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Green Finance and Sustainable Development: Investigating the Role of Greentech Business Ecosystem Through PRISMA-Driven Bibliometric Analysis

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Abstract: This research aims to examine the relationship between green finance, fintech, and sustainable development. PRISMA and bibliometric analyses were conducted to determine the most important trends related to this subject. A total of 432 scientific documents were analyzed, sourced from the Scopus database. The PRISMA approach was used to choose the bibliometric data, including the application of suitable inclusion and exclusion criteria. The bibliometric analysis study framework, produced using the statistical programming language R alongside sophisticated bibliographic tools Biblioshiny and VOSviewer, particularly concentrates on carbon emissions, renewable energy, green technology innovation, and fintech. The study highlights the most significant authors, sources, and emerging research domains in the subject. Furthermore, the findings suggest that the organization's performance regarding ESG may be enhanced via the interplay between green financing and fintech. The study's results highlight the significance of green finance in achieving sustainable development and the need for fintech to evolve into greentech to promote ecologically sustainable activities.

Keywords: greentech; green finance; sustainable ecosystem; Fintech; green transition

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Received: 4 March 2025
Revised: 1 April 2025
Accepted: 16 April 2025
Published: 19 April 2025

Citation: Zournatzidou, G. (2025). Green Finance and Sustainable Development: Investigating the Role of Greentech Business Ecosystem Through PRISMA-Driven Bibliometric Analysis. *Administrative Sciences*, *15*(4), 150. https://doi.org/10.3390/admsci15040150

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1. Introduction

The development of a sustainable economy relies on the execution of green funding, which has a transformative influence. To attain this objective, financial resources are designated for a range of activities that are socially responsible and environmentally advantageous (Xing et al., 2024; X. Zhang et al., 2024). These initiatives substantially impact the environment, and their role in sustainable development is guaranteed by the distribution of these resources. The precise origin of the term "green finance" is open to interpretation. During the 1992 "Earth Summit" held in Rio de Janeiro, Brazil, the term was often used. In 2016, the International Finance Corporation (IFC) defined green finance as "the allocation of financial resources for projects that yield beneficial environmental results". The notion includes a diverse array of financial products and assets, such as green bonds, green banks, carbon market instruments, fiscal policy, green central banking, financial technology, and community-based green funds, among others (Song & Hao, 2024; Y. Yang et al., 2021). Each device was designed to promote and enable the establishment of companies that are environmentally aware and ecologically sustainable. Green funding facilitates governmental investment in environmentally beneficial activities, therefore achieving the objective of developing a low-carbon economy. This kind of financing is often appealing to socially conscious investors since it mitigates the financial constraints encountered by ecologically sustainable enterprises, often known as "green projects".

The incorporation of ecologically responsible funding has become a significant trend in academic writing. The Sustainable Development Goals (SDGs), namely SDG 13 (Climate Action) and SDG 7 (Affordable and Clean Energy), are crucial components of the global initiative for sustainable development. This is a crucial element of the program. Both the Paris Agreement and the United Nations Sustainable Development Goals emphasize the need for substantial financial expenditures in environmentally beneficial initiatives. It is theoretically possible to determine the relationship between environmental, social, and governance (ESG) variables and corporate performance. Consequently, firms implementing these strategies are strategically positioned to advance global initiatives focused on enhancing sustainable development and reducing environmental impact (Alsedrah, 2024; Tong et al., 2024; Uche et al., 2024; Wei et al., 2024; L. Wu et al., 2024; Zheng & Zhang, 2023).

Moreover, regarding fintech businesses and their need to comply with the green transition, there is currently an absence of a thorough examination of the topic. This situation persists despite existing research that has examined certain facets of green finance, like the efficacy of green bonds and the functions of financial institutions. This is a problem as it complicates the attainment of a comprehensive understanding of the diverse aspects of green finance and its relation to overarching sustainability objectives. This study aims to examine the subject of green finance via modern bibliometric methodologies to provide a comprehensive overview of the sector. Thus, the current research tries to investigate the developments that have transpired in the realm of green finance during the last few decades, as well as the need for transition from the traditional form of fintech to that of greentech. To date, there is an absence of bibliometric analysis in the area being examined. Dar et al. (2024) examine the correlation between fintech and green funding. The study findings primarily target financial managers, recommending that writers explore the use of technology and green finance in financial services to assist financial organizations in the green transition (Dar et al., 2024).

This study's results reveal substantial deficiencies in the existing literature, especially on underexplored topics like the transition of fintech to the alternative paradigm of greentech. This suggests new study avenues that might advance the field. The results possess significant policy implications for aiding policymakers and practitioners in harmonizing financial strategies with sustainability objectives. This facilitates the implementation of green finance initiatives that achieve greater success at both national and global scales. The formation of a significant role for green finance in fulfilling its core objective of sustainable development and fostering international collaboration is crucial for these reasons.

The following is an organization of the succeeding component of the study that is currently being conducted. Within the Section 2 is a literature review that provides an overview of the many studies that have been carried out on green financing in the past. Detailed explanations of the methodology and the materials are provided in the Section 3, the results are presented in the Section 4, and the Section 5 analyzes the findings and suggests potential avenues for future investigation. The conclusion of the inquiry is reported in the sixth part of the report of findings.

2. Literature Review

2.1. Green Financing: The Interconnection Among Sustainability and Finance for Battling Climate Risk

The concept of green finance has garnered substantial attention in recent decades, indicating the growing acknowledgement of the importance of sustainable economic growth. In general, green finance is the term used to describe financial investments in sustainable initiatives that have the potential to reduce the carbon footprint of humanity. These initiatives include renewable energy, energy efficiency, sustainable agriculture, and

pollution management. The review offers a succinct overview of the primary research that has been conducted in the field of green finance. It outlines the objectives of green financial instruments, the numerous research topics, and their impact on the economy and the environment (Tang et al., 2024; Yadav et al., 2024).

Initial investigations focused on the development and dissemination of green financial instruments, such as green bonds and green loans. However, the scholarly discourse on green finance has witnessed a significant transformation. Yeow and Ng's pioneering research, which examined the financial performance of corporations that issue green bonds, revealed a correlation between their issuance and improved corporate environmental performance and favorable financial returns. The study conducted by Dhayal et al. examines the potential of green financing to facilitate the transition to Industry 5.0, thereby clarifying the direction of future research and resolving its sustainability (Dhayal et al., 2023). In the same vein, Maltais and Nykvist examined the viability of green bonds as a strategy for fostering environmental sustainability (Maltais & Nykvist, 2020). They contend that green bonds are essential because they facilitate the reduction of carbon emissions. Dhayal et al. investigated the present state of green energy innovation initiatives that are intended to protect the environment and identified potential research trajectories to improve their efficacy (Dhayal et al., 2023).

Recent research in green finance has concentrated on the role of financial institutions and markets in fostering sustainability. Edunjobi and Odejide's research investigated the manner in which financial institutions and banks incorporate environmental factors into their credit risk assessments (Odejide & Edunjobi, 2024). It was determined that financial institutions that evaluate environmental hazards prior to extending credit would generate higher profits than their counterparts. This implies a positive correlation between profitability and environmental risk. The literature on green finance is noteworthy for its association with sustainable development. The significance of green money in the pursuance of SDGs is underscored in the lectures delivered by S. Zhang and Lee (2020). This research posited that green financing promotes environmental sustainability and social and economic development by encouraging investment in green technology and infrastructures.

2.2. Greentech: The Impact of Green Finance on Fintech

Fintech is significantly enhancing the banking industry by providing customers with digital and paperless financial experiences. Furthermore, it is cultivating various technologies and creating chances to tackle climate-related data and services. Simultaneously, other financial institutions are reassessing their strategy to diminish their carbon impact and encourage their clients to do likewise. The key aim of new entrants is financial solutions that provide value to all stakeholders while achieving zero carbon emissions (Dicuonzo et al., 2024; Galeone et al., 2024; Macchiavello & Siri, 2020).

Specifically, recent fiscal years (2020–2025) saw considerable financial expenditures in decarbonization based on climate considerations. Fintech can provide transparent financial services and create unique use cases for its users by using advanced technologies such as artificial intelligence (AI), big data, and blockchain. It aids businesses in monitoring and alleviating their environmental effect by diminishing atmospheric greenhouse gas emissions. Moreover, fintech companies are endeavoring to motivate customers to confront climate change by tracking energy use and carbon emissions. As a result, people are increasingly expecting substantial financial inclusion inside the banking environment. This emphasized the need for the establishment of a new type of fintech, referred to as green fintech or greentech (Koemtzopoulos et al., 2025a). This category is defined by the amalgamation of financial technology (fintech) solutions with environmental sustainability goals. This approach utilizes cutting-edge financial technology to tackle environmental

issues and promote sustainable behavior in the financial industry. Nonetheless, the existing literature has yet to include any study on greentech. The originality of this research stems from the examination of the transition of fintech to greentech and the possible new needs that may arise in their context.

3. Materials and Methods

This section describes the bibliometric analysis, which was essential for examining citation metrics and other statistical characteristics of research articles in the field. Researchers assert that bibliometric analysis is a legitimate approach for analyzing large scientific datasets. Advancements in a discipline influence academic domains. Bibliographic analysis has enabled researchers to assess published works, identify emerging research trends, and understand collaborative dynamics. Furthermore, the author tries to interrogate the database using suitable search terms. Table 1 illustrates the compilation of these articles using keyword research methodologies. Initially, keyword research was used to conduct extensive searches of Scopus's scientific article titles and terms from 2019 to 2025. These databases enhance the effectiveness of bibliographic analysis and literary study.

Table 1. Keyword search formula. Source: Own elaboration.

Step	Keyword Search
1	((“green finance” AND “sustainability”)) (Kashif et al., 2024)
2	((“green finance” OR “sustainable finance”) AND (“sustainability”)) (Hoang et al., 2024)
3	((“green finance” OR “sustainable finance”) AND (“sustainability”) AND (“ESG”)) (Tong et al., 2024; Xie, 2024)
4	((“green finance” OR “sustainable finance”) AND (“Fintech”) AND (“sustainability”) AND (“ESG”)) (Alsedrah, 2024; Wei et al., 2024; Y. Yang et al., 2021)
5	((“green finance” OR “sustainable finance”) AND (“Fintech”) AND (“sustainability” OR “sustainable development”) AND (“ESG”)) (Tang et al., 2024)
6	((“green finance” OR “sustainable finance”) AND (“Fintech”) AND (“sustainability” OR “sustainable development”) AND (“ESG”) AND (“green technology”)) (Susan & Pan, 2024)
7	((“green finance” OR “sustainable finance”) AND (“Fintech”) AND (“sustainability” OR “sustainable development”) AND (“ESG”) AND (“green technology” OR “sustainable technology”)) (Kiran et al., 2024; T. Li et al., 2024)
8	((“green finance” OR “sustainable finance”) AND (“Fintech”) AND (“sustainability” OR “sustainable development”) AND (“ESG”) AND (“green technology” OR “sustainable technology”) AND (“green innovation”)) (Obobisa & Ahakwa, 2024; Tong et al., 2024; Xing et al., 2024)
9	((“green finance” OR “sustainable finance”) AND (“Fintech”) AND (“sustainability” OR “sustainable development”) AND (“ESG” OR “corporate environmental responsibility”) AND (“green technology” OR “sustainable technology”) AND (“green innovation”)) (Wang et al., 2024; Xing et al., 2024)
10	((“green finance” OR “sustainable finance”) AND (“Fintech”) AND (“sustainability” OR “sustainable development”) AND (“ESG” OR “corporate environmental responsibility”) AND (“green technology” OR “sustainable technology”) AND (“green innovation”))AND (LIMIT-TO (PUBSTAGE, “final”) OR LIMIT-TO (PUBSTAGE, “aip”)) AND (LIMIT-TO (SRCTYPE, “j”))

Institutions, publications, and authors are employed to evaluate the efficacy of research. Utilizing performance data and VOSviewer can contribute to the visualization of the bibliographic connection. The next step was to provide data for analysis, with a particular emphasis on scientific cartography and performance assessment, which are two

critical bibliometric components. This study evaluates bibliometrics by employing all three methodologies. Biblioshiny's network analysis and performance evaluation metrics are employed to display thematic maps and academic research topics. Researchers can evaluate their research and improve visualization by employing scientific mapping, network analysis, and performance assessment instruments. To achieve that, the author of this research assessed the most prominent authors, institutions, and journals based on their h-index, total citations, and publishing metrics. The next step was to employ a clustering methodology to associate phrases with similar subjects (Koemtzopoulos et al., 2025b; Zournatzidou & Floros, 2023).

