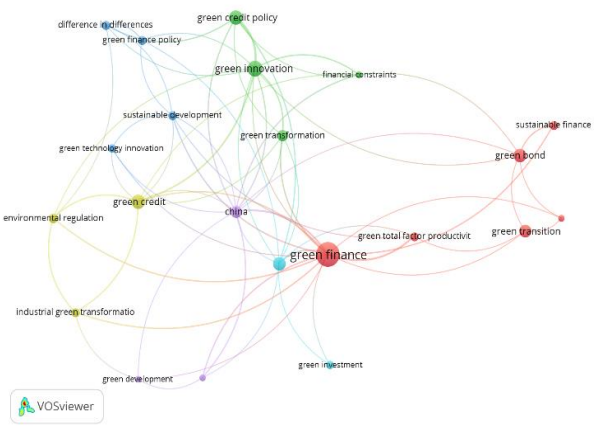


Fig 6. Science mapping: co-occurrence keyword

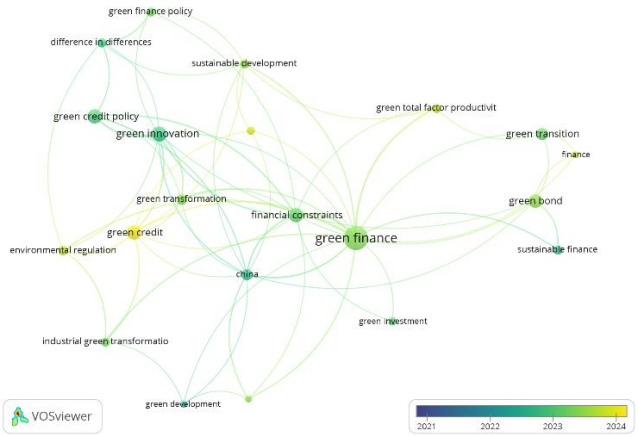


Fig 7. Science mapping: co-occurrence keyword over time

To identify the outstanding topics in the field of green finance, we use the keyword analysis map exported from the VOSviewer tool. The keyword co-occurrence analysis map consists of nodes representing keywords, where the size of each node indicates how often the keyword appears in the data, the color represents the focused topic clusters, and the connecting lines illustrate the level of connection between keywords. The map is divided into six clusters with six colors as above, which is the result of running the data of 21 keywords with at least 3 appearances. The six colored clusters are divided into four different topics: (i) Green finance foundations; (ii) Policy impacts; (iii) Green credit impacts; (iv) China's

green financial pathways. The keywords with the highest number of appearances are green finance (34), green innovation (14), green credit (12), financial constraints (12), green credit policy (12), and green bond (11). China, the name of one of the countries where the research was conducted, was one of the most prominent keywords among the words commonly used in this topic.

Table 4. High occurrence keywords

Cluster's color	Cluster's name	Keyword occurrences (occurrences) (Avg.pub.year)	Quantity
Red	Green finance foundations	green finance (34) (2023.29), green bond (11) (2023.36), green transition (9) (2023.11), sustainable finance (5) (2022.6), green total factor productivity (5) (2023.6), finance (3) (2023.67).	(6 keywords)
Green	Policy impact	difference in difference (5) (2022.8), green finance policy (5) (2023.2), sustainable development (5) (2023.4), green technology innovation (4) (2023.75).	(4 keywords)
Yellow		green innovation (14) (2023.79), green credit policy (12) (2022.92), green transformation (7) (2023.29).	(3 keywords)
Blue	Green credit impact	green credit (12) (2023.92), environmental regulation (6) (2023.67), industrial green transformation (5) (2023.2).	(3 keywords)
Purple	China's Green Financial Pathway	China (8) (2023.62), green development (3) (2022.33), mediating effect (3) (2022.33)	(3 keywords)
Light blue		financial constraints (12) (2023.08), green investment (4) (2023.00)	(2 keywords)

