

A Bibliometric Study of Green Finance Research in 2000 until 2024

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ABSTRACT

This bibliometric study explores the evolution of green finance research from 2000 to 2024, employing a comprehensive dataset derived from Scopus. It analyzes the development of themes, the geographic distribution of research, and the dynamics of academic collaboration within the field. Our findings indicate a significant growth in literature, with a pronounced focus on sustainable investments, green bonds, and the integration of environmental concerns into banking practices. The study highlights the role of technological innovation and decentralized finance in advancing the field, reflecting a shift towards more efficient and transparent financial processes. Geographical analysis reveals a strong contribution from countries like China, India, and the United States, with extensive international collaborations across continents. The research landscape is characterized by a diverse array of contributions that address both the economic and environmental aspects of green finance. This study provides valuable insights into the intellectual structure of green finance and suggests areas for future research, including the need for more interdisciplinary approaches and empirical studies to assess the effectiveness of green finance mechanisms.

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1. INTRODUCTION

Green finance has emerged as a critical component in addressing global environmental challenges by channeling financial flows from banking, micro-credit, insurance, and investment to environmentally sustainable development projects. Since the early 2000s, the concept of green finance has evolved significantly, aligning financial systems with sustainable development objectives [1]. The urgency of environmental issues such as climate change, deforestation, and biodiversity loss has necessitated this shift towards sustainable financial practices. These practices are designed to support

projects that provide environmental benefits, such as renewable energy installations, energy efficiency upgrades, and sustainable agriculture [2].

The academic interest in green finance has mirrored its growing practical importance. Researchers have explored various dimensions, including the effectiveness of green bonds, the role of green banking, and the impact of sustainable investment on financial performance [3]. This scholarly attention is crucial as it provides evidence-based insights and recommendations that can influence policy-making and corporate strategies.

Additionally, the rise of international agreements, such as the Paris Agreement, has further propelled the need for research in this area to ensure compliance with and progress towards environmental targets [4].

However, the field of green finance is not without its complexities. It spans multiple disciplines including economics, environmental science, and policy studies, which contributes to a rich but fragmented body of knowledge [5]. This interdisciplinary nature poses challenges for researchers and practitioners alike, as synthesizing information across different fields can be daunting. Furthermore, the rapid evolution of green financial products and regulations demands continual academic scrutiny to keep pace with market developments and regulatory changes [6].

A bibliometric analysis offers a valuable methodological approach in such a rapidly developing field. It provides a quantitative way to review and analyze the extensive literature on green finance, revealing trends, gaps, and the evolution of themes over time [7]. Such analyses help in understanding how research in green finance has progressed, the main contributors to the field, and the most influential studies. Moreover, bibliometric studies can guide future research by highlighting under-explored areas and suggesting new directions based on past work. Given the extensive scope of research from 2000 to 2024, this period marks significant advancements and shifts in the focus within the field of green finance. The early 2000s saw foundational research that mostly concentrated on the conceptualization of green finance, while recent years have witnessed a surge in empirical studies assessing the impacts and efficiencies of green financial policies and instruments [8].

Despite the growing body of literature, there remains a lack of comprehensive synthesis that maps the development of green finance research over an extended period. This gap hinders the ability of researchers, policymakers, and practitioners to obtain a clear and systematic understanding of the field's evolution,

predominant themes, and seminal works. It also poses challenges in identifying consensus areas and points of contention within the academic discourse, which are essential for formulating effective and informed green finance strategies. The objective of this study is to conduct a bibliometric analysis of green finance research published from 2000 to 2024.

Evolution of Green Finance

The literature on green finance has evolved significantly since the early 2000s, with scholars examining its role in fostering sustainable economic growth and environmental conservation. Early studies focused on the conceptualization of green finance and its potential to support environmentally friendly projects. [9] argued that green finance could be a pivotal tool for achieving sustainable development goals by aligning financial services with environmental consciousness. This foundational idea set the stage for further exploration into various financial instruments, such as green bonds and green mortgages, which facilitate investments in renewable energy and energy-efficient projects [10]. As the field matured, empirical research began to dominate, examining the performance and impact of green financial products. For instance, studies by [11] and [12] explored the financial viability and performance of green bonds and environmental mutual funds, respectively. These studies generally found that green financial instruments do not necessarily compromise returns when compared to conventional finance, challenging earlier skepticism about the economic feasibility of prioritizing environmental factors in investment decisions.