The R software (R 3.6.0+) offers sophisticated data analysis functionalities for this research. Bibliometrix is open-source software that analyzes scientific literature for the purpose of science mapping. This instrument facilitates researchers' quantitative bibliometric assessment. Bibliographic data from Scopus are accurately imported using R-based RStudio version 3.6.0 or above. Diverse scientific fields have meticulously examined the significance of R and its libraries. The official website allowed this study to conduct a bibliometric analysis using the Biblioshiny online tool, which is a component of the Bibliometrix program, owing to its intuitive interface. This research's software tools are accessible to everybody, particularly scholars.

Data

To conduct this investigation, data were obtained from the Scopus database for the years 2019–2025. To select the appropriate data, the PRISMA method (Figure 1) was implemented. Information was also collected to determine whether it was feasible to conduct bibliometric analyses and identify pertinent scientific articles. The sole focus of a series of papers that exclusively address this subject is the significance and trends of green finance in the transition of fintech to greentech. In preparation for this investigation, exhaustive filtering procedures were implemented. The document categories are restricted to research papers to conduct an additional evaluation of the research. Therefore, to ensure the unity and consistency of the articles under investigation, the author implements the above procedure.

Figure 1 presents the PRISMA flow diagram, which outlines the main approaches used for the systematic selection of publications in bibliometric research. The collection has a total of 945 sources, as determined by the search query. Consequently, the author restricted the quantity of articles, resulting in a total of 783, and performed a thorough assessment of 512 research papers, excluding those that were very vague or lacked a clear connection, since they were inappropriate for our present study. This inquiry examines the influence of green finance and sustainability on the transformation of fintech into greentech. Findings show that the names or keywords of the sources that were selected do not accurately represent the qualities and nuances of the subject area under investigation, despite a comprehensive study of all the articles. The search criteria were modified to focus on research pertinent to the present study and to exclude extraneous references. A total of 299 academic articles were found and included in the bibliometric study using this screening method.

In order to facilitate the selection of sources, the PRISMA methodology was used to determine the following inclusion and exclusion criteria: (i) the date of publication; (ii) the relationship between green finance, sustainability, and greentech; (iii) the language of the publication (only research studies written in English are included); and (iv) geographic considerations, which encompass specific regions, states, countries, or populations. This is the reason why each of these works was incorporated into the bibliometric analysis.

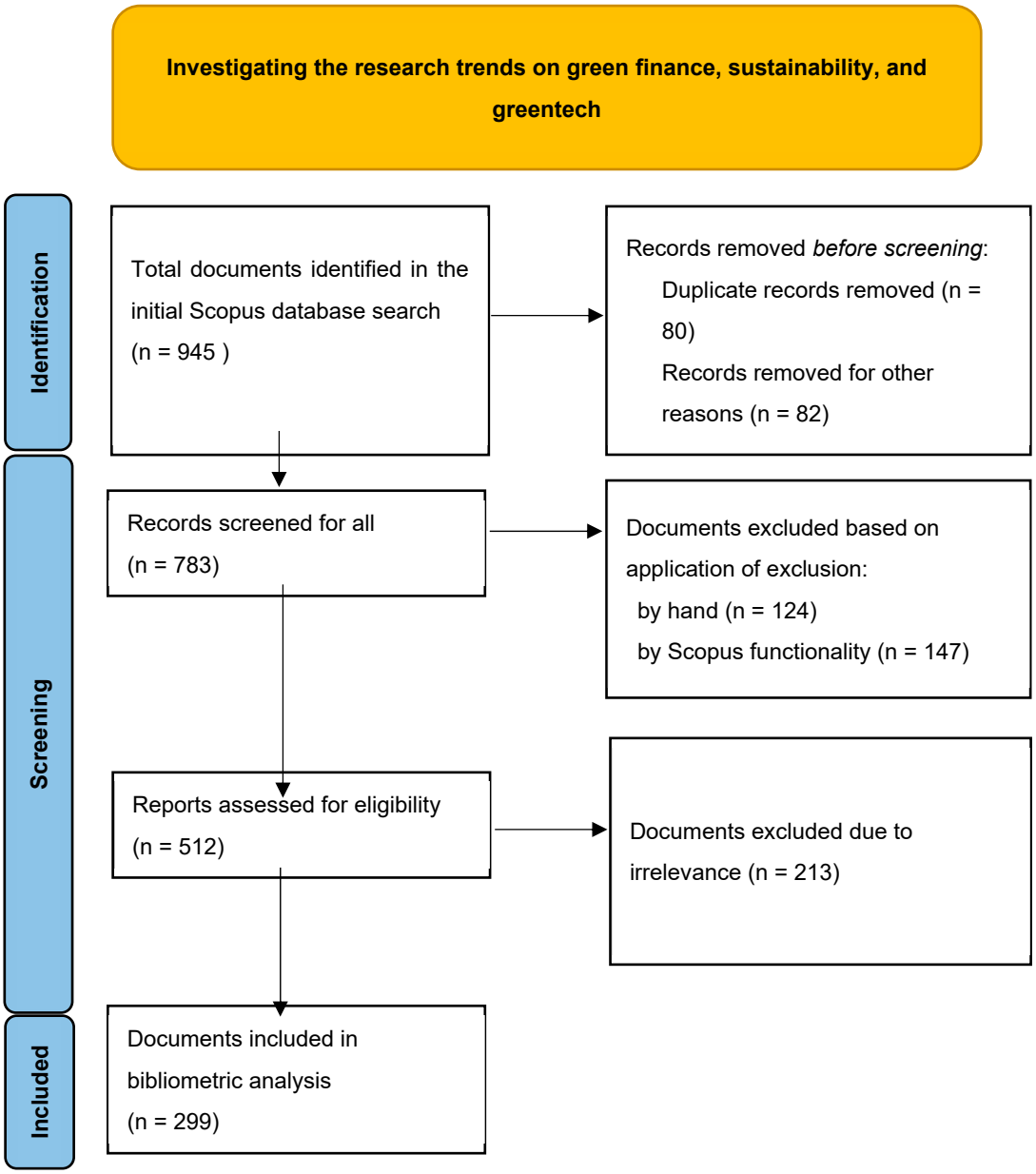


Figure 1. PRISMA flow diagram.

4. Results

4.1. Network Analysis

Figure 2 illustrates the annual production of research publications concerning the link between green finance, sustainability, and the move from fintech to greentech. It is essential to recognize that this subject is very recent in the literature, with the first papers dating to 2019. Publication growth remained moderate from 2019 to 2021. Nonetheless, there has been significant growth from 2022 to the present. This is since green fintech or greentech is an innovative intersection of digital technology, financial services, and climate change, capable of substantially expediting the shift towards a more sustainable economy. As mentioned previously, greentech may be defined as the use of digital technology to enhance adaptation and mitigation via financial services, therefore aiding people and enterprises in making environmentally beneficial financial choices. It has the capacity to improve the accessibility and efficiency of climate financing by using digital transformation and restructuring the financial sector. It is a solution to the need for funding the green transition and engaging investors and companies to meet climate targets. Technological

applications may catalyze enhancements in data and information flows, consequently augmenting the attractiveness of climate-related activities to investors. Examples include green digital banking and payments, sustainable investment and asset management, green crowdfunding and lending, and the supply of environmental and climatic data (Kiohos & Sariannidis, 2010; Zournatzidou et al., 2024).

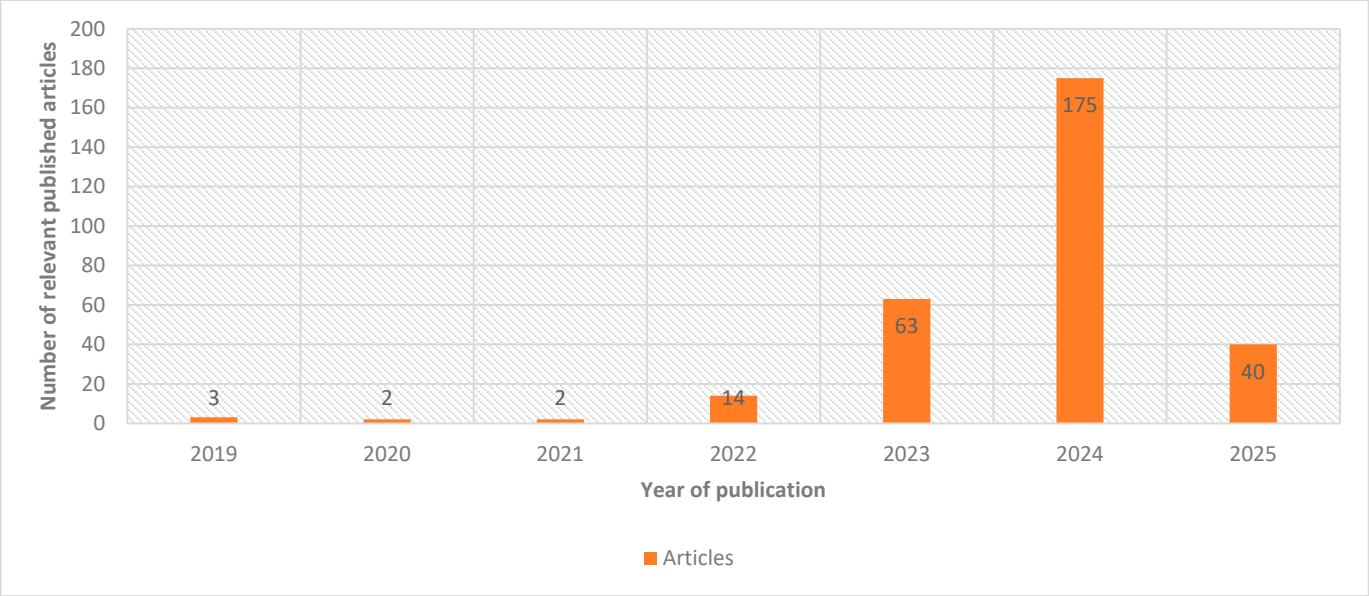


Figure 2. Annual scientific production in the field. Source: Scopus/Biblioshiny.

In addition, Figure 3 illustrates the significance of the transition from fintech to greentech and the most influential authors in the field of green finance. Green finance, renewable energy, and green technology are the primary areas of inquiry for Assistant Professor Liu X., who is one of the most influential writers in China. Guo W. and he have recently collaborated on a research project titled "Dynamic Impact of Green Finance on Renewable Energy Development: Based on Scale, Structure, and Efficiency Perspectives" (X. Liu & Guo, 2025). The dynamic evolution characteristics, type heterogeneity, and mechanisms by which green finance influences renewable energy development in China were investigated using a dynamic panel quantile regression model and a mediating test model. In addition, they evaluated the operational efficiency, structure, and scope of green finance. There were subsequent discoveries that resulted from the investigation. Development of renewable energy is facilitated by the scope, structure, and efficacy of green finance. The green financial framework's influence is, however, particularly noteworthy. With the advancement of renewable energy, the influence of green financial efficacy increases, while the influence of green financial scope and structure decreases. In comparison to hydroelectric and solar power, wind power is most significantly promoted by green finance. A U-shaped curve is used to describe the marginal effects of green financial scope and structure on wind power. The primary factor is the direct impact of green finance on the development of renewable energy, with indirect effects functioning as a complement. In channels that are associated with green qualities, the way green finance influences the development of renewable energy is relatively seamless. The results of this research suggest strategies to improve the development of renewable energy through green finance, with a particular focus on efficiency, structure, and scale.

