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# SYSTEMATIC LITERATURE REVIEW ON SUSTAINABLE FINANCE: OVERVIEW AND FUTURE DIRECTIONS

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**Abstract**

The increased global concerns over social and environmental protection, climate change, and sustainable development have gained attention in recent literature. Sustainable finance plays a significant role in integrating financial capital to address these challenges. The current study explores the trends and extent of research in sustainable finance. The quantitative (bibliometric) and qualitative (content) analyses are conducted, utilizing scientometric and strategic mapping techniques to identify themes and key research areas. The dataset is extracted from the Scopus database from 2001 to 2023. After rigorous exclusion and inclusion criteria, 2022 articles were used for bibliometric analysis, and 15 articles were used for content analysis. The findings highlight the surge in publications, such as 691 articles published in 2023, mainly due to the Paris Agreement, 2015, and after the COVID-19 pandemic. The results also highlight the frequency of keywords used by authors, so green finance has been used largely, with a denomination of 556 occurrences with 197 nodes and a total link strength of 947, representing the main research themes from the sustainable finance literature, followed by sustainable finance, with a denomination of 319 occurrences with a total link strength of 585, and climate finance, with 257 occurrences. Furthermore, researchers can use the future directions provided in the findings of this study. In addition, it provides practical implications for environmental regulators and academicians. The study highlights the potential of sustainable finance to make a more significant impact by offering environmentally protective financial instruments.

**Keywords:** Sustainable finance, Systematic literature review, Sustainability, Network analysis, Bibliometric analysis, future agenda

**JEL Classification**: G20; G30, Q50, Q56

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## 1. INTRODUCTION

Sustainable finance involves managing financial resources through investing activities to protect the environment and society. It has redefined the financial flows in response to growing concerns over climate disasters and social issues. The innovative instrument under sustainable finance has gained importance across the stakeholders (Singhania et al., 2023). Climate Bonds Initiatives (2023) states that the Green, sustainability-linked, and social sustainability debt market is expected to increase to 5$ trillion issuances annually until 2025. The financial sector

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is considered a catalyst that accelerates the transition of financial inflows and enables efficient allocation of funds to boost sustainable economic development (Ronaldo & Suryanto, 2022; K.-H. Wang et al., 2022). Literature has emphasized that the financial market participants are increasingly focused on resilience against environmental degradation and sustainability (Fatemi & Fooladi, 2013; Tao et al., 2022; Q. Zhang et al., 2020).

The challenges of unstable climate change demand the urgent need for investments dedicated to low-carbon emissions. Consequently, in 2010 UN Framework Convention established the Green Climate Fund, which seeks to mobilize funds to invest in low-carbon emissions and climate-resilient development projects (UNFC, 2010). These funds are considered transition funds towards low carbon, and minimizing environmental harms is essential to mitigate climate adversities and adopt long-term changes. Therefore, sustainable finance is a key driver and ensures that financial resources are effectively channeled towards environmental sustainability. The support and role of sustainable finance are crucial for achieving sustainable development goals. The SDG components of sustainable finance emphasize the participation of all stakeholders to start a financially sustainable ecosystem. Therefore, the framework set forth by the SDGs and Paris Agreement leads to sustainable development focusing on environmental and social protection while mobilizing financial resources. Thus, sustainable finance plays a significant role in facilitating the transition toward a greener economy in both developing and developed nations (C. Wang et al., 2021). The existing literature provides various definitions of sustainable finance as the field evolves. Soppe,(2004) described sustainable finance as a bridge that blends finance and business ethics literature and viewed it as integrating financial, social, and environmental elements. While other researchers expanded the framework (Chang et al., 2022; Poyser & Daugaard, 2023a; STARKS, 2023) Khan et al., (2022) Belaïd, (2022) defined sustainable finance as an effective tool for improving environmental and social protection. At the same time, Tao et al., (2022) added an economic aspect. Another stream of literature provides other aspects of sustainable finance, as Cheng & Taghizadeh-Hesary (2023) evaluated the effect of sustainable finance on the energy poverty gap, focusing on 20 Asian developing countries, and found that a sustainable finance market reduces the energy poverty gap. Furthermore, Wan et al., (2023) examined the integration of ESG with the three firm dimensions: risk, capital cost, and financial performance. Popescu et al. (2021) provided insightful results, suggesting that the carbon footprints and ESG factors could be improved in measuring real-world sustainability issues. Mashari et al., (2023) have explored the connection between sustainable finance and the carbon trading mechanism and concluded that no strong link is witnessed between green finance enhancing the success of carbon trading.

Prior literature witnessed diverse perspectives within sustainable finance, different studies explore various domains. Building on the Poyser & Daugaard (2023b) conducted a systematic literature review on the nexus between sustainable investments and indigenous approaches to sustainability. It found that economic development and entrepreneurship play crucial roles in understanding sustainable business and economic growth approaches. Khan, (2022) conducted a bibliometric analysis on ESG disclosure and firm financial performance and found that the relationship still needs clarification due to contradicting results and paradoxes. Debrah et al., (2023) conducted a bibliometric analysis of green finance, exploring new research avenues: green bond market, green premium credit, carbon investment, green banking, and climate

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finance, extending studies on green bonds. Kashi & Shah (2023) conducted a bibliometric analysis on sustainable finance and found that the UK and China are major centers in publications related to sustainable finance, identifying studies on the sustainability of bank performance, risk profiles, and sustainable profits. Nevertheless, it is worth noting that there have been many studies of bibliometric and systematic literature on sustainable finance; existing research has adopted a narrow scope, focusing on specific themes, industries, and two-dimensional relationships between variables. These limitations restrict the overall literary development of the topic. Therefore, this systematic review aims to overcome this limitation by adopting a more comprehensive approach, incorporating data from two important databases, i.e., Scopus and Google Scholar. These broader data sources enhance the literature's richness and diversity, minimizing the chances of missing significant contributions. Furthermore, previous systematic literature focused on specific industries or themes, such as the banking industry, energy-intensive industries, or connections with particular themes, i.e., carbon emission, green finance, climate finance, ESG, and renewable energy, which could result in a partial representation of the sustainable finance literature. This systematic literature review addresses this limitation by adopting a more inclusive perspective and ensures a more comprehensive understanding of sustainable finance by relaxing the relevance of articles. The keyword-based search strategies employed in prior studies have limited the scope of the research. By solely relying on a set of keywords in titles, abstracts, or keywords, there is a potential for missing articles that might not explicitly use those terms but belong to the field. The current systematic review addresses this limitation by selecting broader keywords that seek to add more articles related to sustainable finance. Aligning with the research gap, this study complements the prior systematic reviews and bibliometric literature and contributes to the knowledge in several ways. First, it explores broadly the key trends in research on sustainable finance. Second, the leading subjects or themes emanating from sustainable finance literature, top contributing authors, journals, institutions, and countries. Third, reach on future research streams to explore sustainable finance further.

The paper is structured into six sections. The first section provides an introduction. Section two details the methodology and the construction of a final sample of articles for review. Section 3 presents performance analysis, while Section 4 focuses on intellectual and bibliometric network analysis. Section 5 provides an in-depth discussion of the findings, and finally, section 6 concludes the study.

## 2. METHODOLOGY

The financial sector plays a significant role in accelerating sustainable solutions for society and the environment, specifically, from transforming conventional businesses to sustainable businesses in terms of social and environmental benefits. To seek the real effects of these ideas, the current study is conducting a systematic literature review. The mixed method is primarily adopted in this study. The method includes both quantitative (Bibliometric approach) and qualitative (systematic) for analysis and synthesizing the available research on the topic (Oraee et al., 2017). This methodology can reduce biases and author's judgment and expand the breadth and depth of the field. Moreover, this study has followed the outlined data collection and analysis protocol. Furthermore, tabulated in Figure 1 provides the process flow of methodology.