Green Bonds and Investment

Green bonds have received substantial attention as effective tools for mobilizing resources for green projects. A report by the Climate Bonds Initiative highlighted a significant increase in green bond issuances, indicating robust market growth and acceptance. Research by [13] demonstrated that green bonds not only help companies to attract capital but also

significantly improve their environmental performance post-issuance, suggesting a tangible impact beyond financial metrics. However, the literature also points to challenges in the green bond market, particularly regarding the verification and standardization of what qualifies as a 'green' bond. Critics argue that without stringent standards and clearer definitions, the risk of 'greenwashing'—where claims of environmental benefit are misleading—remains high [14]. This highlights an ongoing debate within the academic community about the need for more robust frameworks and transparency in green finance.

Green Banking

Green banking is another crucial area within green finance, involving financial products and services that have a direct or indirect positive impact on the environment. [15] provided comprehensive reviews of how banks are integrating environmental criteria into their operations, from lending practices to investment activities. The findings suggest that green banking not only mitigates the environmental risks but also enhances the banks' reputations and fulfills their corporate social responsibility. Moreover, studies like that of [16] have analyzed the challenges banks face in implementing green banking practices, such as additional costs and the complexity of assessing environmental benefits. Despite these challenges, the trend towards green banking is growing, with financial institutions increasingly recognizing the strategic benefits of environmental and social responsibility.

Role of Policy and Regulation

The literature consistently emphasizes the importance of policy and regulation in promoting green finance. Government policies and international agreements, such as the Paris Agreement, play a pivotal role in shaping the financial landscape by setting standards and targets for sustainability. Research by [17] and others has explored how regulatory frameworks can encourage or hinder the development of green finance markets. A notable area of interest is the effect of carbon pricing and

subsidies on green investments. Studies by [18] suggest that well-designed policy instruments, like carbon taxes and green subsidies, can significantly influence financial flows towards sustainable projects. The research calls for an integrated approach, combining financial incentives with stricter environmental regulations to foster a more sustainable economy.

2. METHODS

This bibliometric study employs quantitative methods to analyze the evolution of green finance research from 2000 to 2024. We utilized the Scopus database to extract relevant academic papers using keywords such as "green finance," "sustainable finance," "green bonds," "green banking," and "environmental finance." The initial dataset was refined by excluding papers that did not focus primarily on green finance, as determined by their abstracts and keywords. The final dataset includes papers published in peer-reviewed journals. We analyzed the data using VOSviewer software for co-citation and co-authorship analysis, which helped in identifying the most influential authors, institutions, and countries in the field. Additionally, content analysis was conducted on the titles, abstracts, and keywords to discern major themes, trends, and gaps in the literature. The study employs bibliometric indicators such as total citations, h-index, and journal impact factors to assess the impact and quality of the research in the field of green finance.

3. RESULTS AND DISCUSSION

3.1 *Keyword Co-Occurrence Network Visualization*

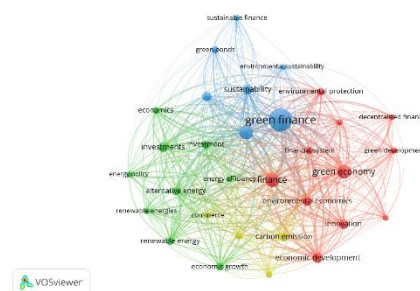


Figure 1. Network Visualization

Source: Data Analysis, 2025

In the center, "green finance" serves as the core node, strongly linked to adjacent concepts such as "sustainable finance," "environmental sustainability," and "financial system." This central positioning underscores green finance's pivotal role in integrating financial practices with sustainability objectives. The close connectivity between "green finance" and "sustainable finance" indicates that these terms are often used interchangeably or in close context, reflecting their overlapping goals of promoting economic activities that are environmentally conscious and sustainable. Surrounding nodes like "green bonds," "green economy," and "decentralized finance" highlight specific areas of focus within the broader green finance landscape. "Green bonds" are particularly notable as they represent a practical financial instrument through which investments are directed towards environmental projects. The linkage to "environmental protection" and "carbon emission" underscores the role of green bonds in combating climate change and promoting cleaner industries.

The node "energy efficiency" connects with both "renewable energies" and "alternative energy," indicating a significant emphasis on the energy sector within green finance research. This connection points to a robust discourse on how financial tools can support the transition to energy systems that are not only efficient but also less dependent on fossil fuels. Such topics are critical in the context of global efforts to reduce greenhouse gas emissions and enhance sustainability. The map includes terms like "economic development" and "innovation," which suggest that the scope of green finance research extends beyond environmental issues to encompass economic growth and technological advancement. This reflects a recognition that sustainable finance must also address economic viability and encourage innovative solutions to environmental challenges, thereby fostering a holistic approach to sustainability.