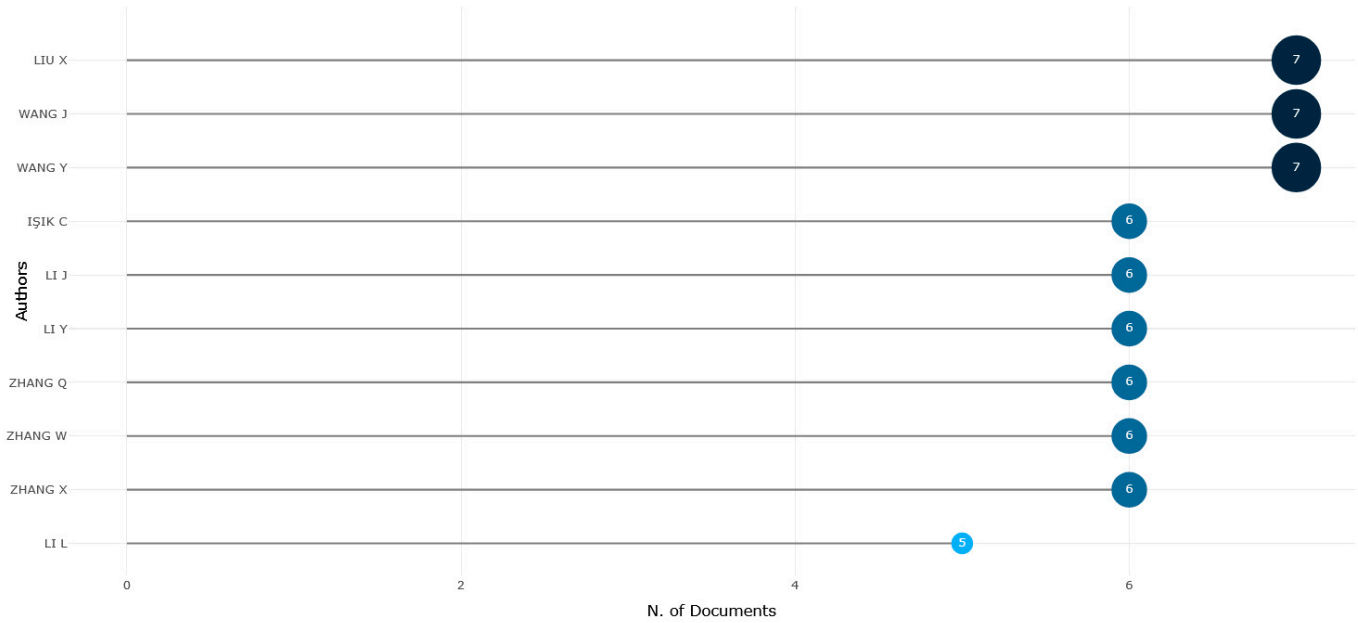


Figure 3. Most relevant authors in the field. Source: Scopus/Biblioshiny.

Furthermore, Wang J. is the second most influential and pertinent author in the field of green finance. Wang J. emphasizes the importance of financial institutions and fintech in promoting green innovation to facilitate the green transition in his scholarly works. The most recent research of the author, "Dual-threshold Effect of Resources and Governance on the Role of Regulations in Green Innovation: Novel Insights from a Four-Regime Panel Approach", examines the individual impacts of environmental laws, financial resources, and governance on green innovation (Tang et al., 2025). It utilizes a unique theoretical framework that is founded on institutional theory, a resource-based perspective, and an attention-based view to illustrate the interplay of these elements in the process of "going green". To demonstrate that environmental restrictions have a detrimental impact on green innovation until two critical values—financial resources and governmental emphasis on environmental issues—are simultaneously achieved, the study implements advanced threshold regression with two threshold variables. Furthermore, the pertinent threshold range encompasses less than 10% of the data. This implies that the significance of governance exceeds that of financial resources. These findings have significant ramifications for the implementation of environmental legislation and "green" finance strategies, particularly in China and other analogous emergent countries where governmental intervention remains indispensable for environmental governance.

Additionally, another author with high impact on the field under investigation is Zhang Q. Actually, one of his most impactful studies with the title "The construction of green finance and high-quality economic development under China's SDGs target" tries to examine the logical link between green financing and high-quality economic development, as well as the transmission mechanism behind this relationship. Using data from 30 Chinese regions from 2011 to 2021, his empirical study shows that green financing may improve high-quality economic development. Several robustness tests show that this association exists. Furthermore, our findings indicate that more robust government governance and market synergy may promote green finance for high-quality economic development. Green finance can enhance high-quality economic development by minimizing resource mismatch and encouraging green technology advancement. Simultaneously, green finance for high-quality economic development is significantly heterogeneous. Also, it is noteworthy that in this research some of the co-authors are researchers that are listed

in Figure 3, which indicates the connection among the authors in the field (Han et al., 2023; Khaskheli & Zhao, 2025).

The evaluation of the most relevant and important research publications occurs after assessing the most prominent authors in the subject (Table 2). The primary item is "The Wall Street Consensus", a research article authored by Professor Gabor D. The purpose is to establish relationships with global finance to reorganize development efforts (Gabor, 2021). Institutional investors and their asset managers in the Global North are being guided towards development asset classes via the UN's Billions to Trillions initiative, the World Bank's Maximizing Finance for Development framework, and the G20's Infrastructure as an Asset Class strategy (Jackson et al., 2023; Xiao et al., 2024). These projects reconfigure the Washington Consensus for the period of portfolio excess. A dual strategy is essential to make development investable: involving the government in mitigating risks linked to development assets and fostering the structural transformation of local financial institutions towards market-oriented financing that better serves portfolio investors. The "de-risking state" is constituted by ten specific policy directives. They act as a safeguard for investors in developmental assets, protecting their profits from demand risks linked to commodified infrastructure assets, political risks from progressive policies that may disrupt cash flows, such as nationalization and elevated minimum wages, and, crucially, climate regulation, in addition to liquidity and currency risks. The financial statement indicates that the state accepts these risks. The ability of a green developmental state to provide a fair transition to a low-carbon economy is constrained by the growing paradigm of "development as de-risking" (Halden & Cali, 2024; Jackson et al., 2023; Z. Liu & Li, 2024).

Table 2. Most impactful scientific documents in the field. Source: Scopus/Biblioshiny.

Paper	Total Citations	TC per Year	Normalized TC
The Wall Street Consensus (Gabor, 2021)	277	55.4	1.18
Investment in renewable energy and electricity output: Role of green finance, environmental tax, and geopolitical risk: Empirical evidence from China (Abbas et al., 2023)	200	66.67	7.74
Fintech and SMEs sustainable business models: Reflections and considerations for a circular economy (Pizzi et al., 2021)	194	38.8	0.82
Green bonds for sustainable development: Review of literature on development and impact of green bonds (Bhutta et al., 2022)	193	48.25	2.99
Asymmetric influence of digital finance, and renewable energy technology innovation on green growth in China (Razzaq et al., 2023)	165	55.00	6.39
How volatility in green financing, clean energy, and green economic practices derive sustainable performance through ESG indicators? A sectoral study of G7 countries (Q. Yang et al., 2022)	139	34.75	2.15
FinTech and Sustainable Development: Evidence from China Based on P2P Data (Deng et al., 2019)	139	19.86	2.16
Clustered institutional investors, shared ESG preferences and low-carbon innovation in family firm (B. Wu et al., 2023)	106	35.33	4.1
Transitioning green finance from theory to practice for renewable energy development (Sharma et al., 2022)	96	24.00	1.49
Green energy transition and sustainable development of energy firms: An assessment of renewable energy policy (D. Zhang & Kong, 2022)	96	24.00	1.49

Among the research publications highlighting the challenges of fintech, green finance, and the green transition is "Fintech and SMEs Sustainable Business Models: Reflections and Considerations for a Circular Economy" by Pizzi, Corbo, and Caputo. This article is founded on the operational paradigms of Industry 4.0, marked by the fast expansion of technology-driven enterprises that are progressively embracing sustainable business models in recent years (Pizzi et al., 2021). An increasing number of fintech companies are launching innovative services to overcome the organizational obstacles that hinder SMEs from voluntarily adopting sustainable business strategies. Research on the systematization of efforts and the identification of enabling variables for such a shift remains limited. This study analyzes and discusses case studies that link fintech applications to the circular economy (CE) across many sectors and situations, using a varied array of organizations. The findings of the qualitative research suggest that fintech, a sector emerging from Industry 4.0, has the capacity to significantly influence the transition of SMEs towards a more sustainable business model, hence promoting the adoption of circular economy practices. Also, authors of the above research subsequently provide a conceptual framework that employs the ReSOLVE model and has significant implications for both research and practice.

Additionally, it is essential to analyze the most impactful connections with the most significant study works on the topic. Table 3 delineates the links between research institutes and academic institutions. According to the data, China is the site of most of the connections. This concept is founded on the federal government's "30/60" decarbonization target, which seeks to achieve carbon neutrality by 2060 and a carbon peak prior to 2030. China has built a multi-tiered green finance market structure, with prominent green loans and bonds that rank among the top internationally, as the nation prioritizes the financial sector's contribution to a green and low-carbon transformation. China has achieved substantial progress in the green industry over the last decade due to advantageous government policies and local efforts, such as the carbon trading market and experimental zones for green finance (Sadiq et al., 2024; Tong et al., 2024; Xing et al., 2024).

Table 3. Most relevant affiliations. Source: Scopus/Biblioshiny.

Affiliation	Articles
University of International Business and Economics	15
China University of Geosciences	13
Sunway University	13
Zhejiang University of Technology	13
Sichuan University	12
Qingdao University	10
Southwestern University of Finance and Economics	10
Wuhan University	10
Hunan University	9
Guangzhou University	8

Lastly, the presentation of the most influential sources in the subject under investigation is another critical component of the network analysis. Table A1 (see Appendix A) provides a tally of articles divided into sources to identify the most pertinent journals and conferences in the analyzed domain knowledge. The examination of academic journals and conference articles can be beneficial for researchers and academicians in identifying the most active and current research groups, authors, and sources. The Biblioshiny online utility is employed to conduct an additional analysis of the source impact in accordance with Bradford's law. Bradford's law delineates the way information is dispersed within a field, as determined by the distribution of citations. Bradford's law is expressed as follows: "If the journals are arranged in descending order based on the number of articles they

contain on the subject, then successive zones of periodicals that contain the same number of articles on the subject form the simple geometric series 1: n1S: n2S: n3S". Bradford's law divides all citations of a subject into three zones on an equal basis. The first zone, referred to as the "core zone", contains the maximum number of citations with the fewest number of journals. To achieve the same number of citations, the second zone necessitates extra journals, while the third zone necessitates more journals than the second.

Bradford describes a "decrease in productivity" during the transition from central zone 1 to zone 3. The methodology of collection creation has been influenced by Bradford's law, which has facilitated the organization and management of academic documentation and bibliographic works. Bradford's law can be employed to identify the most highly cited journals for a field or subject, thereby assisting in the classification of primary journals in the field. The primary zone, zone 1, comprises 108 documents that have been collected from five sources. Zone 2, the intermediate zone, is composed of ninety-three articles that are collected in eighteen sources. Zone 3, the secondary zone, is composed of 98 articles that are gathered in eighty-six sources. To encourage the dissemination of Bradford's law's findings, a visualization of the findings was achieved through the development of Figure 4.