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### *2.1. Search for publication*

The first stage of this study entailed searching for research articles. The data collection approach is adopted from the previous research of (Debrah et al., 2023; Mashari et al., 2023; Popescu et al., 2021). Therefore, incorporating key terminology of earlier studies is considered to enhance the quality and validity of the collected data. The keyword combination from previous literature has defined sustainable finance. Moreover, in bibliometric studies, the coverage of literature depends on the logical selection of keywords. However, to broaden the article's scope, "sustainable finance" has been used to search the articles in Scopus due to the high coverage of documents. Google Scholar is used to download and correct selected articles. The Scopus database provides 60% more articles than the Web of Science, thus serving more valuable source for scholars (Comerio & Strozzi, 2019; Kumari & Joshi, 2024). To provide a comprehensive database, searches were conducted using the criteria, such as 'title,' 'abstract,' and 'keywords.' Initially, 5056 articles, book chapters, reviews, and conference papers were yielded, which was quite large. Therefore, we must restrict research to some additional base to get absolute and concrete results.

### *2.2. Exclusion and Inclusion Criteria*

In exclusion and inclusion criteria, the document type was limited to journal articles because it follows a more rigorous peer-to-peer process than conference papers. The articles also provide more knowledge in the systematic literature review (Debrah et al., 2022). Moreover, after including only articles and limiting them to the social science, finance, and management areas in Scopus, 2022 articles were used for bibliometric analysis.

### *2.3. Bibliometric Analysis*

Bibliometric analysis is a "quantitative" technique that assists academicians in exploring and examining vast scientific data sources through mapping and visualization (Donthu et al., 2021; Merigó & Yang, 2017). It refers to comprehending the dynamic features and structure of an article in the field of social sciences. It encompasses techniques to scrutinize and identify a particular research area's social, intellectual, and conceptual structures. This approach helps highlight key research themes, gain a comprehensive understanding of the area, identify relevant gaps, generate innovative research insights, and provide the directions that previous research has conducted (Donthu et al., 2021).

Similarly, this study employed bibliometric analysis for the knowledge domain to identify research trends and important research outlets in the topic area. There are multiple bibliometric analysis tools available. This study uses 'Biblioshiny' software, a package in R-Studio version 4.3.0. free, open-source software used for data analysis (Aria & Cuccurullo, 2017), and VOSviewer.

### *2.4. Content Analysis*

A qualitative systematic analysis was also conducted, in which articles were selected carefully for content analysis (Harden & Thomas 2010). The analysis is important for reaching significant knowledge gaps and suggesting future directions. This method can enhance the research area's deep understanding and comprehension of the research findings. Therefore, the approach of Debrah et al. (2023) was followed for identifying and selecting the articles for in-depth analysis. The selection of articles is based on the theme's relevance, i.e., green finance and fintech. Finally, 35 papers were randomly chosen using a manual forward-and-backward search based

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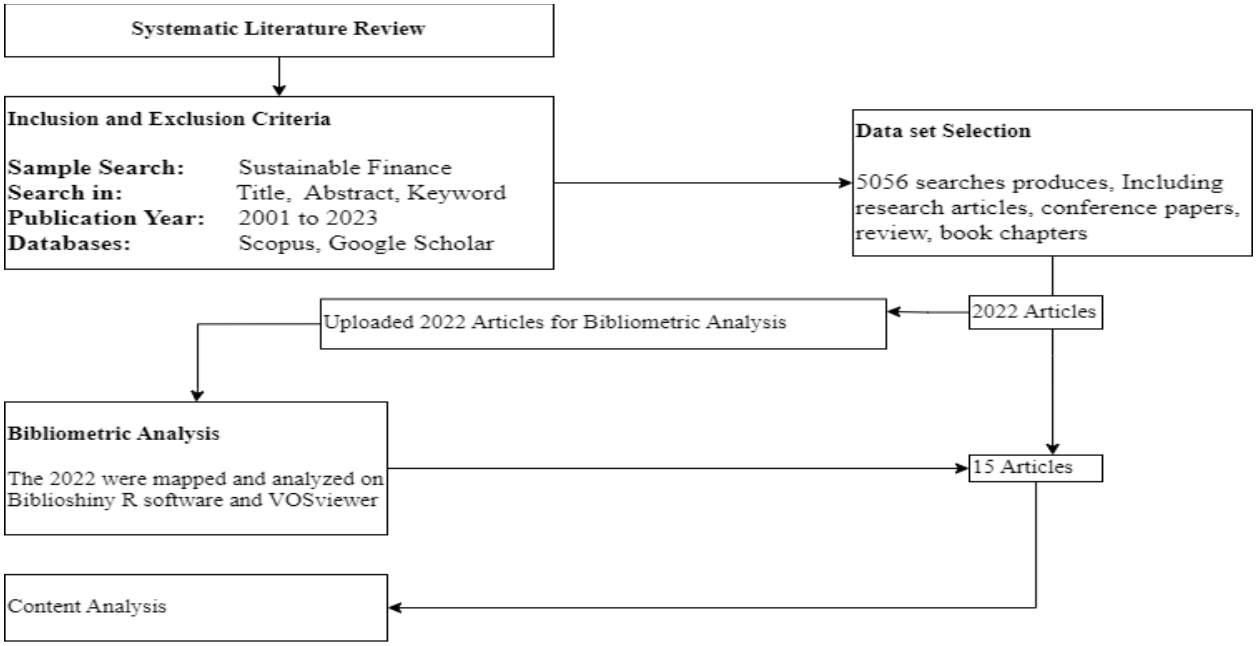
on their significance in the literature. After duplication and checking the relevance of articles on sustainable finance, 15 studies were finally selected for content analysis. These are the most relevant in terms of theoretical advancement and practical implementation of sustainable finance. Furthermore, these articles have relatively higher citations and are considered methodologically robust.

**Figure 1. Process flow**




## 3. BIBLIOMETRIC PERFORMANCE ANALYSIS

### *3.1. Most Influential Countries and Institutions*

Sustainable finance seeks to incorporate social, environmental, and climate change factors into the business strategies of financial institutions. The economic system's ability to transform sustainability into a financial instrument has gained the attention of many countries (Kashi & Shah, 2023). Therefore, countries and institutions must establish and enforce transformation processes to support financial and non-financial integration of sustainable criteria into their business and operational strategies. Consequently, to investigate and determine the most active contributors to sustainable finance research, the current study identifies the most contributing nations and institutions.

Figure 2 shows countries' scientific production, actively participating in research related to sustainable finance. China remains in the top 10 countries, followed by the United Kingdom and Germany. No doubt, China has prioritized green finance, carbon neutrality, and sustainable development as part of the country's national strategy. Universities and research institutions have received substantial funding to explore the area. Furthermore, the country's data shows that research on sustainable finance has emerged in developed and emerging countries.

As a result, academic readers should remember that the outcome is based on document analysis rather than per capita contribution. Furthermore, we encourage future research to consider this

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aspect while examining the topic of sustainable finance throughout the world based on the data utilized for this analysis.