The keyword co-occurrence analysis map over time shows the development trend of research topics over the years. Each node on the map is a keyword; the size of each node shows the frequency of occurrence of the keywords, and the color of the nodes shows the average year in which the keyword appears. Dark blue nodes show keywords corresponding to topics that appeared from around 2021 onwards, green nodes show topics of interest in the period 2022-2023, and yellow nodes show emerging topics that are attracting the attention of scholars from the second half of 2023 onwards. The 2022-2023 topic group is colored green, including key words such as green finance (2023.29), green bond (2023.36), green transition (2023.11), sustainable finance (2022.6), green total factor productivity (2023.6), and finance (2023.67). Throughout this period, scholars are researching these topics. We are in the process of completing the fundamental concepts, which serve as a theoretical foundation for the subsequent research branches. From the end of 2022 to the end of 2023, the main keywords include green innovation (14) (2023.79), green credit policy (12) (2022.92), green transformation (7) (2023.29), difference in difference (5) (2022.8), green finance policy (5) (2023.2), and sustainable development (5) (2023.4). This result suggests that at this stage, scholars are focusing on the coordination of policy instruments to facilitate the green transition.

The emerging topic group from 2023 to the present (in yellow) includes the main keyword, green credit. This is a new research direction of current interest, focusing on the impact of green credit in promoting the transition to sustainable financial markets.

Green finance emerges as the dominant research hub, with China occupying a central role in shaping knowledge production, reflecting the country's proactive policy frameworks and strong state-led interventions. However, green credit, green bond remains weakly connected, suggesting that current research has not yet fully integrated these instruments into a cohesive framework for advancing the green transition. This gap presents a critical opportunity for future scholarship to investigate the causal relationships between credit allocation and bond issuance. It is suggested for the policymakers to utilize empirical findings to design blended instruments that coordinate green credit incentives with green bond frameworks. Practitioners, in turn, can leverage these insights by adopting bundled products and harmonized impact measurement practices to maximize environmental and financial returns. However, this dominance might raise issues of unbalance in green finance research and application globally. Bibliometric analysis illustrates that most of scientific works, academic collaboration networks and citations are closely linked to Chinese scholars, institutions and policies. Meanwhile, other countries, especially developing economies such as Vietnam, Thailand or Africa, Latin America, have not yet achieved a corresponding position. This may lead to the risk of forming a biased discourse, where theoretical frameworks, research priorities and green finance policies are heavily influenced by the specific Chinese context, rather than reflecting the diversity of global practices. Therefore, we encourage international cooperation, increasing the participation of other countries and promoting cross-national comparative research is necessary to avoid the concentration of academic and practical power in a single country.

4. CONCLUSION

This paper employs a bibliometric approach to comprehensively assess the state and research trends of green finance within the broader framework of the green transition. Based on 128 selected articles, we compiled and analyzed scientific maps to provide a panoramic view of this field. To ensure methodological rigor, the PRISMA framework was applied during the selection and screening of relevant literature. The analysis of graphs, tables, and mappings provides a structured overview of the research landscape, focusing on annual scientific production, journal distributions, highly cited articles, author keywords, and collaboration networks among authors and countries.

The results reveal several key trends. First, there has been a marked increase in green finance publications since 2021, and this upward trajectory is expected to continue through 2024, underscoring the priority status of green finance as a research topic. Among the most active publication outlets, *Sustainability*, *Journal of Cleaner Production*, *Energy Economics*, *Resources Policy*, and *PLoS One* rank as the top five journals in the field. *Sustainability* is the most productive journal, while *Energy Economics* emerges as the most highly cited.

Second, the two most influential papers are Hu, Wang, and Wang's study, *"Can the green credit policy stimulate green innovation in heavily polluting enterprises? Evidence from a quasi-natural experiment in China"*, and Lu, Gao, Zhang, and Wang's work, *"Can the green finance policy force the green transformation of high-polluting enterprises?"*, based on China's *Green Credit Guidelines*. Both studies examine the role of environmental policies in promoting green transitions, reflecting the dominance of China-focused research in shaping this field of study. Co-authorship patterns show that publications are predominantly collaborative, forming four distinct author clusters. Geographical distribution further indicates that most research originates from China. International collaboration mapping reveals an increasing trend in cooperation, particularly between China and the United Kingdom, China and Taiwan, and China and South Korea.