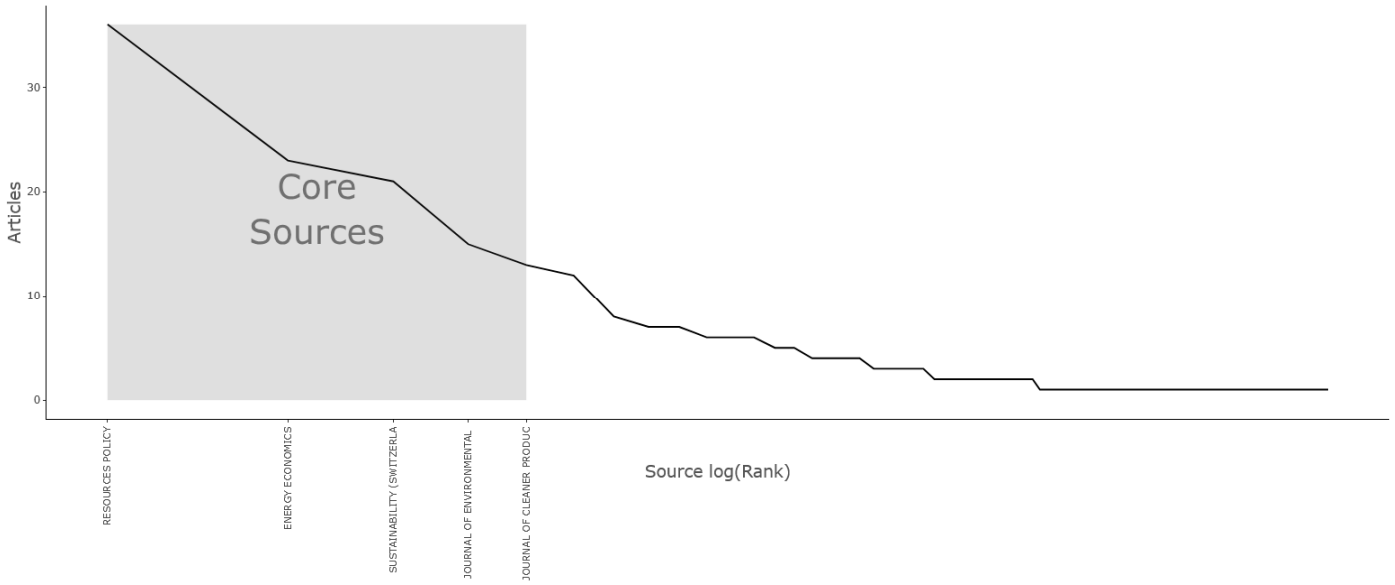


Figure 4. Bradford's law plot. Source: Scopus/Biblioshiny.

4.2. Bibliometric Analysis

Figure 5 illustrates the Sankey diagram (or three fields plot) of the field under examination. The Sankey diagram depicts the connections between authors and their corresponding countries, along with the vocabulary they mostly use. The height of the rectangle nodes is directly proportional to the frequency of recurrence of a certain author, country, or authors' keywords inside the collaboration network. The thickness of the lines connecting the nodes is directly proportionate to the quantity of connections. Thus, Figure 4 depicts a dynamic relationship between fintech and ESG performance. The ESG strategy has emerged as a crucial focus for enterprises across all industries, including the fintech industry (Feng & Yuan, 2024; Qian, 2024; Tong et al., 2024; H. Zhang & Wang, 2024). Numerous fintech businesses may intrinsically prioritize ESG as a basic business aim due to their business models that emphasize environmental and social growth. Despite the growing importance of ESG, less than 25% of firms formed an ESG council or working group by the end of 2021 to focus their strategic initiatives on ESG matters. Is it conceivable for fintech to improve its ESG performance? The influence of fintech on the ESG performance of firms has been insufficiently examined. A limited number of scholars have started studies on the ESG

market, ESG greenwashing, ESG performance, and related topics. Liu, Li, and Lu have shown that banking fintech may mitigate ESG greenwashing activities. The predominant body of existing research on impact channels focuses on financing limitations; however, a limited number of studies examine the relationships between environmental uncertainty and associated variables (J. Liu et al., 2025). Ding, Li, and Zhao found that fintech can improve business ESG performance by alleviating financial constraints (Ding et al., 2024).

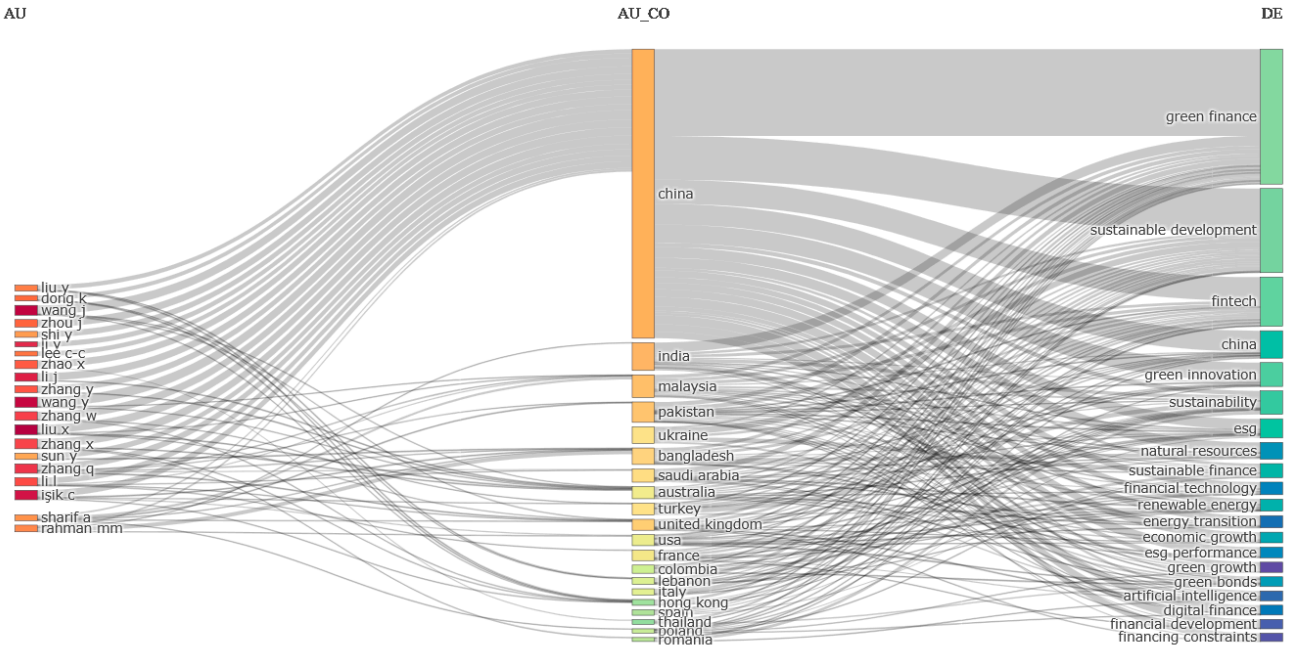


Figure 5. Sankey diagram. Source: Scopus/Biblioshiny.

Despite various research examining the usefulness of fintech and corporate ESG, the following issues need more examination. The measuring approaches for fintech indicators remain limited, since they mostly depend on a singular dimension to evaluate the growth rate of fintech. Consequently, it is prudent to expand the array of indicators to more thoroughly evaluate the progress of financial technology. Secondly, most current research emphasizes internal determinants affecting ESG performance from a business operations and management viewpoint, neglecting the substantial effect of fintech on corporate ESG outcomes. The predominant focus of contemporary research on impact routes is on financial limitations. The mechanisms via which fintech impacts corporate ESG concerning sustainable green innovation and environmental uncertainties need more examination. Furthermore, it is essential to perform further investigation into the possible avenues and implications of fintech for the ESG performance of organizations (Qian, 2024).

No study has investigated the impact of greentech on ESG performance. Greentech firms may enhance the social aspect of ESG by forming strong strategic partnerships to fulfill their sustainability goals via their philosophy and strategy. To improve sustainable quality, adhere to the principles of the circular economy, and guarantee transparency in supply chains, greentech might exert considerable effort. To foster and enhance innovative techniques and developments, greentech may partner with universities and colleges, offering them networks, resources, technical expertise, and substantial industry experience. Thus, greentech has the capacity to expedite the advancement of novel methodology, practical applications, and scientific progress, while also communicating the outcomes to our business consortium, partners, and the broader public.

Furthermore, we developed a conceptual map (Figure 6) that used two dimensions based on the authors' keywords. The primary element is density, which quantifies the

degree of theme development based on the underlying relationships among the keywords. The second metric is centrality, which measures the significance of the themes by analyzing the external relationships among the terms. The map illustrates four quadrants: (a) motor themes (characterized by high density and centrality), (b) basic themes (noted for low density and high centrality), (c) niche themes (identified by high density and low centrality), and (d) emerging/declining themes (marked by low density and centrality). The investigation demonstrated fintech's substantial role in combating energy poverty and climate danger. Green finance encounters a significant barrier in its endeavor to mitigate energy poverty because of climate risk. Climate risk refers to the uncertainty arising from severe weather occurrences, such as floods, droughts, tsunamis, and prolonged climatic alterations (Y. Liu, 2024; Mohammed et al., 2024). Research indicates that the effectiveness of green finance is significantly compromised by climate change and related severe weather phenomena. Moreover, climate risk may lead to heightened investment expenses and losses in green finance initiatives, including damage to renewable energy infrastructure such as solar panels and wind turbines, eventually resulting in investor losses. Extreme weather phenomena, such as droughts, floods, and hurricanes, may cause delays and cost overruns in renewable energy systems by disrupting their production and distribution stages. The integration of green finance and fintech concepts with green innovation and technology may advance greentech, addressing energy poverty and climate danger. Furthermore, greentech is intricately linked to corporate environmental accountability. Greentech must focus on its internal structures and procedures to expedite expansion. One of their main aims is to retain personnel for a prolonged duration, since they emphasize ideal job happiness. One of the future aims is to ensure and sustainably enhance social and environmental standards within the supply chains used by greentech (Alsedrah, 2024; Sadiq et al., 2024; Y. Yang et al., 2021).

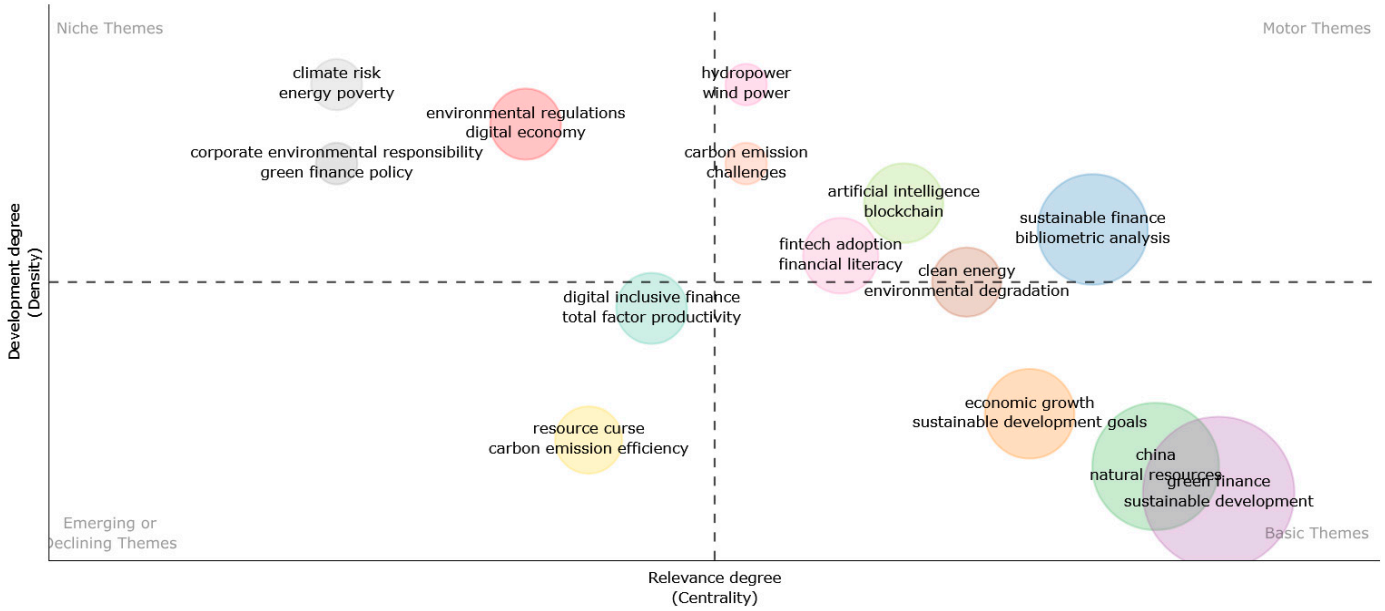


Figure 6. Conceptual thematic map. Source: Scopus/Biblioshiny.