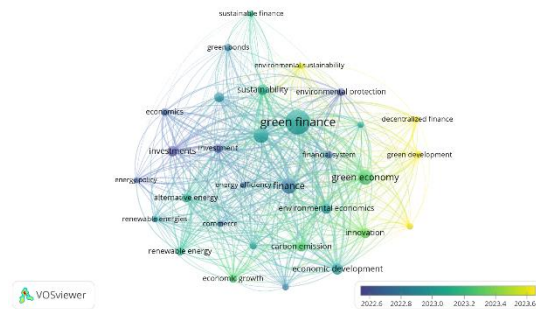


Figure 2. Overlay Visualization

Source: Data Analysis, 2025

The second visualization provides a more recent and dynamic perspective on the interconnected topics within green finance research, covering data through mid-2023. The presence of terms like "innovation" and "decentralized finance" gaining prominence, particularly in the more recent nodes colored in yellow, suggests a shift in the research focus. These newer topics indicate that the field is beginning to explore the impact of technological advancements such as blockchain and artificial intelligence on sustainable finance. This reflects a broader trend towards integrating digital technologies with green finance, which can potentially enhance transparency, efficiency, and scalability of investments in sustainability projects.

Central themes like "green economy" and "economic development" remain robustly connected to both foundational and emerging concepts, highlighting ongoing discussions about the balance between economic growth and environmental sustainability. The persistence of these themes suggests a continued academic and practical focus on how financial practices can support broader socio-economic goals without compromising environmental integrity. This area bridges traditional economic studies with modern environmental concerns, showing the interdisciplinary nature of green finance research.

Furthermore, the network shows a strong linkage between "environmental protection" and "carbon emission," which underscores the global urgency to address climate change through financial strategies. The connections to "energy efficiency" and

"renewable energies" emphasize the role of finance in driving the transition towards low-carbon energy sources. These links suggest that significant scholarly attention is dedicated to exploring how financial tools can incentivize and support energy transformations necessary for achieving international climate goals.

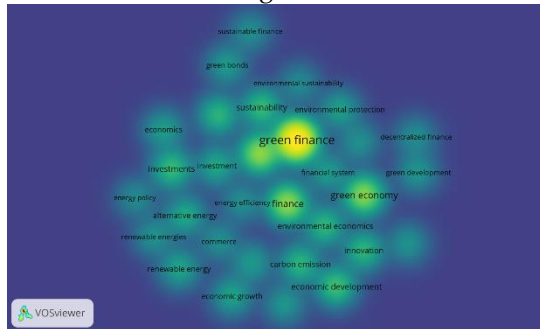


Figure 3. Density Visualization

Source: Data Analysis, 2025

This visualization offers a vibrant portrayal of key research themes within the field of green finance, emphasizing how central concepts are interconnected through various hues, indicating their density and clustering. "Green finance" remains the central hub, reinforcing its role as the foundational concept around which other themes orbit. Its proximity to "sustainable finance" and "environmental sustainability" illustrates the strong thematic overlaps that define the field, suggesting that sustainable finance principles are increasingly being integrated into broader financial systems and practices. This central cluster is tightly connected to both traditional financial terms like "investments" and "financial system," and more specific environmental terms such as "environmental protection" and "carbon emission," reflecting the dual focus on economic viability and environmental responsibility.

On the periphery, the terms "innovation" and "decentralized finance" appear as emerging themes that are gaining traction within the green finance discourse. This indicates a shift towards exploring how new technologies and innovative financial models can support sustainable development goals. The presence of "energy efficiency," "renewable energies," and "alternative

energy" in close proximity suggests a strong focus on the energy sector as a critical area for green finance application. These connections highlight the role of finance in supporting the transition to a green economy by funding technologies and projects that aim to reduce carbon emissions and enhance sustainability.

3.2 Co-Authorship Network Visualization

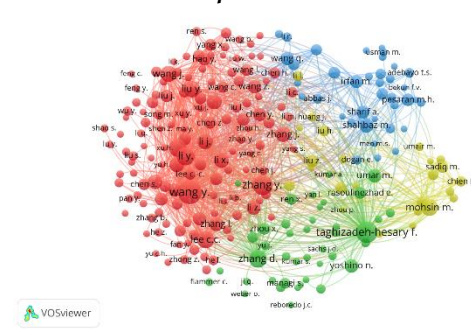


Figure 4. Author Visualization

Source: Data Analysis, 2025

The network map presented focuses on the co-authorship among researchers in the field of green finance, showcasing the dominant clusters of collaboration and scholarly influence. The largest, primarily red cluster, contains a high concentration of authors with surnames like "Wang," "Zhang," and "Liu," suggesting a strong representation of Chinese scholars, which reflects China's significant contributions to green finance research. Blue and green clusters primarily represent other international contributors, with notable researchers such as "Taghizadeh-Hesary" and "Yoshino" indicating active academic partnerships across Asia. The visualization illustrates not only the prolific nature of these researchers but also the global collaboration patterns, with linkages across different regions, highlighting the international and interdisciplinary nature of green finance studies.