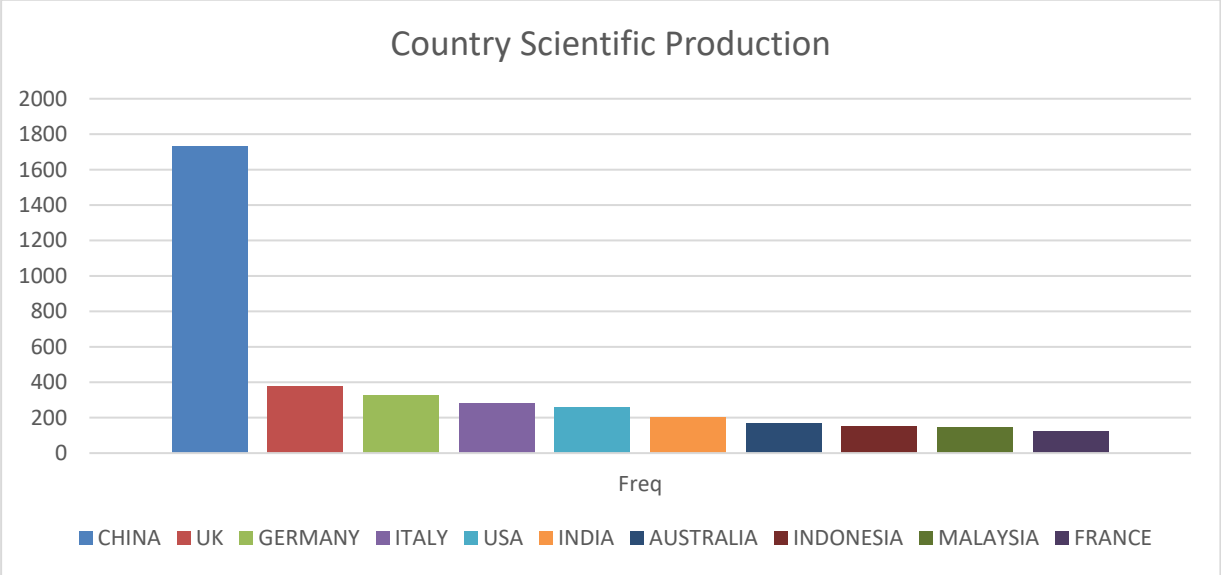


**Figure 2.** Top Ten Countries from the number of publications. *Source: Source:* authors' estimates

Moreover, according to the average and highest citation, the classification of countries has changed. Figure 3 shows the number of citations. At the same time, China continues to dominate with 9,890 citations. However, the classification has been changed for the USA, Italy, and Australia. The high citations of these countries suggest that these countries have established strong institutional support, well-established research networks, and major contributions to policy development. Furthermore, India, Indonesia, and Malaysia have been excluded from the top ten most cited countries. This could be due to various reasons, including research quality and journal impact factors. It is important to note that China and the United Kingdom have the highest citations. It means that both countries have influenced researchers in this field.

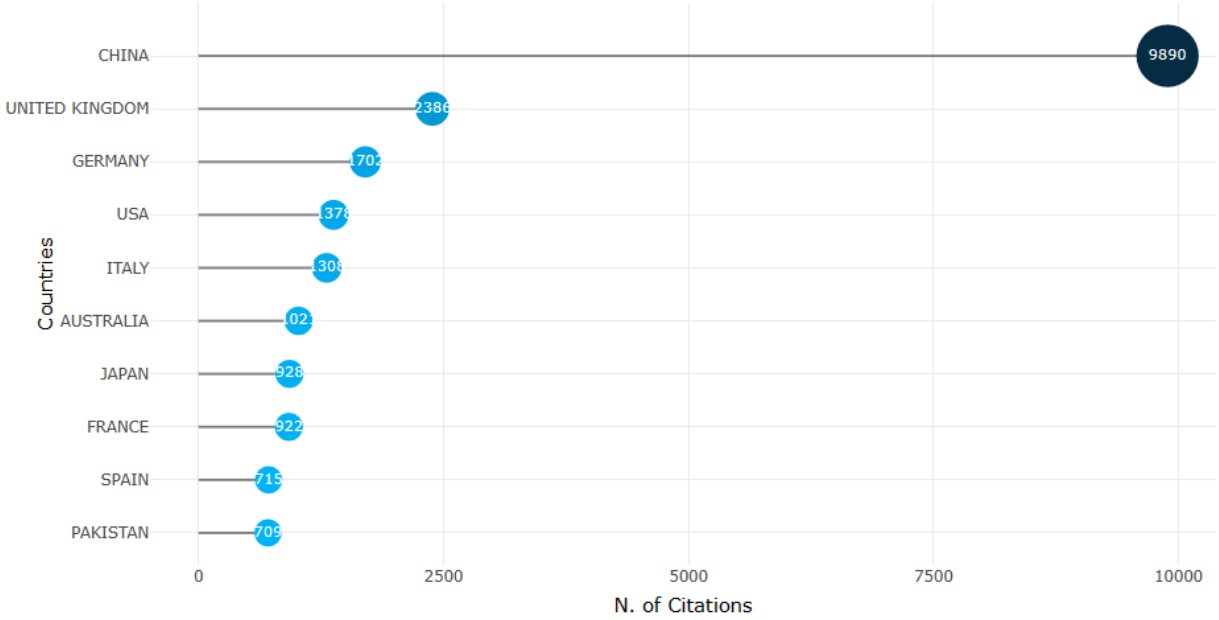


**Figure 3.** Most influential countries from the perspective of the number of citations. *Source:* authors' estimates

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### *3.2. Countries Collaboration Network*

Figure 4 highlights the collaboration network in sustainable finance research; China is the most central and collaborated network, particularly with the United Kingdom; it indicates the depth of collaboration in terms of co-authorships. This suggests that China has not only published the most articles actively engaged in international research collaborations. Moreover, the blue cluster comprises countries strongly linked to China and the United Kingdom. These include emerging economies like Bangladesh, Indonesia, and Nigeria. This clustering suggests that China and the UK play significant roles in fostering global academic networks in sustainable finance. Their collaboration with diverse countries may be driven by shared policy interests, financial incentives, and joint research projects. The second cluster, in red, consists of European countries such as Germany, Switzerland, Netherlands, and others. Their research collaborations seem to be more internally focused within Europe. This is due to Europe's regional sustainability policies, as the European Union introduced the first green bond. Moreover, strengthening regional collaborations could enhance the global impact of sustainable finance research.

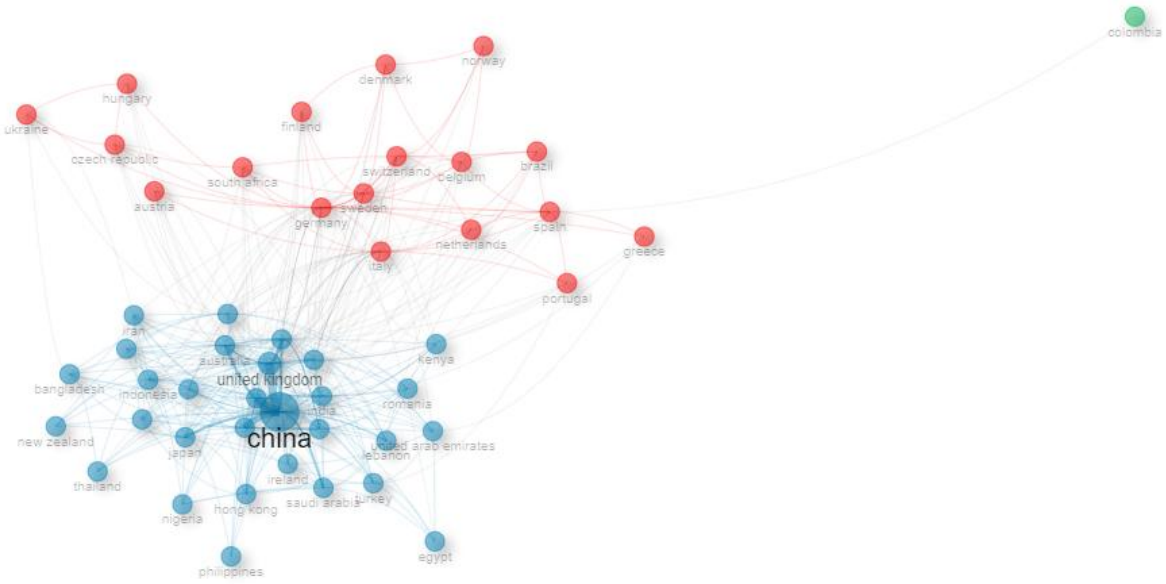


**Figure 4.** Mapping of countries' collaboration. *Source:* authors' estimates

Regarding the institutions and authors' affiliations. There are ten notable institutions from which authors are affiliated, as mentioned in Figure 5. In which Southern University of Finance and Economics has the highest affiliation. It is worth noting that from the of the top 10 affiliated Institutions eight Institutions belong to China. There can be various reasons for the high number of research in China, such as implementing the "Green Credit Policy" in 2007 and the following "Green Credit Guidelines" in 2012 prompted institutional pressures. This required Chinese financial institutions to adopt more sustainable and socially responsible practices. Moreover, Chinese banks have taken some initiatives in credit policy to limit loans whose proceeds are used in environmentally destructive projects. These policies have increased the awareness and importance of sustainable and green finance.