The co-occurrence analysis of the writers' terms is illustrated in Figure 7. The analytical results demonstrate the substantial correlation between sustainability, green finance, and fintech. The objective of a sustainable financial system is to establish an economy that is environmentally conscious, sustainable, and inclusive through the creative valuation and transaction of financial assets. Fintech and financial institutions are transitioning to green financing to combat climate change and achieve net-zero objectives. This is achieved by em-

ploying a variety of sustainable and environmental finance strategies to decarbonize their daily operations. Financial institutions are collaborating with environmentally conscious consumers and companies to investigate sustainable products (Chueca Vergara et al., 2021; Dunbar et al., 2024; X. Li et al., 2024; D. Zhang et al., 2024). However, the realization of genuine green and sustainable finance is contingent upon the synergistic interplay of policy, regulation, market dynamics, and consumer demand. In the past few decades, financial institutions have implemented a diverse array of sophisticated technologies that have had a substantial impact on their operations and client services. Artificial intelligence (AI), machine learning (ML), big data analytics, the Internet of Things (IoT), and distributed ledgers (blockchain) have all played a significant role in the transformation of financial institutions' strategies thanks to cutting-edge technologies, which are collectively known as fintech (Deng et al., 2019; Dong & Huang, 2024; Zhou & Sun, 2024).

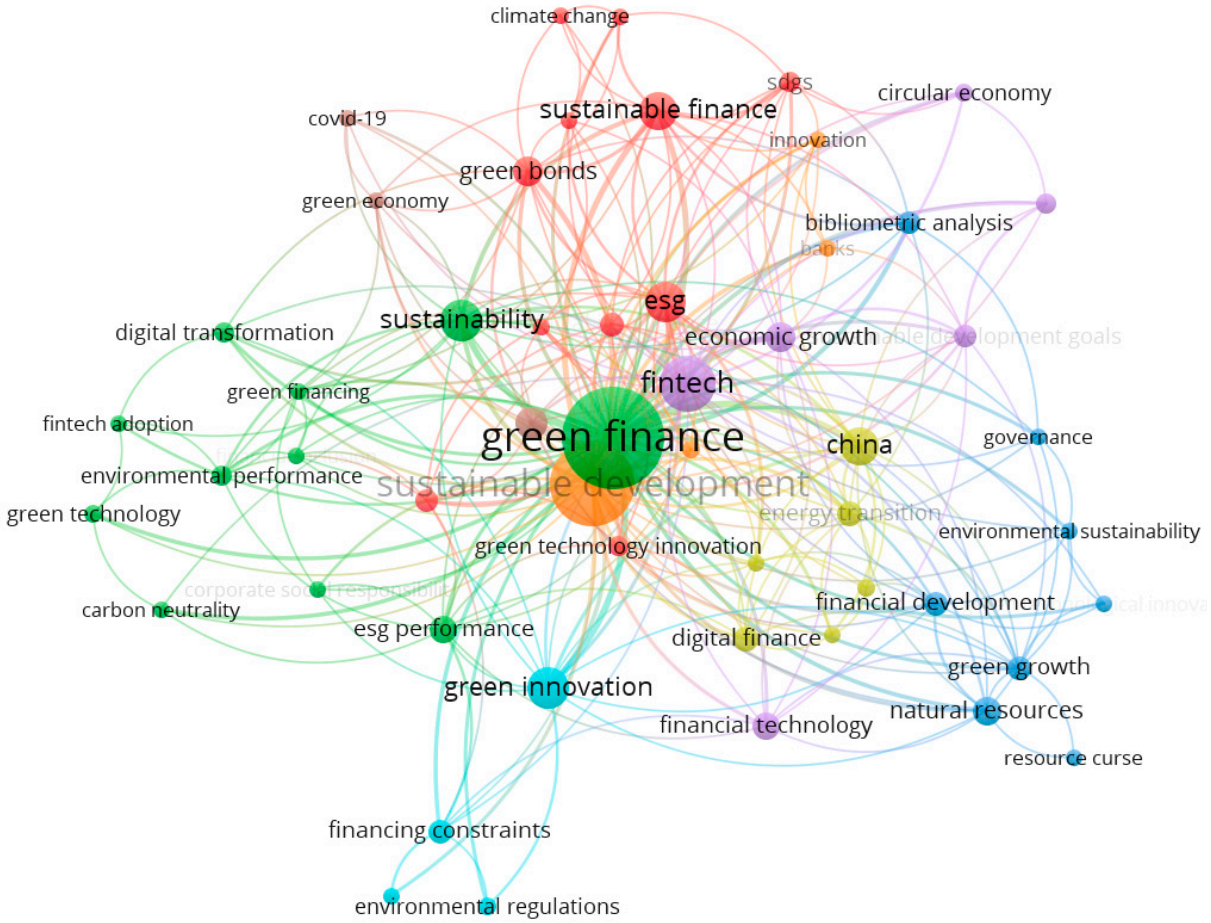


Figure 7. Co-occurrence analysis. Source: Scopus/VOSviewer.

The research demonstrates the correlation between green fintech and its influence on ESG performance. The emergence of greentech has had a significant impact on the current financial landscape. Fintech has transformed conventional financial practices by providing innovative and efficient solutions, which have been facilitated by technological advancements and globalization. Blockchain technology, artificial intelligence, and mobile payments are transforming the financial services industry by expanding the landscape and introducing innovative business opportunities. At the same time, the global community is confronted with an expanding variety of environmental concerns. A change in economic paradigms is required as a result of the depletion of resources, climate change, and the loss of biodiversity. Green finance has emerged as a solution, facilitating environmentally responsible economic development and aligning financial operations with ecological

sustainability. According to recent data, green finance has a beneficial effect on both developed and developing economies by directing capital toward sustainable endeavors and promoting environmental initiatives. The growing emphasis on corporate environmental responsibility and the examination of environmental, social, and governance (ESG) concerns by investors have established ESG as a critical paradigm for evaluating company performance (Dicuonzo et al., 2024; Galeone et al., 2024; Giakoumelou et al., 2024). This modification is indicative of the increasing demand for sustainable products and services and the increasing awareness of customers. Research suggests that green financing may be a substantial asset in the pursuit of companies' corporate social responsibility objectives. The post-pandemic period has underscored the importance of sustainable business practices and environmentally conscious purchasing behavior, resulting in heightened awareness of green marketing strategies and carbon emission reduction initiatives.

Subsequent to the bibliometric analysis, a factorial analysis, grounded on correspondence analysis, is conducted. The factorial analysis approach specifically calculates the similarity index and enables the user to normalize bibliographic coupling, co-occurrence, and co-citation as measures of similarity. Factorial analysis may be used to delineate the conceptual structure of a certain subject by examining the frequency of words within a particular bibliographic category. Consequently, Figure 8 presents the outcomes of the factorial analysis performed in this research. A significant conclusion from the factorial study is the correlation between financial constraints and fintech, along with the shift to greentech that organizations also perform. The potential advantages of fintech are dependent on the presence of a suitable regulatory framework. Fintech and greentech both possess the capacity to pose substantial systemic hazards to the integrity and stability of the financial system. This arises from the heightened technological complexity and susceptibility to cybersecurity vulnerabilities inherent in both technologies. A factorial analysis indicates that both green technology and financial technology may significantly contribute to the shift to renewable energy.

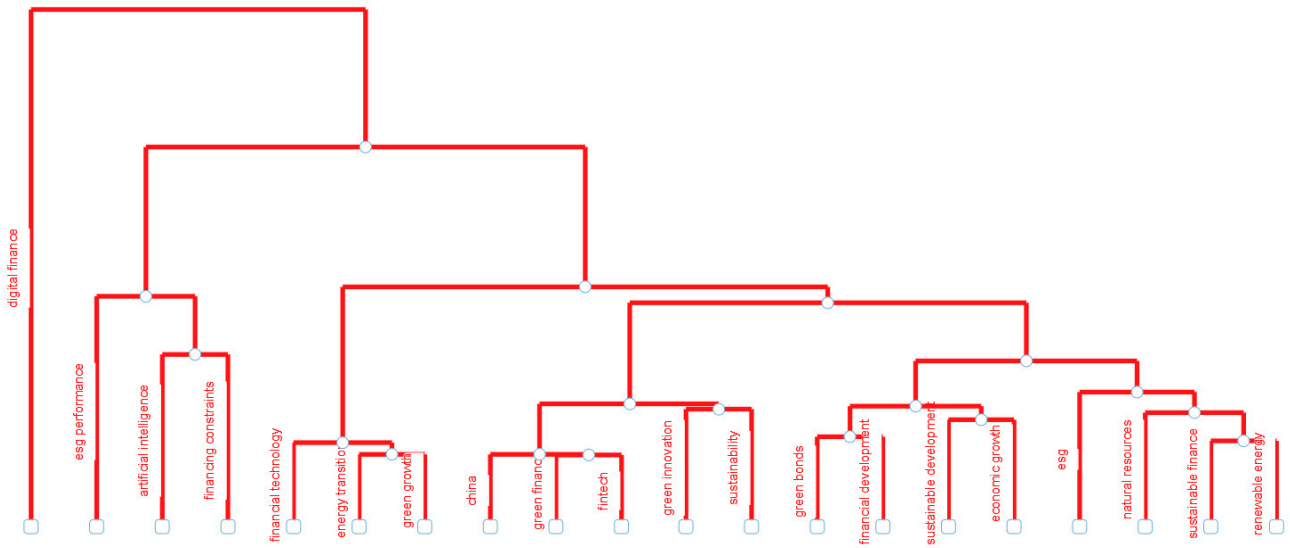


Figure 8. Factorial analysis. Source: Scopus. Biblioshiny.

Figure 9 presents an alternate approach to n-gram analysis, focusing on the examination of trending themes derived from the most frequently used keywords by writers in the domain. The research reiterates the significance of developing a new paradigm in fintech, namely greentech, as emphasized by the concept of green digital finance. The amalgamation of digital finance with greentech within banking presents several prospects for innovation, consumer involvement, and sustainability. By adopting frameworks such

as people, process, and technology, banks may evaluate their maturity in implementing digital and greentech initiatives, therefore finding deficiencies and opportunities for improvement. Through sustained investment in digital transformation and sustainability, the banking industry can realize substantial value, advance environmental objectives, and provide clients with more accessible, efficient, and eco-friendly financial services. The future of banking is digital and environmentally sustainable. Ethiopian banks provide a unique opportunity to spearhead this transition by using technology to enhance service accessibility and embracing sustainable practices to save the environment. By adhering to global best practices and tailoring them to local requirements, banks can enhance financial inclusion, stimulate economic development, and promote a sustainable future.