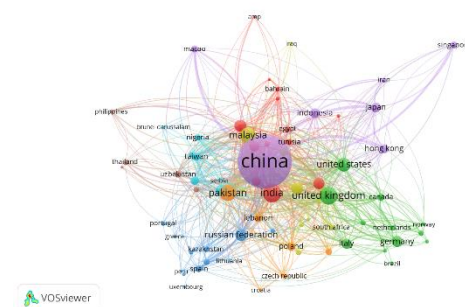


Figure 5. Country Visualization

Source: Data Analysis, 2025

The network map depicted highlights the global collaboration and research output in green finance, emphasizing significant contributions from countries across various continents. The prominent positioning and size of nodes such as China, India, and the United States suggest these countries are central hubs of green finance research, indicating a high volume of scholarly output and international collaborations. The dense network of lines connecting countries like Malaysia, the United Kingdom, and Germany to other regions illustrates extensive cross-border cooperation in this field, reflecting the global nature of environmental and financial challenges. The visualization also shows emerging contributions from countries in diverse geographical areas, including Southeast Asia, Europe, and the Middle East, pointing to the widespread acknowledgment and integration of green finance principles into broader economic and sustainability discussions worldwide.

DISCUSSION

Thematic Evolution and Core Areas

The thematic analysis indicates a robust focus on the integration of environmental sustainability into financial systems. Central themes like "green bonds," "green banking," and "sustainable investments" reflect a proactive approach to harnessing financial markets for environmental goals. The prominence of "green bonds" as a recurring theme underscores their significance as a tool for raising capital for environmental projects, supported by studies that highlight their effectiveness in improving environmental outcomes [19]. Similarly, the focus on "green banking" suggests a paradigm shift in banking operations, prioritizing sustainability within lending and investment practices, as discussed by [20] and [21]. Another notable finding is the increasing attention towards "innovation" and "decentralized finance" in recent years. This shift points to a growing recognition of technology's role in enhancing the efficiency and transparency of green finance practices. Technologies such as

blockchain and fintech are being explored for their potential to revolutionize green finance by reducing transaction costs, enhancing measurement and reporting of environmental impact, and facilitating increased involvement from a broader range of investors.

Geographical Diversity and Global Collaboration

The analysis reveals a strong geographical diversity in green finance research, with significant contributions from China, India, and the United States. The dominant role of China, evident from the bibliometric mapping, can be attributed to the country's aggressive policies towards sustainability and green finance, as part of its broader environmental and economic strategies. Similarly, the involvement of countries like India and the United States highlights the global nature of green finance, transcending economic and regional boundaries to address universal environmental challenges. International collaborations, as depicted in the network maps, are extensive and span across continents, indicating that green finance is a universally relevant field that benefits from diverse perspectives and expertise. The collaborations between developed and developing countries are particularly noteworthy, as they combine advanced technological capabilities and innovative financial models from the former with urgent sustainability needs and implementation opportunities from the latter.

Influential Research and Scholarly Impact

The bibliometric analysis also highlights the influential authors and papers that have shaped the green finance research landscape. Scholars from China, as indicated by frequent co-authorships and citations, have had a significant impact on the field, contributing to both theoretical advancements and empirical research. The work of researchers like Taghizadeh-Hesary and Yoshino has been pivotal in exploring the economic impacts of green finance policies in Asia, providing valuable insights into the effectiveness of various financial instruments

and strategies. In addition, the analysis shows that journals focusing on sustainability, economics, and finance have played a crucial role in disseminating green finance research, thereby influencing policy-making and practice. The high citation counts and h-index values associated with these journals underscore their importance in the academic and practical realms of green finance.

Limitations and Future Research Directions

While the bibliometric study provides comprehensive insights, it also reveals certain limitations inherent in the field's current research scope. One notable limitation is the potential underrepresentation of interdisciplinary approaches that integrate insights from behavioral sciences, technology, and economics. Addressing complex environmental challenges through green finance requires a holistic approach that transcends traditional disciplinary boundaries. Future research in green finance could benefit from a greater focus on the social and behavioral aspects of financial decision-making in the context of environmental sustainability. Additionally,

more empirical studies are needed to assess the long-term impacts of green finance policies and instruments across different economic contexts and climates. Exploring the role of public policy and regulatory frameworks in different countries could also provide deeper insights into the drivers and barriers of green finance adoption globally.

4. CONCLUSION

The bibliometric analysis of green finance research conducted from 2000 to 2024 illustrates a dynamic and rapidly evolving field. With its roots in environmental sustainability, the field has expanded to incorporate technological innovations and diverse international perspectives, making it a pivotal area of study in addressing global environmental challenges. As the world continues to face pressing environmental issues, the insights from this research not only highlight past achievements but also pave the way for future endeavors that could further integrate sustainability into the global financial landscape.

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