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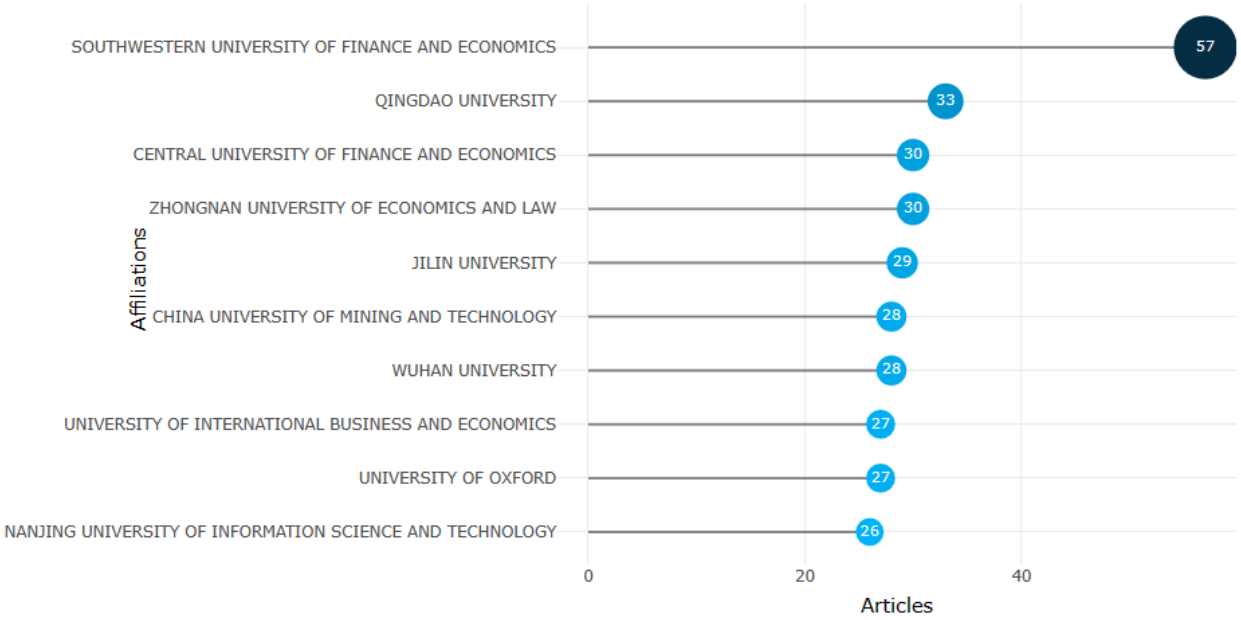


**Figure 5.** Most influential institutions that have contributed to sustainable finance. *Source:* authors' estimates

### *3.3. Most Influential Journals and Authors*

Identifying the most influential authors is important for regulators, policymakers, academic institutions, and financial organizations because they have identified the real challenges in the area and provided solutions based on real empirical evidence. There are almost 565 journals that publish articles related to sustainable finance. Moreover, figure 6. Shows the top 10 most relevant journals to sustainable finance. "Sustainability (Switzerland)" has published more articles (226 articles), followed by "Resources Policy" (115 articles) and "Journal of Cleaner Energy" (77 articles).

Figure 7. shows Bradford's law, which ranked journals based on keywords. It contains the most relevant 50 articles in the top-ranked journal and then the next 50 articles in the next journal. Sustainability has been ranked highest. It has published high-quality publications in the broad field of sustainable finance. Specifically, related financial implications of ESG, sustainable investments, climate finance, and SDGs.

Moreover, the Journal of CleanerL Production, Resources Policy, and Journal of Sustainable Finance have contributed largely to the field. The more articles in these journals indicate that social and environmental protection research has gained prominence in the scholarly world, possibly due to international institutional interventions like the Paris Agreement 2015 and SDGs-17.

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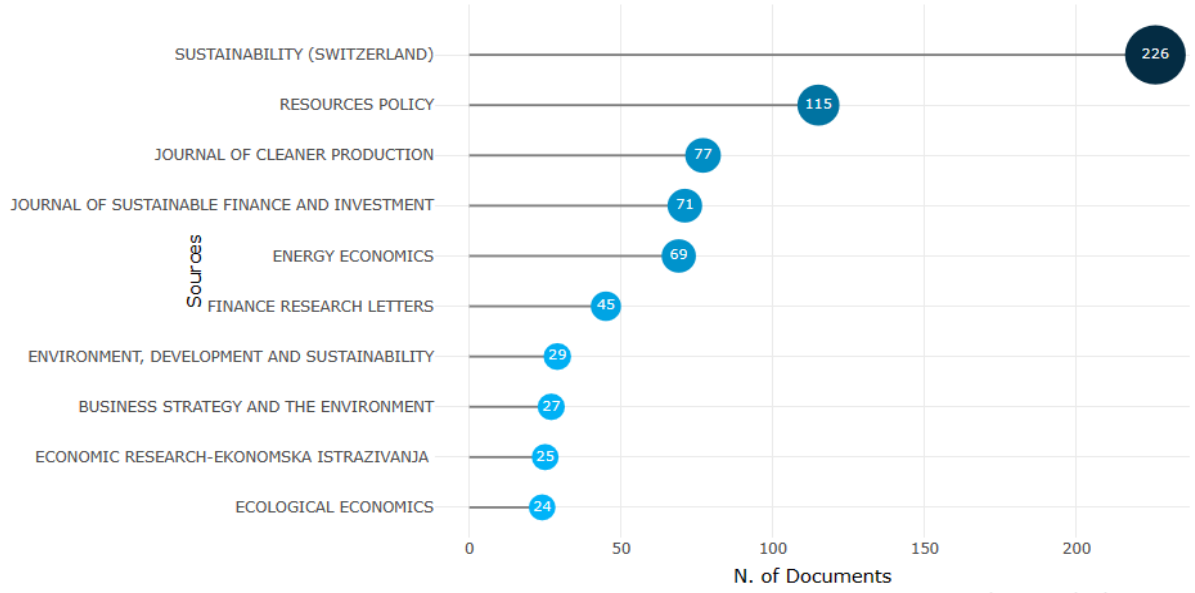