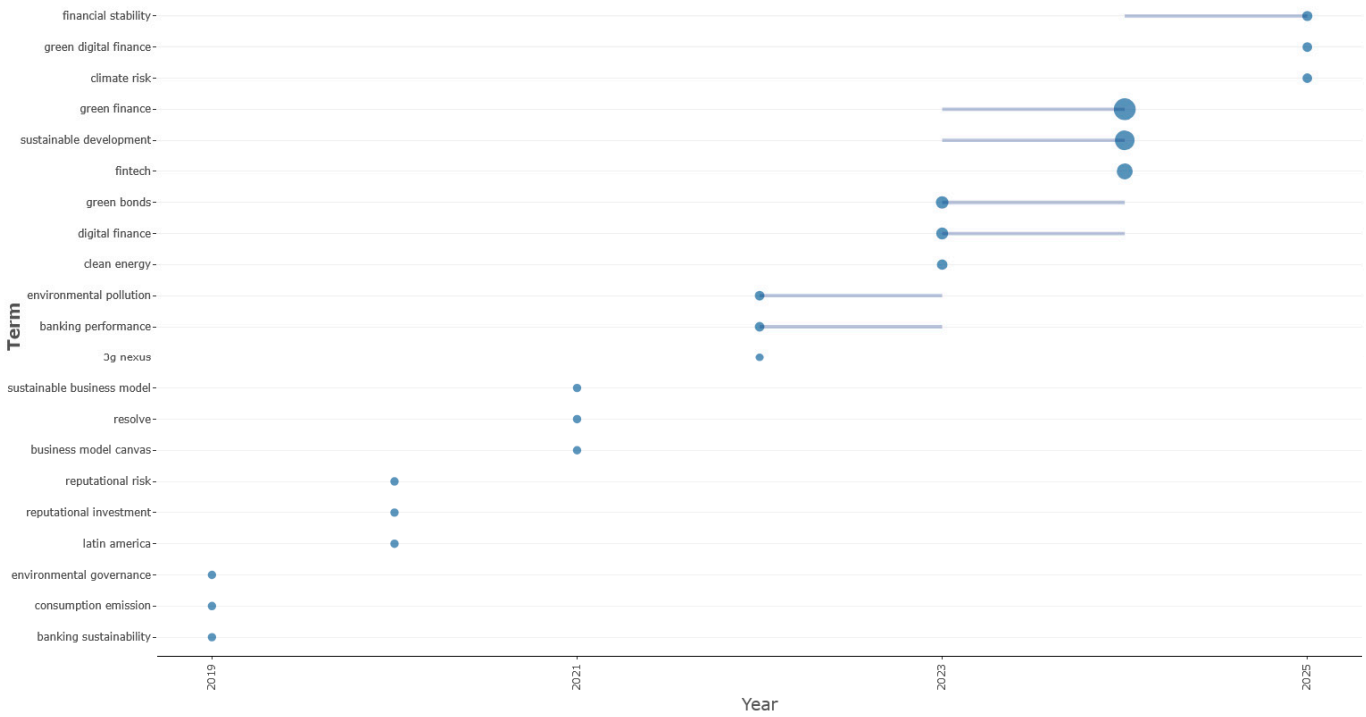


Figure 9. Trend topics. Source: Scopus/Biblioshiny.

5. Discussion

Green and sustainable finance is transitioning to mainstream industry. The financial sector's position in any economy allows it to lead the transition to a low-carbon and more sustainable future. In addition, following the publication of the most recent report by the Intergovernmental Panel on Climate Change (IPCC), which was appropriately referred to as "a code red for humanity", it has become increasingly important to ensure that the optimal amount of capital is allocated for this transition time. Throughout the decades, the financial industry has emerged as a main adopter of sophisticated technology, seeing the advance of fintech. The utilization of smartphones, artificial intelligence (AI), machine learning (ML), data analytics, the Internet of Things (IoT), and distributed ledgers (blockchain) has fundamentally transformed the operations and customer service of financial institutions (Tang et al., 2024; Yadav et al., 2024).

Sustainable financing is essential, and it provides businesses with a variety of options for developing in a manner that is environmentally responsible. There are sufficient opportunities to contribute to the preservation of the environment while simultaneously producing sustainable revenue, regardless of whether a company has been in existence for a short period of time or has been contemplating doing so for a considerable amount of time. Because people want to be a part of something that is more comprehensive and helpful

to the environment, businesses that advocate for sustainability are more likely to attract customers. This article focuses mostly on analyzing the success story of the green fintech paradigm, which is often referred to as greentech. The objective of this research study is to shed light on the connection that exists between green finance and financial technology (fintech), as well as to highlight the importance of fintech progressively transitioning into a new paradigm, which may be referred to as green fintech, greentech, or climate fintech. In order to accomplish the goal of the research, a PRISMA-driven bibliometric analysis was carried out. This analysis included the extraction of bibliometric data from the Scopus database for the years 2019–2025. Additionally, the bibliometric tools Biblioshiny and VOSviewer were used in conjunction with the statistical programming language R in order to perform the analysis of the bibliometric data that were provided. In addition, the selection of the samples was carried out using a mix of inclusion and exclusion criteria in line with the PRISMA approach.

This bibliometric study highlights a fresh component of green finance and creating green technology, which is climate fintech or greentech. The findings of this research highlight the importance of this aspect. One definition of green technology is the development of financial technology. The use of financial technology to solve challenges related to climate change is a relatively new component of the larger fintech industry more generally. This sector comprises many businesses that make use of digital technology in the financial sector to enhance environmental sustainability, decrease emissions of greenhouse gases, increase climate resilience, and accelerate recent adjustments. In 2023, climate fintech businesses were able to obtain USD 2.3 billion, which is about 19 percent less than the record amount that was secured in 2022. Most of the funding was directed towards carbon markets and energy management. It is anticipated that the sector will expand in 2024, attracting a wide variety of investors, the majority of which are venture capitalists, followed by incubators, and it is starting to garner attention from other parties. The financial technology sector in countries with better digital infrastructure and a more sophisticated environment receives more funding than the businesses in countries with less developed infrastructure (Deng et al., 2019; P. Li et al., 2024; J. Liu et al., 2025).

Furthermore, climate fintech is not capable of addressing the challenges that are associated with climate funding on its own by virtue of its constraints. Significant barriers to global climate funding include restricted access to capital for low-income countries (LICs) and undeveloped emerging markets (EMs). In these countries, investment is sometimes hampered by heightened perceived risks and poor financial infrastructure. Another significant barrier is the lack of global climate financing. Furthermore, there is a gap between the magnitude of essential expenditures and the accessibility of resources. This imbalance is made worse by the complexity of legal frameworks and the limited capacities for the formulation and implementation of projects. The implementation of technology is limited by a number of factors, one of which is the degree to which countries have developed their economies and their digital infrastructure. As a result, climate fintech has the potential to become an essential component in the fight against climate change; nevertheless, it cannot serve as the whole answer to the problem. It is possible that the use of fintech technology to alleviate financial hurdles would result in an increase in investment from both business and government organizations. Furthermore, the use of fintech to alleviate financial barriers may result in an increase in investment from a variety of sources, keeping in mind that these impediments are present in all types of financing (Ahmad et al., 2024; Z. Liu & Li, 2024; Sanga & Aziakpono, 2023).

Historically, the financial sector has been seen as a leader in the environmental, social, and governance (ESG) movement. This is since several banks and financial institutions have made commitments to implement ESG-oriented policies and procedures. The financial

industry, which includes the fintech industry, is in an excellent position to exert influence and construct a future that is conducive to sustainability. Banks may choose to invest their financial resources in environmentally responsible initiatives and businesses that are working toward achieving environmental, social, and governance (ESG) objectives and reducing their carbon footprint. It is possible for the financial services sector to make use of its position to advocate for responsible business policies, such as diversity and inclusion initiatives, as well as ethical banking practices. Therefore, it is vital for financial institutions to include environmental, social, and governance (ESG) considerations in their strategies in order to preserve their competitiveness in the market and ensure their long-term success with the growing number of clients who are environmentally sensitive. The introduction of fintech has brought about a substantial change in the general environment of the financial industry. The provision of consumers and investors with access to cutting-edge technology and services has resulted in the creation of a number of options for sustainable financing. Investors now have access to a variety of investment options that are focused on environmental, social, and governance (ESG) factors, such as green bonds, sustainable exchange-traded funds (ETFs), and impact investments. Consequently, this has made it possible for investors to invest in companies and projects that are making progress toward a more sustainable future in a way that is both simple and convenient. Fintech companies are making strides in incorporating environmental, social, and governance (ESG) themes into their business frameworks in order to fulfill the needs of stakeholders and promote sustainable finance (Dicuonzo et al., 2024; Galeone et al., 2024).

Meanwhile, fintech has enabled financial institutions to provide more efficient and sustainable banking services. Fintech has enabled banks to establish digital banking systems that are safer and more efficient than traditional banking, facilitating accelerated and secure transactions. The rise of fintech has thus led to the emergence of several ESG-focused trends. Robo-advisors increasingly use artificial intelligence (AI) to analyze data and provide customers with sustainable investment advice. Additionally, blockchain technology enhances the transparency and security of financial services, while cryptocurrencies provide faster and more efficient transactions. The concept of using technology to advance sustainable finance is proliferating, with several fintech firms focusing on ESG-oriented products and services. This benefits investors by enhancing their capacity to invest in sustainable companies and projects effortlessly.

The present research emphasized the essential relationship between green finance and fintech, highlighting the need for fintech to adopt an alternate paradigm termed green fintech. The inquiry results revealed that green fintech is experiencing a transformative revolution due to the incorporation of sustainability into its fundamental processes. The financial services sector's response to environmental challenges is being revolutionized by the new field known as green fintech or greentech. Green fintech is a supplier of financial services and products that use advanced technologies, including blockchain, artificial intelligence, and big data, to stimulate investments in environmentally beneficial projects, decrease carbon emissions, and foster environmental sustainability. Blockchain facilitates the establishment of decentralized platforms for environmentally sustainable investments, artificial intelligence enhances energy efficiency and uncovers sustainable investment prospects, while big data offer an extensive insight into corporate sustainability performance. The transition from conventional finance to green fintech is not a fad but a crucial advancement in addressing global environmental challenges. Fintech firms foster a more sustainable and ecologically beneficial financial future by persistently innovating and incorporating sustainability into their operations. The sector's capacity to provide substantial economic and environmental advantages is underscored by the burgeoning green fintech industry, which has positioned itself as an essential element of the contemporary

financial scene. The eco-efficiency of greentech will ultimately be assessed in a forthcoming proposal, based on the outcomes of the present research. The research question will be examined in the next study using the TOPSIS and entropy weight methods.

6. Conclusions

This study indicates that fintech businesses should implement a green technology business model, possibly marking a new paradigm in green finance. This alteration will promote a carbon-neutral environment for financial institutions and assist fintech companies in minimizing their ecological impact.

Currently, two primary innovations are revolutionizing the financial industry. On one side, technology-driven financial innovation (fintech) has profoundly influenced the financial industry via the development of innovative business models, products, and services. Conversely, promoting the green transition necessitates that policymakers identify optimal methods for integrating environmental considerations into financial planning. To date, the EU has addressed these two areas independently. Two distinct frameworks advocate for and govern the digitalization and sustainability of the financial industry. There is an increasing interest in examining the relationship and potential linkages between digital and sustainable finance.

Fintech activities, such as digital banking, robo-advisory services, and crowdfunding, are facilitated by several technologies, notably artificial intelligence (AI), machine learning (ML), and distributed ledger technology (DLT). We classify these operations as green fintech when they deliberately advance the Sustainable Development Goals and tackle sustainability challenges. The significance of fintech companies is heightened in crucial initiatives to combat climate change. Policymakers should cultivate a favorable climate for green technology while considering the associated risks and constraints. An integrated approach combining digital and sustainable principles may advantage important stakeholders inside the organization, including regulators and supervisors. We must emphasize data integrity, customer protection, and efficient infrastructure. Moreover, advancing financial inclusion and literacy is crucial for enabling people to make educated and sustainable financial choices.

Funding: This work has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No. 101178789 (EVOSST). Funded by the European Union.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Dataset available on request from the author.

Acknowledgments: This work has received funding from the European Union's Horizon Europe Research and Innovation Programme under grant agreement No. 101178789 (EVOSST). Funded by the European Union. Views and opinions expressed are, however, those of the author only and do not necessarily reflect those of the European Union. Neither the European Union nor the granting authority can be held responsible for them.

Conflicts of Interest: The author declares no conflicts of interest.

Appendix A

Table A1. Most impactful sources in the field. Source: Scopus/Biblioshiny.