Third, four primary research directions emerge: (i) foundations of green finance; (ii) policy impacts; (iii) green credit effects; and (iv) China's green financial pathways. Analysis of author keywords over time suggests several promising future directions, including the effects of green credit on green transformation, the role of environmental regulation, the contribution of green innovation to sustainable outcomes, and the influence of financial constraints on green initiatives. The bibliometric results not only reflect China's success but also suggest an important gap for the scientific community and policymakers in building a more multipolar, equitable, and sustainable green financial ecosystem. Advancing research in these areas would deepen theoretical understanding of the mechanisms underpinning the green transition while offering actionable insights for policymakers, financial institutions, and businesses seeking to integrate sustainability into their strategies.

Overall, the findings underscore China's dominant role in green finance research. Through a combination of robust legal frameworks, scientific and technological progress, and strategic investments, China has positioned itself as a global leader in fostering sustainable development and environmental protection within the context of the green transition.

Despite these contributions, the study faces several limitations. The dataset was restricted to Scopus-indexed, English-language journal articles, thereby excluding conference papers, book chapters, and non-English scholarship. While Scopus provides extensive coverage, it disproportionately represents established journals from major regions and overlooks valuable research in languages other than English and local databases. Consequently, the results should be interpreted as a partial rather than a comprehensive representation of global green finance scholarship. Additionally, this study examines green finance trends specifically within the green transition framework, which narrows its scope. Future research should address these limitations by incorporating non-English sources, regional databases, and qualitative assessments of policy and market impacts to offer a more inclusive and globally relevant perspective.

5. REFERENCES

Akomea-Frimpong, Isaac, David Adeabah, Deborah Ofosu, and Emmanuel Junior Tenakwah. 2022. "A Review of Studies on Green Finance of Banks, Research Gaps and Future Directions." *Journal of Sustainable Finance & Investment* 12(4):1241–64. doi: 10.1080/20430795.2020.1870202.

Aria, Massimo, and Corrado Cuccurullo. 2017. "Bibliometrix: An R-Tool for Comprehensive Science Mapping Analysis." *Journal of Informetrics* 11(4):959–75. doi: 10.1016/J.JOI.2017.08.007.

Berrou, Romain, Philippe Dessertine, and Marco Migliorelli. 2019. "An Overview of Green Finance." 3–29. doi: 10.1007/978-3-030-22510-0_1.

Bikram Khadka, Prajjwol, Dipendra Karki, Rewan Kumar Dahal, and Dristi Khanal. 2024. "Mapping the Landscape of Green Finance and Banking Performance Research: A Bibliometric Analysis." *SSRN Electronic Journal*. doi: 10.2139/SSRN.5187725.

Bistline, John, Geoffrey Blanford, Maxwell Brown, Dallas Burtraw, Maya Domeshek, Jamil Farbes, Allen Fawcett, Anne Hamilton, Jesse Jenkins, Ryan Jones, Ben King, Hannah Kolus, John Larsen, Amanda Levin, Megan Mahajan, Cara Marcy, Erin Mayfield, James McFarland, Haewon McJeon, Robbie Orvis, Neha Patankar, Kevin Rennert,

Christopher Roney, Nicholas Roy, Greg Schivley, Daniel Steinberg, Nadejda Victor, Shelley Wenzel, John Weyant, Ryan Wiser, Mei Yuan, and Alicia Zhao. 2023. "Emissions and Energy Impacts of the Inflation Reduction Act." *Science* 380(6652):1324–27. doi: 10.1126/SCIENCE.ADG3781.

Broadus, R. N. 1987. "Toward a Definition of 'Bibliometrics.'" *Scientometrics* 12(5–6):373–79. doi: 10.1007/BF02016680/METRICS.

Brühl, Volker. 2021. "Green Finance in Europe — Strategy, Regulation and Instruments." *Intereconomics* 56(6):323–30. doi: 10.1007/S10272-021-1011-8/METRICS.