**Figure 6.** Top Ten Relevant Journals. *Source:* authors' estimates

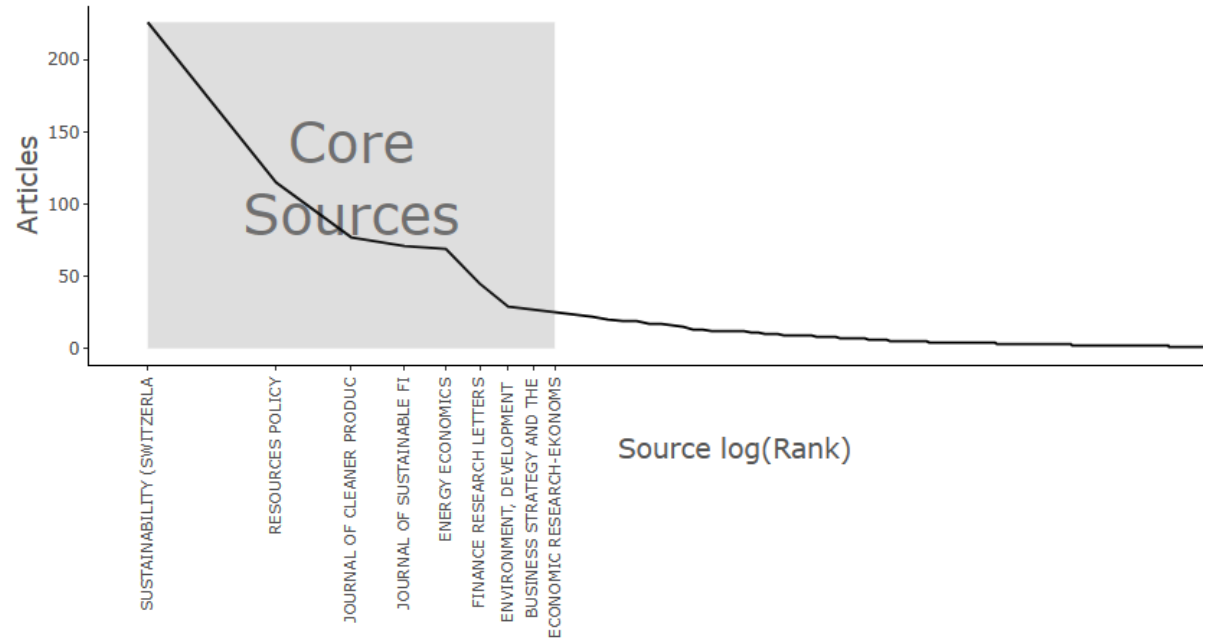


**Figure 7.** Core Source by Bradford's Law. *Source:* authors' estimates

### *3.4. Most Influential Articles*

The review of the most influential articles based on the number of citations can provide insight to researchers regarding the emergence, development, and coverage of more popular research themes that have gained the attention of many researchers. Table 1 provides information on the top ten influential articles.

**Table 1.** Top 10 Articles according to citations

| Author and Year | Title and Journal | Cites |
|---|---|---|

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| | | | |
|---|---|---|---|
| 1 | (Lee & Lee, 2022) | How does green finance affect green total factor productivity? Evidence from China, "Energy Economics." | 438 |
| 2 | (Flammer, 2021) | Corporate green bonds, "Journal of Financial Economics" | 414 |
| 3 | (Taghizadeh-Hesary & Yoshino, 2019) | The way to induce private participation in green finance and investment "Finance Research Letters." | 396 |
| 4 | (Irfan et al., 2022) | Influence mechanism between green finance and green innovation: Exploring regional policy intervention effects in China "Technological Forecasting and Social Change". | 265 |
| 5 | (Ren et al., 2020) | Nexus between green finance, non-fossil energy use, and carbon intensity: Empirical evidence from China based on a vector error correction model. "Journal of Cleaner Production". | 246 |
| 6 | (Meo & Abd Karim, 2022) | The role of green finance in reducing CO2 emissions: An empirical analysis, "Borsa Istanbul Review." | 215 |
| 7 | (Mohsin et al., 2021) | Developing Low Carbon Finance Index: Evidence From Developed and Developing Economies. "Finance Research Letters". | 195 |
| 8 | (Zhou et al., 2022) | The impact of fintech innovation on green growth in China: Mediating effect of green finance, "Ecological Economics." | 194 |
| 9 | (Yang et al., 2021) | Nexus between green finance, Fintech, and high-quality economic development: Empirical evidence from China, "Resource Policy." | 166 |
| 10 | (Jiakui et al., 2023) | Green technological innovation, green finance, and financial development and their role in green total factor productivity: Empirical insights from China, "Journal of Cleaner Production". | 165 |

These top-cited articles aim to evaluate the issuance of green financial instruments for climate and social impacts. Green finance positively influences mitigating highly polluted areas and improving environmental protection initiatives (Lee & Lee, 2022). (2) Green bonds whose proceeds finance climate-friendly projects specifically and their multiple effects on investors' clientele, cost of capital, and concerns regarding greenwashing (Flammer, 2021). (3) Similarly, green credit guarantee employing blockchain technology can help mitigate the risk associated with Green, thereby enhancing investor confidence (Taghizadeh-Hesary & Yoshino, 2019). (4) However, the effective use of green finance is important for driving green innovation that fosters sustainable economic development; the intervention of research and development centers and industrial structures can be the input for green solutions in the economy (Irfan et

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al., 2022). (5) concerning environmental and carbon emissions, mobilizing financing for renewable and non-fossil energy is crucial for reducing carbon emissions. Therefore, the proceedings from green financing have effectively employed green policies in China (Ren et al., 2020). (6) Similar evidence was found for green finance and CO2 emissions and improving green finance measures in economic externalities (Meo & Abd Karim, 2022). (7) mitigating carbon emissions is a universal solution for climate change; the low carbon finance index is for low-carbon energy sectors, the low-carbon investments needed to achieve the global climate targets (Mohsin et al., 2021). (8) Although economic development relates to green growth, similarly, technological advancement has played a crucial role in economic growth, so the nexus of Fintech and green finance has played a significant role (Zhou et al., 2022). (9) As the fintech ecosystem has been expanding, it plays a significant role in the transition to a green financial system and sustainable economic development; it can help accelerate the development of green finance (Yang et al., 2021). In summarizing Sustainable Investments, Green bonds, a sustainable finance instrument, gained traction in the early 21st century, but understanding the significance of sustainable investment is crucial. The concept of investor value maximization needs to be updated, and a sustainable value-creation framework can account for social and environmental costs and benefits. Transitioning to sustainable finance is important for scaling up low-carbon investments and achieving global climate targets. Policymakers are now focusing on green investments and reducing harmful environmental pollution.

## 4. BIBLIOMETRIC NETWORK MAP ANALYSIS

The field of sustainable finance has had tremendous growth in recent years. Figure 8 shows the papers published from 2001 to 2023 on sustainable finance. There has been exceptional growth in publication, specifically from 2019 to 2023; 691 articles were published in 2023. This trend is projected to increase till 2024, with the number of articles rising by the end of 2023. The proliferation of research may be attributed to the COVID-19 and Paris Agreement. The pandemic has highlighted the vulnerabilities of the financial system and emphasized sustainable and resilient economic models as tools for economic recovery and long-term environmental sustainability. Moreover, the Paris Agreement is the world's first globally legally binding international treaty on climate change. The agreement encourages financial flows to support low-carbon and climate-resilient development. It has increased the financial mobilization and driven the research into green bonds, climate risk mechanisms, and financial institutions. The increased concern about sustainability has progressively prompted most academicians to investigate the field of green finance. Consequently, Figure 7 shows that the number of publications increased rapidly after 2015 and peaked at 222 papers published in 2021. This might be due to the urgency of the Paris Agreement (Agreement, 2015) and the UN agenda "2030 Agenda of Sustainable Development 2015, which came up with 17 sustainable development goals that provide a blueprint for sustainable development". These global policy frameworks have played a significant role in enhancing interest in sustainable finance, as they help provide a road map for aligning financial systems with sustainability objectives. The increasing urgency of addressing climate change risks, along with corporate regulatory change in ESG disclosure criteria and increased investor interest in sustainable investments. The rising trend indicates how debatable and significant the topic is in the eyes of econometricians,

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environmentalists, and fields of finance and management. Around 18.3 percent of articles were published from 2016 to 2020 and 65 percent from 2021 to 2023. The increasing literature on sustainable finance has motivated authors to investigate its research collaborative network, intellectual framework, and conceptual foundations, broadly encompassing the overall knowledge of sustainable finance.