SO	Rank	Freq	cumFreq	Zone
RESOURCES POLICY	1	36	36	Zone 1
ENERGY ECONOMICS	2	23	59	Zone 1
SUSTAINABILITY (SWITZERLAND)	3	21	80	Zone 1
JOURNAL OF ENVIRONMENTAL MANAGEMENT	4	15	95	Zone 1
JOURNAL OF CLEANER PRODUCTION	5	13	108	Zone 1
TECHNOLOGICAL FORECASTING AND SOCIAL CHANGE	6	12	120	Zone 2
ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH	7	8	128	Zone 2
ENVIRONMENT, DEVELOPMENT AND SUSTAINABILITY	8	7	135	Zone 2
FRONTIERS IN ENVIRONMENTAL SCIENCE	9	7	142	Zone 2
RENEWABLE ENERGY	10	6	148	Zone 2
RESEARCH IN INTERNATIONAL BUSINESS AND FINANCE	11	6	154	Zone 2
SUSTAINABLE DEVELOPMENT	12	6	160	Zone 2
FINANCE RESEARCH LETTERS	13	5	165	Zone 2
PLOS ONE	14	5	170	Zone 2
DISCOVER SUSTAINABILITY	15	4	174	Zone 2
HELIYON	16	4	178	Zone 2
INTERNATIONAL REVIEW OF FINANCIAL ANALYSIS	17	4	182	Zone 2
SUSTAINABILITY (SWITZERLAND)	18	4	186	Zone 2
BUSINESS STRATEGY AND DEVELOPMENT	19	3	189	Zone 2
ENERGIES	20	3	192	Zone 2
ENERGY STRATEGY REVIEWS	21	3	195	Zone 2
INTERNATIONAL REVIEW OF ECONOMICS AND FINANCE	22	3	198	Zone 2
NATURAL RESOURCES FORUM	23	3	201	Zone 2
BUSINESS STRATEGY AND THE ENVIRONMENT	24	2	203	Zone 3
COGENT ECONOMICS AND FINANCE	25	2	205	Zone 3
CORPORATE SOCIAL RESPONSIBILITY AND ENVIRONMENTAL MANAGEMENT	26	2	207	Zone 3
ENVIRONMENTAL IMPACT ASSESSMENT REVIEW	27	2	209	Zone 3
ENVIRONMENTAL RESEARCH COMMUNICATIONS	28	2	211	Zone 3
GEOSCIENCE FRONTIERS	29	2	213	Zone 3
IEEE TRANSACTIONS ON ENGINEERING MANAGEMENT	30	2	215	Zone 3
INTERNATIONAL JOURNAL OF ENERGY ECONOMICS AND POLICY	31	2	217	Zone 3
INTERNATIONAL JOURNAL OF FINANCE AND ECONOMICS	32	2	219	Zone 3
INTERNATIONAL JOURNAL OF SUSTAINABLE DEVELOPMENT AND PLANNING	33	2	221	Zone 3
KYBERNETES	34	2	223	Zone 3
SUSTAINABLE CITIES AND SOCIETY	35	2	225	Zone 3
ACTUALIDAD JURIDICA IBEROAMERICANA	36	1	226	Zone 3
AMFITEATRU ECONOMIC	37	1	227	Zone 3
ANNALS OF OPERATIONS RESEARCH	38	1	228	Zone 3
APPLIED ENERGY	39	1	229	Zone 3
APPLIED SOFT COMPUTING	40	1	230	Zone 3
ARTIFICIAL INTELLIGENCE REVIEW	41	1	231	Zone 3
ASIA-PACIFIC JOURNAL OF ACCOUNTING AND ECONOMICS	42	1	232	Zone 3
ASIA-PACIFIC JOURNAL OF BUSINESS ADMINISTRATION	43	1	233	Zone 3
ASIA PACIFIC MANAGEMENT REVIEW	44	1	234	Zone 3
ASIAN DEVELOPMENT POLICY REVIEW	45	1	235	Zone 3
BANKING AND FINANCE REVIEW	46	1	236	Zone 3
CHINA FINANCE REVIEW INTERNATIONAL	47	1	237	Zone 3
CHINA JOURNAL OF ACCOUNTING RESEARCH	48	1	238	Zone 3
COGENT BUSINESS AND MANAGEMENT	49	1	239	Zone 3
COMPETITION AND CHANGE	50	1	240	Zone 3

Table A1. *Cont.*

SO	Rank	Freq	cumFreq	Zone
CUADERNOS DE ECONOMIA	51	1	241	Zone 3
DEVELOPMENT AND CHANGE	52	1	242	Zone 3
ECONOMIC ANALYSIS AND POLICY	53	1	243	Zone 3
ECONOMIC CHANGE AND RESTRUCTURING	54	1	244	Zone 3
ECONOMIC RESEARCH-EKONOMSKA ISTRAZIVANJA	55	1	245	Zone 3
ECONOMICS AND ENVIRONMENT	56	1	246	Zone 3
ECONOMICS AND SOCIOLOGY	57	1	247	Zone 3
EDELWEISS APPLIED SCIENCE AND TECHNOLOGY	58	1	248	Zone 3
EMERGING MARKETS FINANCE AND TRADE	59	1	249	Zone 3
ENERGIES	60	1	250	Zone 3
ENERGY	61	1	251	Zone 3
ENERGY AND ENVIRONMENT	62	1	252	Zone 3
ENERGY REPORTS	63	1	253	Zone 3
ENVIRONMENTAL TECHNOLOGY AND INNOVATION	64	1	254	Zone 3
ETNOGRAFIA E RICERCA QUALITATIVA	65	1	255	Zone 3
EUROPEAN BUSINESS ORGANIZATION LAW REVIEW	66	1	256	Zone 3
FINANCIAL AND CREDIT ACTIVITY: PROBLEMS OF THEORY AND PRACTICE	67	1	257	Zone 3
FRONTIERS IN ECOLOGY AND EVOLUTION	68	1	258	Zone 3
FRONTIERS IN ENERGY RESEARCH	69	1	259	Zone 3
FRONTIERS IN PUBLIC HEALTH	70	1	260	Zone 3
GLOBAL BUSINESS REVIEW	71	1	261	Zone 3
GLOBAL NEST JOURNAL	72	1	262	Zone 3
GONDWANA RESEARCH	73	1	263	Zone 3
HUMANITIES AND SOCIAL SCIENCES LETTERS	74	1	264	Zone 3
INFORMATION (SWITZERLAND)	75	1	265	Zone 3
INTERNATIONAL JOURNAL OF ECONOMICS AND FINANCE STUDIES	76	1	266	Zone 3
INTERNATIONAL JOURNAL OF EMERGING MARKETS	77	1	267	Zone 3
INTERNATIONAL JOURNAL OF ENVIRONMENTAL RESEARCH AND PUBLIC HEALTH	78	1	268	Zone 3
INTERNATIONAL JOURNAL OF INNOVATION SCIENCE	79	1	269	Zone 3
INTERNATIONAL JOURNAL OF KNOWLEDGE MANAGEMENT	80	1	270	Zone 3
INTERNATIONAL JOURNAL OF LOGISTICS RESEARCH AND APPLICATIONS	81	1	271	Zone 3
INTERNATIONAL JOURNAL OF LOW-CARBON TECHNOLOGIES	82	1	272	Zone 3
INTERNATIONAL JOURNAL OF NEUTROSOPHIC SCIENCE	83	1	273	Zone 3
INTERNATIONAL JOURNAL OF OCCUPATIONAL SAFETY AND ERGONOMICS	84	1	274	Zone 3
JOURNAL OF FINANCIAL REGULATION AND COMPLIANCE	85	1	275	Zone 3
JOURNAL OF INFRASTRUCTURE, POLICY AND DEVELOPMENT	86	1	276	Zone 3
JOURNAL OF QUALITY	87	1	277	Zone 3
JOURNAL OF RISK AND FINANCIAL MANAGEMENT	88	1	278	Zone 3
JOURNAL OF THE KNOWLEDGE ECONOMY	89	1	279	Zone 3
LAND	90	1	280	Zone 3
MANAGEMENT OF ENVIRONMENTAL QUALITY	91	1	281	Zone 3
NORTH AMERICAN JOURNAL OF ECONOMICS AND FINANCE	92	1	282	Zone 3
OIDA INTERNATIONAL JOURNAL OF SUSTAINABLE DEVELOPMENT	93	1	283	Zone 3
QUALITATIVE RESEARCH IN FINANCIAL MARKETS	94	1	284	Zone 3
RAIRO—OPERATIONS RESEARCH	95	1	285	Zone 3
RENEWABLE ENERGY AND POWER QUALITY JOURNAL	96	1	286	Zone 3

Table A1. *Cont.*

SO	Rank	Freq	cumFreq	Zone
REVIEW OF INTERNATIONAL BUSINESS AND STRATEGY	97	1	287	Zone 3
REVISTA VENEZOLANA DE GERENCIA	98	1	288	Zone 3
SCIENTIFIC PAPERS OF THE UNIVERSITY OF PARDUBICE, SERIES D: FACULTY OF ECONOMICS AND ADMINISTRATION	99	1	289	Zone 3
SCIENTIFIC REPORTS	100	1	290	Zone 3
SINGAPORE ECONOMIC REVIEW	101	1	291	Zone 3
STRATEGIC CHANGE	102	1	292	Zone 3
STRUCTURAL CHANGE AND ECONOMIC DYNAMICS	103	1	293	Zone 3
SUSTAINABLE FUTURES	104	1	294	Zone 3
SYSTEMS	105	1	295	Zone 3
TECHNOLOGY IN SOCIETY	106	1	296	Zone 3
TELECOMMUNICATIONS POLICY	107	1	297	Zone 3
TQM JOURNAL	108	1	298	Zone 3
UTILITIES POLICY	109	1	299	Zone 3

References

Abbas, J., Wang, L., Ben Belgacem, S., Pawar, P. S., Najam, H., & Abbas, J. (2023). Investment in renewable energy and electricity output: Role of green finance, environmental tax, and geopolitical risk: Empirical evidence from China. *Energy*, *269*, 126683. [CrossRef]

Ahmad, M., Pata, U. K., Ahmed, Z., & Zhao, R. (2024). Fintech, natural resources management, green energy transition, and ecological footprint: Empirical insights from EU countries. *Resources Policy*, *92*, 104972. [CrossRef]

Alsedrah, I. T. (2024). Fintech and green finance revolutionizing carbon emission reduction through green energy projects in mineral-rich countries. *Resources Policy*, *94*, 105064. [CrossRef]

Bhutta, U. S., Tariq, A., Farrukh, M., Raza, A., & Iqbal, M. K. (2022). Green bonds for sustainable development: Review of literature on development and impact of green bonds. *Technological Forecasting and Social Change*, *175*, 121378. [CrossRef]

Chueca Vergara, C., Ferruz Agudo, L., Rambaud, C., López Pascual, J., & Morley, B. (2021). Fintech and sustainability: Do they affect each other? *Sustainability*, *13*(13), 7012. [CrossRef]

Dar, B. I., Badwan, N., & Kumar, J. (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*, 1175–1195. [CrossRef]

Deng, X., Huang, Z., & Cheng, X. (2019). FinTech and sustainable development: Evidence from China based on P2P data. *Sustainability*, *11*(22), 6434. [CrossRef]

Dhayal, K. S., Giri, A. K., Esposito, L., & Agrawal, S. (2023). Mapping the significance of green venture capital for sustainable development: A systematic review and future research agenda. *Journal of Cleaner Production*, *396*, 136489. [CrossRef]

Dicuonzo, G., Palmaccio, M., & Shini, M. (2024). ESG, governance variables and Fintech: An empirical analysis. *Research in International Business and Finance*, *69*, 102205. [CrossRef]

Ding, J., Li, L., & Zhao, J. (2024). How does fintech prompt corporations toward ESG sustainable development? Evidence from China. *Energy Economics*, *131*, 107387. [CrossRef]

Dong, X., & Huang, L. (2024). Exploring ripple effect of oil price, fintech, and financial stress on clean energy stocks: A global perspective. *Resources Policy*, *89*, 104582. [CrossRef]

Dunbar, K., Sarkis, J., & Treku, D. N. (2024). FinTech for environmental sustainability: Promises and pitfalls. *One Earth*, *7*(1), 23–30. [CrossRef]

Feng, J., & Yuan, Y. (2024). Green investors and corporate ESG performance: Evidence from China. *Finance Research Letters*, *60*, 104892. [CrossRef]

Gabor, D. (2021). The wall street consensus. *Development and Change*, *52*(3), 429–459. [CrossRef]