Chandran, Renju, and Sarath Chandran MC. 2024. "Green Finance and Sustainability: Mapping Research Development through Bibliometric Analysis." *Discover Sustainability* 5(1):1–19. doi: 10.1007/S43621-024-00549-Z/FIGURES/8.

Chin, Mui Yin, Sheue Li Ong, Daniel Boon Yann Ooi, and Chin Hong Puah. 2024. "The Impact of Green Finance on Environmental Degradation in BRI Region." *Environment, Development and Sustainability* 26(1):303–18. doi: 10.1007/S10668-022-02709-5/TABLES/6.

Dar, Bakir Illahi, Nemer Badwan, and Jatinder Kumar. 2024. "Investigating the Role of Fintech Innovations and Green Finance toward Sustainable Economic Development: A Bibliometric Analysis." *International Journal of Islamic and Middle Eastern Finance and Management* 17(6):1175–95. doi: 10.1108/IMEFM-01-2024-0018.

Ellegaard, Ole, and Johan A. Wallin. 2015. "The Bibliometric Analysis of Scholarly Production: How Great Is the Impact?" *Scientometrics* 105(3):1809–31. doi: 10.1007/S11192-015-1645-Z/TABLES/9.

Elliott, Christian, and Le Yin Zhang. 2019. "Diffusion and Innovation for Transition: Transnational Governance in China's Green Bond Market Development." *Journal of Environmental Policy & Planning* 21(4):391–406. doi: 10.1080/1523908X.2019.1623655.

Fahim, Faryal, and Batiah Mahadi. 2022. "Green Supply Chain Management/Green Finance: A Bibliometric Analysis of the Last Twenty Years by Using the Scopus Database." *Environmental Science and Pollution Research International* 29(56):84714–40. doi: 10.1007/S11356-022-21764-Z/FIGURES/9.

Fotova Čiković, Katerina, Damira Keček, and Violeta Cvetkoska. 2024. "A Systematic Literature Review of Green Finance and Green Economy Transition in Economy and Business-Related Studies." 264–73. doi: 10.47063/EBTSF.2024.0028.

Giese, Guido, Linda Eling Lee, Dimitris Melas, Zoltán Nagy, and Laura Nishikawa. 2019. "Foundations of ESG Investing: How ESG Affects Equity Valuation, Risk, and Performance." *The Journal of Portfolio Management* 45(5):69–83. doi: 10.3905/JPM.2019.45.5.069.

Han, Xu, Ying Wang, Wanlin Yu, and Xianli Xia. 2023. "Coupling and Coordination between Green Finance and Agricultural Green Development: Evidence from China." *Finance Research Letters* 58:104221. doi: 10.1016/J.FRL.2023.104221.

Hu, Guoqiang, Xiaoqi Wang, and Yu Wang. 2021. "Can the Green Credit Policy Stimulate Green Innovation in Heavily Polluting Enterprises? Evidence from a Quasi-Natural Experiment in China." *Energy Economics* 98:105134. doi: 10.1016/J.ENECO.2021.105134.

Hua, Mingzhong, Zhe Li, Yudong Zhang, and Xiaobei Wei. 2024. "Does Green Finance Promote Green Transformation of the Real Economy?" *Research in International Business and Finance* 67:102090. doi: 10.1016/J.RIBAF.2023.102090.

Huang, Zhe, and Min Fu. 2020. "Research on Green Decision Making of Pharmaceutical Logistics Considering Government Subsidy Strategy." *PLOS ONE* 15(10):e0241400. doi: 10.1371/JOURNAL.PONE.0241400.

Kirby, Andrew. 2023. "Exploratory Bibliometrics: Using VOSviewer as a Preliminary Research Tool." *Publications 2023, Vol. 11, Page 10* 11(1):10. doi: 10.3390/PUBLICATIONS11010010.

Kraus, Sascha, Ricarda B. Bouncken, and Alba Yela Aránega. 2024. "The Burgeoning Role of Literature Review Articles in Management Research: An Introduction and Outlook." *Review of Managerial Science* 18(2):299–314. doi: 10.1007/S11846-024-00729-1/METRICS.