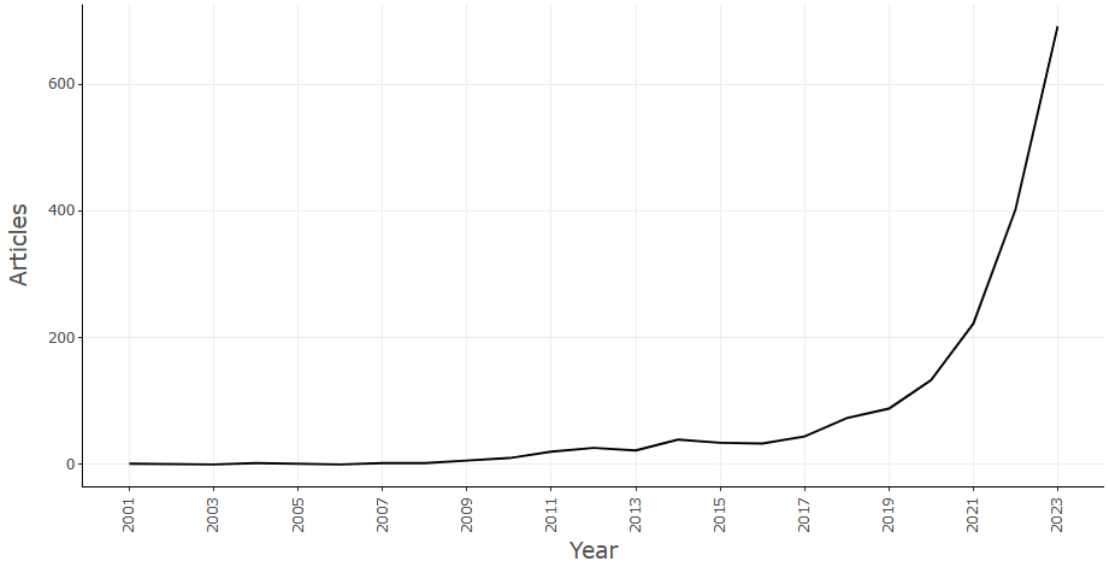


**Figure 8.** Annual scientific production of Articles. *Source:* authors' own estimates

### *4.1. Social Structure of (Co-Authors Analysis)*

The co-authorship map systematically establishes a link between the author's professional and social networks related to the field. A co-citation network is produced when two authors are referenced together by a third author in a separate publication (Baber & Fanea-Ivanovici, 2022). It is an effective way of identifying the most productive and impactful individuals from the area. For review, a co-authorship analysis is performed employing authors as a unit of analysis. From Figure 9, Taghizadeh-Hesary, Wang, Zhang, and Shahbaz have the most impactful team. The density of connections suggests that these scholars have established extensive collaborations, contributing significantly to the development of sustainable finance literature. Furthermore, multi-cross clusters also reflect interdisciplinary collaborations, indicating the scholars from economics, social, and environmental sciences. This enhances the breadth of the field in which sustainable finance is also connected to economics and environmental laws.

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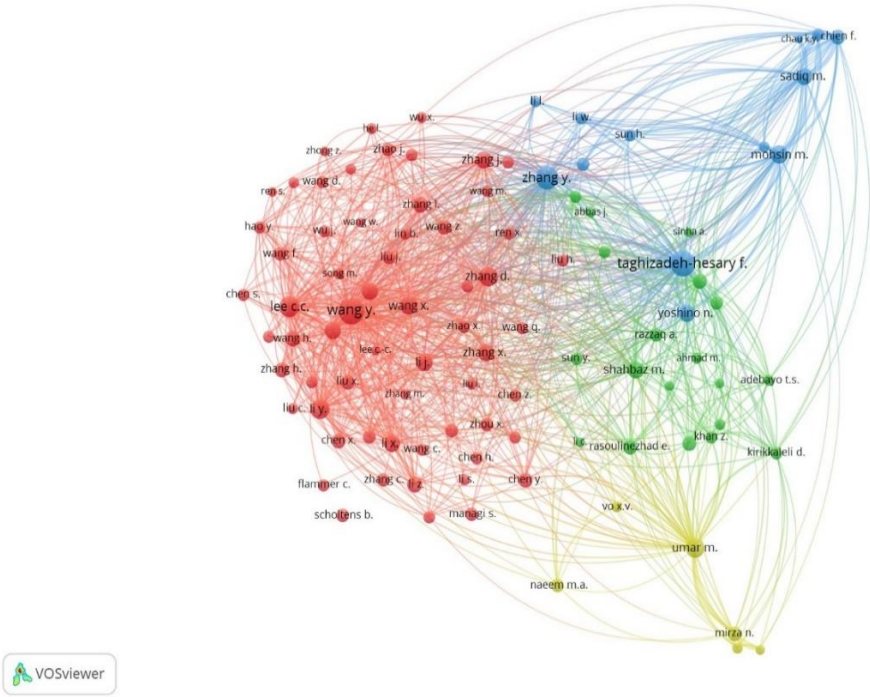


**Figure 9.** Social Network of Research Collaboration. *Source:* authors' own estimates

### *4.2. Conceptual Structure of Sustainable Finance*

#### *4.2.1. Bibliographic Coupling*

Bibliometric coupling provides insights regarding the relatedness of publications concerning references. A strong connection includes information on a related topic or area, which means that when a particular group of references is connected, it has a probability that they are associated with a specific theme or topic. Figure 10 shows that authors and publications such as Lee C.C., Teghizadeh-Hesary, and Flammer have strong bibliometric coupling, which shows their significant role in the knowledge of sustainable finance. This bibliometric coupling allows researchers to identify key studies that have influenced the field.

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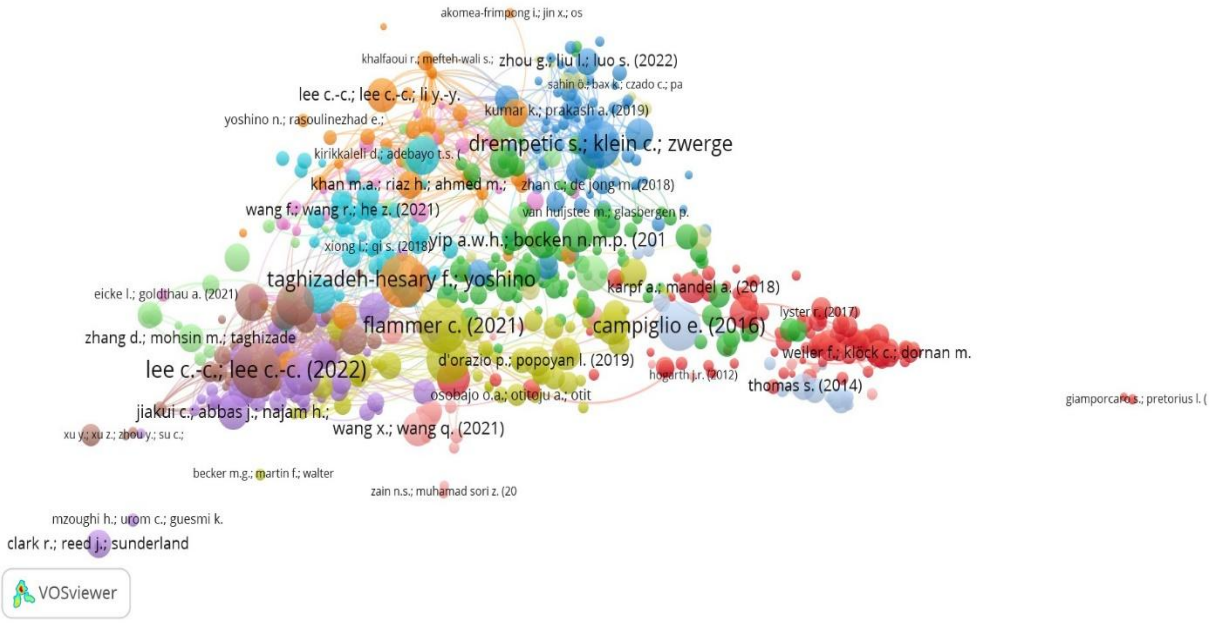