Galeone, G., Ranaldo, S., & Fusco, A. (2024). ESG and FinTech: Are they connected? *Research in International Business and Finance*, *69*, 102225. [CrossRef]

Giakoumelou, A., Salvi, A., Bekiros, S., & Onorato, G. (2024). ESG and FinTech funding in the EU. *Research in International Business and Finance*, *69*, 102233. [CrossRef]

Halden, U., & Cali, U. (2024). Exploiting green energy potential via FinTech: The role of DLT-based crowdfunding in PV and ESS investments. *Renewable Energy*, *228*, 120528. [CrossRef]

Han, J., Zheng, Q., Xie, D., Muhammad, A., & Isik, C. (2023). The construction of green finance and high-quality economic development under China's SDGs target. *Environmental Science and Pollution Research*, *30*(52), 111891–111902. [CrossRef]

Hoang, T. G., Nguyen, P. T., & Le Bui, M. (2024). Green finance initiatives in developing countries: Unveiling critical perspectives for advancing sustainability, environmental stewardship, and ethical management. *Reference Module in Social Sciences*. [CrossRef]

Jackson, D., Dunbar, K., Sarkis, J., & Sarnie, R. (2023). Advancing Fintech through a transdisciplinary approach. *IScience*, *26*(9), 107694. [CrossRef]

Kashif, M., Ullah, A., Ullah, S., & Qian, N. (2024). Towards a greener future: The impact of financial technology (FinTech) and climate finance on ecological sustainability. *Journal of Environmental Management*, *370*, 122876. [CrossRef] [PubMed]

Khaskheli, M. B., & Zhao, Y. (2025). The sustainability of economic and business practices through legal cooperation in the era of the Hainan free trade port and southeast Asian nations. *Sustainability*, *17*(5), 2050. [CrossRef]

Kiohos, A., & Sariannidis, N. (2010). Determinants of the asymmetric gold market. *Investment Management and Financial Innovations*, *7*, 26–33.

Kiran, M., Chughtai, S., & Naeem, M. A. (2024). Navigating greenwashing in the G8: Insights into family-owned firms, technology innovation, and economic policy uncertainty. *Research in International Business and Finance*, *71*, 102481. [CrossRef]

Koemtzopoulos, D., Zournatzidou, G., Ragazou, K., & Sariannidis, N. (2025a). Cryptocurrencies transit to a carbon neutral environment: From Fintech to Greentech through clean energy and eco-efficiency policies. *Energies*, *18*(2), 291. [CrossRef]

Koemtzopoulos, D., Zournatzidou, G., & Sariannidis, N. (2025b). Can cryptocurrencies be green? The role of stablecoins toward a carbon footprint and sustainable ecosystem. *Sustainability*, *17*(2), 483. [CrossRef]

Li, P., Liu, T., Li, J., Ling, F. K., & Li, Z. (2024). Exploring the impact of fintech, natural resources, energy consumption, and international trade on economic growth in China: A dynamic ARDL approach. *Resources Policy*, *98*, 105310. [CrossRef]

Li, T., Yue, X. G., Qin, M., & Norena-Chavez, D. (2024). Towards Paris climate agreement goals: The essential role of green finance and green technology. *Energy Economics*, *129*, 107273. [CrossRef]

Li, X., Ye, Y., Liu, Z., Tao, Y., & Jiang, J. (2024). FinTech and SME' performance: Evidence from China. *Economic Analysis and Policy*, *81*, 670–682. [CrossRef]

Liu, J., Li, L., & Lu, D. (2025). FinTech and consumption resilience to uncertainty shocks: Evidence from digital wealth management in China. *SSRN Electronic Journal*. [CrossRef]

Liu, X., & Guo, W. (2025). Dynamic impact of green finance on renewable energy development: Based on scale, structure, and efficiency perspectives. *Renewable Energy*, *238*, 121854. [CrossRef]

Liu, Y. (2024). Climate risk perception, female directors and greenwashing. *Finance Research Letters*, *70*, 106291. [CrossRef]

Liu, Z., & Li, X. (2024). The impact of bank fintech on ESG greenwashing. *Finance Research Letters*, *62*, 105199. [CrossRef]

Macchiavello, E., & Siri, M. (2020). Sustainable finance and fintech: Can technology contribute to achieving environmental goals? A preliminary assessment of 'Green FinTech'. *SSRN Electronic Journal*. [CrossRef]

Maltais, A., & Nykvist, B. (2020). Understanding the role of green bonds in advancing sustainability. *Journal of Sustainable Finance & Investment*, *11*(3), 233–252. [CrossRef]

Mohammed, K. S., Serret, V., & Urom, C. (2024). The effect of green bonds on climate risk amid economic and environmental policy uncertainties. *Finance Research Letters*, *62*, 105099. [CrossRef]

Obobisa, E. S., & Ahakwa, I. (2024). Stimulating the adoption of green technology innovation, clean energy resources, green finance, and environmental taxes: The way to achieve net zero CO_2 emissions in Europe? *Technological Forecasting and Social Change*, *205*, 123489. [CrossRef]

Odejide, O. A., & Edunjobi, T. E. (2024). AI in project management: Exploring theoretical models for decision-making and risk management. *Engineering Science & Technology Journal*, *5*(3), 1072–1085. [CrossRef]

Pizzi, S., Corbo, L., & Caputo, A. (2021). Fintech and SMEs sustainable business models: Reflections and considerations for a circular economy. *Journal of Cleaner Production*, *281*, 125217. [CrossRef]

Qian, S. (2024). The effect of ESG on enterprise value under the dual carbon goals: From the perspectives of financing constraints and green innovation. *International Review of Economics & Finance*, *93*, 318–331. [CrossRef]

Razzaq, A., Sharif, A., Ozturk, I., & Skare, M. (2023). Asymmetric influence of digital finance, and renewable energy technology innovation on green growth in China. *Renewable Energy*, *202*, 310–319. [CrossRef]

Sadiq, M., Paramaiah, C., Joseph, R., Dong, Z., Nawaz, M. A., & Shukurullaevich, N. K. (2024). Role of fintech, green finance, and natural resource rents in sustainable climate change in China. Mediating role of environmental regulations and government interventions in the pre-post COVID eras. *Resources Policy*, *88*, 104494. [CrossRef]

Sanga, B., & Aziakpono, M. (2023). FinTech and SMEs financing: A systematic literature review and bibliometric analysis. *Digital Business*, *3*(2), 100067. [CrossRef]

Sharma, G. D., Verma, M., Shahbaz, M., Gupta, M., & Chopra, R. (2022). Transitioning green finance from theory to practice for renewable energy development. *Renewable Energy*, *195*, 554–565. [CrossRef]

Song, Y., & Hao, Y. (2024). Understanding the relationship between fintech, natural resources, green finance, and environmental sustainability in China: A BARDL approach. *Resources Policy*, *89*, 104608. [CrossRef]

Susan, E. B., & Pan, Y. (2024). Trust as a determinant of green finance through information sharing and technological penetration: Integrating the moderation of governance for sustainable growth. *Technology in Society*, *77*, 102565. [CrossRef]

Tang, P., Liu, X., Mi, L., Wang, G., & Wang, J. (2025). Dual-threshold effect of resources and governance on the role of regulations in green innovation: Novel insights from a four-regime panel approach. *Business Strategy and the Environment*, *34*(2), 2667–2679. [CrossRef]

Tang, P., Ma, H., Sun, Y., & Xu, X. (2024). Exploring the role of fintech, green finance and natural resources towards environmental sustainability: A study on ASEAN economies. *Resources Policy*, *94*, 105115. [CrossRef]

Tong, Y., Lau, Y. W., & Binti Ngalim, S. M. (2024). Do pilot zones for green finance reform and innovation avoid ESG greenwashing? Evidence from China. *Heliyon*, *10*(13), e33710. [CrossRef]

Uche, E., Ngepah, N., Das, N., & Dey, L. (2024). Dynamic interactions of green innovations, green transitions and ecological load capacity factor in BRICS. *Renewable Energy*, *231*, 120905. [CrossRef]

Wang, W., Huang, H., Peng, X., Wang, Z., & Zeng, Y. (2024). Utilizing support vector machines to foster sustainable development and innovation in the clean energy sector via green finance. *Journal of Environmental Management*, *360*, 121225. [CrossRef] [PubMed]

Wei, H., Yue, G., & Khan, N. U. (2024). Uncovering the impact of fintech, natural resources, green finance and green growth on environment sustainability in BRICS: An MMQR analysis. *Resources Policy*, *89*, 104515. [CrossRef]

Wu, B., Gu, Q., Liu, Z., & Liu, J. (2023). Clustered institutional investors, shared ESG preferences and low-carbon innovation in family firm. *Technological Forecasting and Social Change*, *194*, 122676. [CrossRef]

Wu, L., Wang, C., Ren, H., & Zhang, W. (2024). How does executive green cognition affect enterprise green technology innovation? The mediating effect of ESG performance. *Heliyon*, *10*(14), e34287. [CrossRef]

Xiao, A., Xu, Z., Skare, M., Xiao, J. L., & Qin, Y. (2024). Unlocking the potential of FinTech: A pathway to sustainable resource management in the EU. *Resources Policy*, *98*, 105358. [CrossRef]

Xie, Y. (2024). The interactive impact of green finance, ESG performance, and carbon neutrality. *Journal of Cleaner Production*, *456*, 142269. [CrossRef]

Xing, C., Zhang, X., Zhang, Y., & Zhang, L. (2024). From green-washing to innovation-washing: Environmental information intangibility and corporate green innovation in China. *International Review of Economics and Finance*, *93*, 204–226. [CrossRef]

Yadav, S., Samadhiya, A., Kumar, A., Luthra, S., & Pandey, K. K. (2024). Nexus between fintech, green finance and natural resources management: Transition of BRICS nation industries from resource curse to resource blessed sustainable economies. *Resources Policy*, *91*, 104903. [CrossRef]

Yang, Q., Du, Q., Razzaq, A., & Shang, Y. (2022). How volatility in green financing, clean energy, and green economic practices derive sustainable performance through ESG indicators? A sectoral study of G7 countries. *Resources Policy*, *75*, 102526. [CrossRef]

Yang, Y., Su, X., & Yao, S. (2021). Nexus between green finance, fintech, and high-quality economic development: Empirical evidence from China. *Resources Policy*, *74*, 102445. [CrossRef]

Zhang, D., & Kong, Q. (2022). Green energy transition and sustainable development of energy firms: An assessment of renewable energy policy. *Energy Economics*, *111*, 106060. [CrossRef]

Zhang, D., Wang, C., He, Y., & Vigne, S. A. (2024). Does FinTech efficiently hamper manipulating ESG data behavior? *British Accounting Review*, 101494. [CrossRef]

Zhang, H., & Wang, B. (2024). Impacts of government ESG policies on corporate green innovation. *International Review of Economics and Finance*, *94*, 103383. [CrossRef]

Zhang, S., & Lee, J. H. (2020). Analysis of the main consensus protocols of blockchain. *ICT Express*, *6*, 93–97. [CrossRef]

Zhang, X., Kong, L., & Hu, X. (2024). Shades of green: The impact of greenwashing on stock price crash risk. *Finance Research Letters*, *70*, 106285. [CrossRef]

Zheng, Y., & Zhang, Q. (2023). Digital transformation, corporate social responsibility and green technology innovation-based on empirical evidence of listed companies in China. *Journal of Cleaner Production*, *424*, 138805. [CrossRef]

Zhou, N., & Sun, R. (2024). Coping with the storm: The role of fintech in SME survival. *International Review of Financial Analysis*, *93*, 103157. [CrossRef]

Zournatzidou, G., & Floros, C. (2023). Hurst exponent analysis: Evidence from volatility indices and the volatility of volatility indices. *Journal of Risk and Financial Management*, *16*(5), 272. [CrossRef]

Zournatzidou, G., Sklavos, G., Ragazou, K., & Sariannidis, N. (2024). Anti-competition and anti-corruption controversies in the European financial sector: Examining the anti-ESG factors with entropy weight and TOPSIS methods. *Journal of Risk and Financial Management*, *17*(11), 492. [CrossRef]

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