Kumar, Ashish, Suman Ahuja, Nupur Soti, A. K. Saini, and Bharti. 2024. "Navigating the Green Finance Frontier: A Bibliometric and Content Analysis of Green Finance and Environmental Sustainability." *Cogent Economics and Finance* 12(1). doi: 10.1080/23322039.2024.2398217;PAGE:STRING:ARTICLE/CHAPTER.

Larsen, Mathias Lund. 2023. "Bottom-up Market-Facilitation and Top-down Market-Steering: Comparing and Conceptualizing Green Finance Approaches in the EU and China." *Asia Europe Journal* 21(1):61–80. doi:

10.1007/S10308-023-00663-Z/TABLES/1.

Lazaro, L. L. B., C. S. Grangeia, L. Santos, and L. L. Giatti. 2023. "What Is Green Finance, after All? – Exploring Definitions and Their Implications under the Brazilian Biofuel Policy (RenovaBio)." *Journal of Climate Finance* 2:100009. doi: 10.1016/J.JCLIMF.2023.100009.

Lee, Jung Wan. 2020. "Green Finance and Sustainable Development Goals: The Case of China." *Journal of Asian Finance, Economics and Business* 7(7):577–86. doi: 10.13106/JAFEB.2020.VOL7.NO7.577.

Lindenberg, Nannette. 2014. "Definition of Green Finance."

Liu, Sheng, and Yukai Wang. 2023. "Green Innovation Effect of Pilot Zones for Green Finance Reform: Evidence of Quasi Natural Experiment." *Technological Forecasting and Social Change* 186:122079. doi: 10.1016/J.TECHFORE.2022.122079.

Lu, Yuchen, Yuqiang Gao, Yu Zhang, and Junrong Wang. 2022. "Can the Green Finance Policy Force the Green Transformation of High-Polluting Enterprises? A Quasi-Natural Experiment Based on 'Green Credit Guidelines.'" *Energy Economics* 114:106265. doi: 10.1016/J.ENECO.2022.106265.

Maria, Mariana Reis, Rosangela Ballini, and Roney Fraga Souza. 2023. "Evolution of Green Finance: A Bibliometric Analysis through Complex Networks and Machine Learning." *Sustainability 2023, Vol. 15, Page 967* 15(2):967. doi: 10.3390/SU15020967.

Mohanty, Sagarika, Sudhansu Sekhar Nanda, Tushar Soubhari, N. S. Vishnu, Sthitipragyan Biswal, and Shalini Patnaik. 2023. "Emerging Research Trends in Green Finance: A Bibliometric Overview." *Journal of Risk and Financial Management 2023, Vol. 16, Page 108* 16(2):108. doi: 10.3390/JRFM16020108.

Muganyi, Tadiwanashe, Linnan Yan, and Hua ping Sun. 2021. "Green Finance, Fintech and Environmental Protection: Evidence from China." *Environmental Science and Ecotechnology* 7. doi: 10.1016/J.ESE.2021.100107.

Mukherjee, Debmalya, Weng Marc Lim, Satish Kumar, and Naveen Donthu. 2022. "Guidelines for Advancing Theory and Practice through Bibliometric Research." *Journal of Business Research* 148:101–15. doi: 10.1016/J.JBUSRES.2022.04.042.

Page, Matthew J., Joanne E. McKenzie, Patrick M. Bossuyt, Isabelle Boutron, Tammy C. Hoffmann, Cynthia D. Mulrow, Larissa Shamseer, Jennifer M. Tetzlaff, Elie A. Akl, Sue E. Brennan, Roger Chou, Julie Glanville, Jeremy M. Grimshaw, Asbjørn Hróbjartsson, Manoj M. Lalu, Tianjing Li, Elizabeth W. Loder, Evan Mayo-Wilson, Steve McDonald, Luke A. McGuinness, Lesley A. Stewart, James Thomas, Andrea C. Tricco, Vivian A. Welch, Penny Whiting, and David Moher. 2021. "The PRISMA 2020 Statement: An Updated Guideline for Reporting Systematic Reviews." *BMJ* 372. doi: 10.1136/BMJ.N71.

van der Ploeg, Frederick, and Armon Rezai. 2019. "Stranded Assets in the Transition to a Carbon-Free Economy." *SSRN Electronic Journal*. doi: 10.2139/SSRN.3523529.