**Figure 10.** Bibliographic coupling based on references and documents. *Source:* authors' estimates

### *4.2.2. Keywords Co-Occurrences Analysis*

Keywords represent the core content of published research and define the study's scope within the field. According to keywords, analysis helps in identifying key research areas. Figures 11 and 12 show the author's keywords, with a total of 4588 from the sustainable finance dataset using fractional counting, from which 255 meet the threshold criteria. To incorporate keywords in the map, the minimum number of occurrences is set to 5. Additionally, a thesaurus document was used to merge similar terms (e.g., Sustainable Development Goals, SGDs, Corporate social responsibility, CSR and Environmental, Social and Governance, ESG) following the criterion of prior studies of Debrah et al., (2023) and Hosseini et al., (2018). Green finance is the most common word, with a denomination of 556 occurrences with 197 nodes and a total strength of 947, representing the main research themes from the sustainable finance literature, followed by sustainable finance, with a denomination of 319 occurrences with a total link strength of 585, and climate finance, with 257 occurrences.

These keyword analyses provide notable findings; a weak linkage exists between green finance and technology and innovation. However, sustainable finance is an emerging field, given that technological advancements and financial innovation are important in sustainable transitions through green bonds, fintech solutions, and impact investing. This underrepresentation of important and relevant fields suggests potential research gaps. Additionally, climate finance is the central theme, and the role of adaptation finance appears underrepresented. The analysis provides insights that existing literature emphasizes mitigation strategies, such as renewable energy investments and carbon trading, but offers limited inclusion of financial mechanisms to enhance environmental protection resilience. Furthermore, the presence of China and BRI (Belt and Road Initiative), highlights the regional dimensions in the field. It shows that regional cooperation plays a significant role in promoting sustainable finance.

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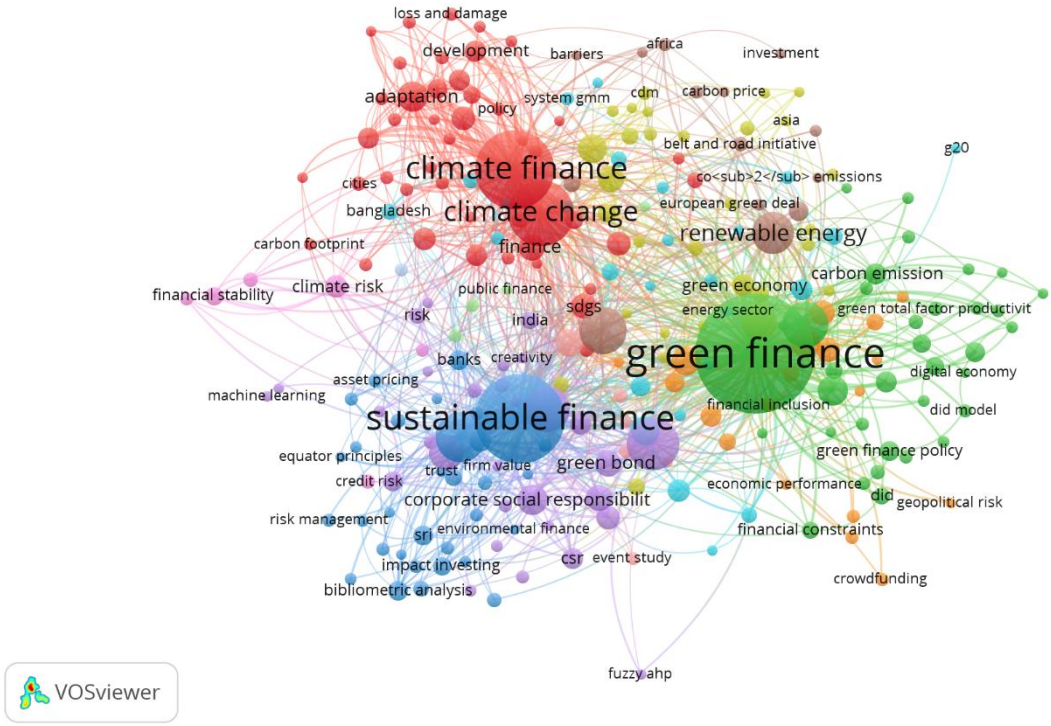


**Figure 11.** Keyword occurrence network. *Source:* authors' estimates


**Figure 12.** word cloud of the author's keyword. *Source:* authors' estimates

### *4.2.3. Title and Abstract Analysis*

The textual data sourced from the titles and abstracts of publications serves as a valuable method for generating keyword co-occurrence maps. Researchers can use these maps to identify the key variables pertinent to their research interests. By considering the clusters of abstracts

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and titles showcased in the network map (as shown in Figure 13 and Figure 14), authors can gain deeper insights into potential combinations of keywords, aiding in developing well-suited research topics. This approach streamlines the research process and promotes a more effective and precise exploration of academic research, ultimately fostering innovation and knowledge advancement. From Figure 12, the co-occurrence network based on the abstract shows that green finance has the highest occurrence with climate finance and sustainable development, followed by sustainable finance, carbon emissions, and green bonds. The analysis provides insights about under-explored themes such as technological innovation, green banking, and carbon finance. From Figure 13, the co-occurrence based on the title shows that green finance has been rigorously used in the sustainable finance literature and has the highest closeness with climate change, renewable energy, and the banking sector.