Radhakrishnan, G. V, J. Deepa, Shrija C. S, Alaknanda Lonare, and Pratyay Das. 2025. "The Rise of Green Finance: Sustainable Investment Trends in the 21st Century." *Journal of Information Systems Engineering and Management* 10(33s):266–75. doi: 10.52783/JISEM.V10I33S.5476.

Rasoulinezhad, Ehsan, and Farhad Taghizadeh-Hesary. 2022. "Role of Green Finance in Improving Energy Efficiency and Renewable Energy Development." *Energy Efficiency* 15(2). doi: 10.1007/S12053-022-10021-4.

Tian, Chao, Xiuqing Li, Liming Xiao, and Bangzhu Zhu. 2022. "Exploring the Impact of Green Credit Policy on Green Transformation of Heavy Polluting Industries." *Journal of Cleaner Production* 335:130257. doi: 10.1016/J.JCLEPRO.2021.130257.

Tolliver, Clarence, Alexander Ryota Keeley, and Shunsuke Managi. 2019. "Green Bonds for the Paris Agreement and Sustainable Development Goals." *Environmental Research Letters* 14(6):064009. doi: 10.1088/1748-9326/AB1118.

Wang, Guizhou, Hongrui Cui, and Kjell Hausken. 2025. "The Evolution of Green Finance Research: A Comprehensive Bibliometric Analysis." *Heliyon* 11(3):e42161. doi: 10.1016/J.HELIYON.2025.E42161.

Wang, Moran, Xuerong Li, and Shouyang Wang. 2021. "Discovering Research Trends and Opportunities of Green Finance and Energy Policy: A Data-Driven Scientometric Analysis." *Energy Policy* 154:112295. doi: 10.1016/J.ENPOL.2021.112295.

Wang, Yao, and Qiang Zhi. 2016. "The Role of Green Finance in Environmental Protection: Two Aspects of Market Mechanism and Policies." *Energy Procedia* 104:311–16. doi: 10.1016/J.EGYPRO.2016.12.053.

Wei, Zhang, Jin Yuguo, and Wang Jiaping. 2015. "Greenization of Venture Capital and Green Innovation of Chinese Entity Industry." *Ecological Indicators* 51:31–41. doi: 10.1016/J.ECOLIND.2014.10.025.

Wu, Kai, E. Bai, Hejie Zhu, Zhijiang Lu, and Hongxin Zhu. 2023. "Can Green Credit Policy Promote the High-Quality Development of China's Heavily-Polluting Enterprises?" *Sustainability 2023, Vol. 15, Page 8470* 15(11):8470. doi: 10.3390/SU15118470.

Yan, Yunfeng, Zongqi Li, Yutong Zhang, Jie Wu, and Yun Zhang. 2025. "The Effects of Foreign Direct Investment on Green Technology Innovation: New Evidence from China's 278 Cities." *Emerging Markets Finance and Trade* 61(4):940–63. doi: 10.1080/1540496X.2024.2401476.

Zhang, Dayong, Zhiwei Zhang, and Shunsuke Managi. 2019. "A Bibliometric Analysis on Green Finance: Current Status, Development, and Future Directions." *Finance Research Letters* 29:425–30. doi: 10.1016/J.FRL.2019.02.003.

Zhang, Dongyang, Muhammad Mohsin, Abdul Khaliq Rasheed, Youngho Chang, and Farhad Taghizadeh-Hesary. 2021. "Public Spending and Green Economic Growth in BRI Region: Mediating Role of Green Finance." *Energy Policy* 153:112256. doi: 10.1016/J.ENPOL.2021.112256.

Zhu, Yue, Juntao Zhang, and Caiquan Duan. 2023. "How Does Green Finance Affect the Low-Carbon Economy? Capital Allocation, Green Technology Innovation and Industry Structure Perspectives." *Economic Research-Ekonomska Istrazivanja* 36(1):3519–41. doi: 10.1080/1331677X.2022.2110138.