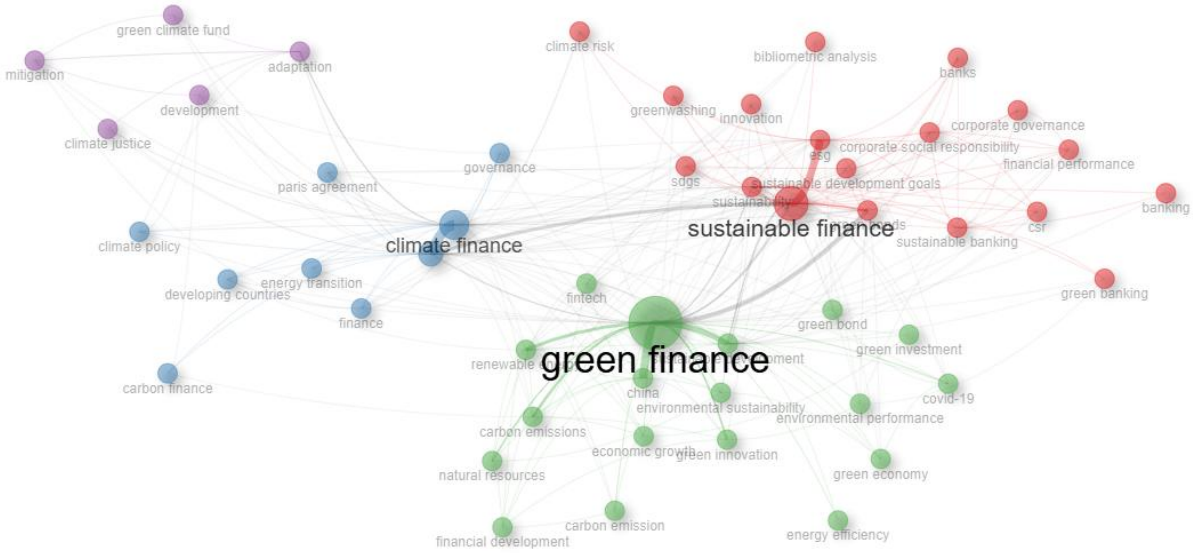


**Figure 13.** Co-occurrence network based on abstract. *Source:* authors' own estimates

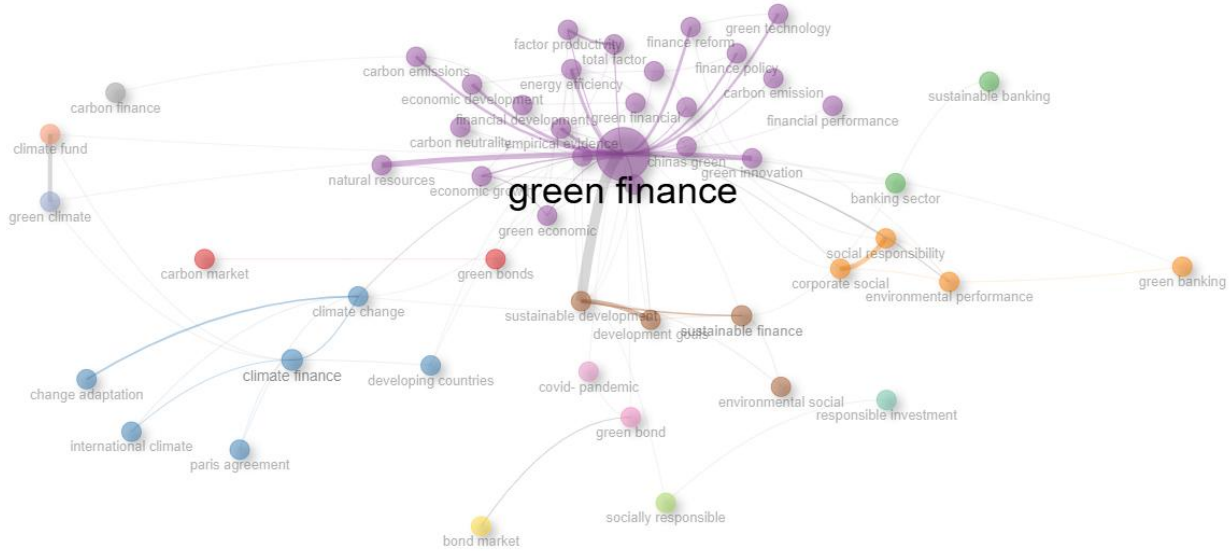


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**Figure 14**. Co-occurrence network based on title. *Source:* authors' own estimates

*4.2.4. Thematic Map Analysis*

Creating strategic networks using keyword co-occurrence analysis, a thematic or strategic map analysis, aids in exploring and describing the dynamics and advancement of research clusters. It measures how much research has been focused on specific topics or categorizing themes based on relevance (centrality) and development (density). Therefore, as Figure 15 illustrates, a thematic map aggregates the literature on a certain research subject into four typologies with greater depth and variety. To narrow the scope and make the thematic map clearer, we selected 100-author keywords structured in 4 clusters. From Figure 14, the upper-right quadrant has high density and centrality called motor themes: sustainable finance, sustainable development, and green bonds. These themes are considered more developed and influential in the area. Their high centrality indicates their strong connection to other themes, while their high density reflects the robust literature on these themes. These findings align with the UN Sustainable Development Goals, emphasizing the need for a financial transition toward sustainable finance. On the other hand, the lower-left quadrant reveals the emerging or declining themes of climate finance, adoption finance, and carbon finance, indicating they are either underdeveloped or declining. While these themes are underdeveloped. The limited visibility of adoption finance suggests important insight that academicians and policymakers have largely emphasized the growth of sustainable finance, and there is a significant surge in green bonds and other financial instruments. However, the adoption of these funds and surveillance of utilization of proceedings are under-explored. Moreover, the upper-right quadrant, labeled as basic themes, includes 'climate change,' 'renewable energy,' and 'finance.' these themes are fundamental but lack exploration.

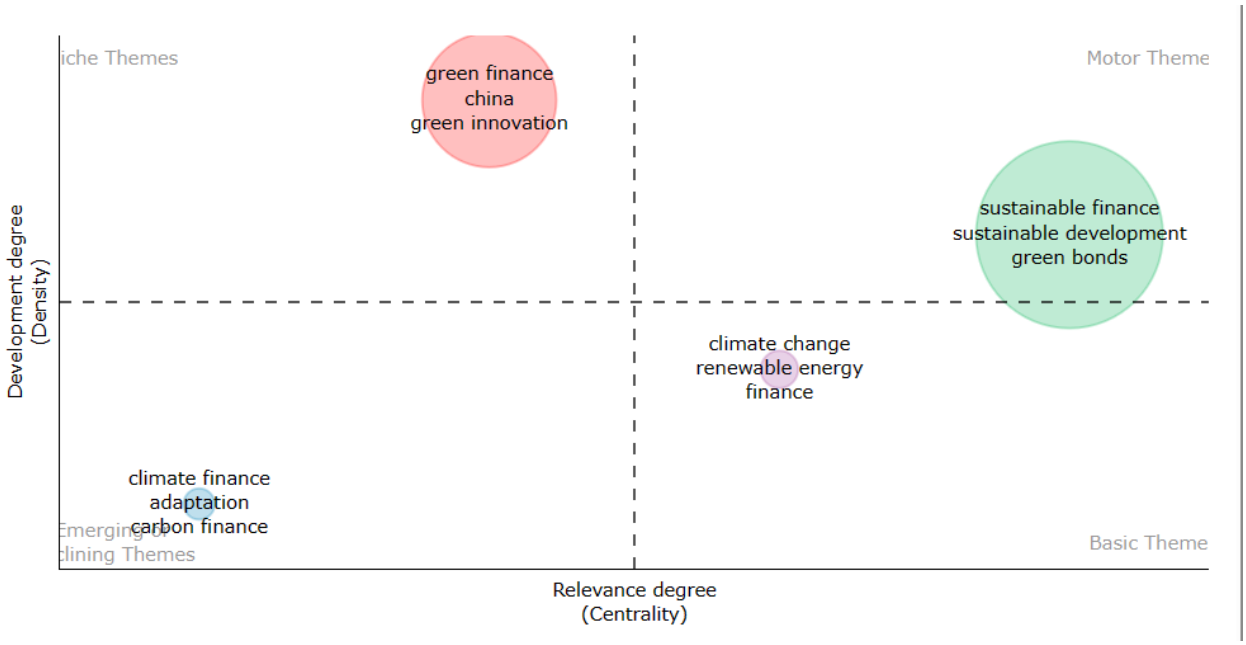


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**Figure 15.** Thematic map analysis of sustainable finance literature. *Source:* authors' own estimates

## 5. CONTENT ANALYSIS:

### *5.1. Sustainable finance and green bonds*

Corporate green bonds are financial instruments whose proceeds are committed to financing environmental and climate-friendly projects, such as renewable energy, green building, or resource conservation (Flammer, 2021; Pan et al., 2023; Sun et al., 2023). Corporate green bonds were non-existent before 2013. It became popular recently due to the "green bond boom."[1]. The growth of the green finance market includes products like green bonds (Flammer, 2021), green credits (Chen et al., 2022), green guarantees (H. Cheng & Taghizadeh-Hesary, 2023), green buildings (Olubunmi et al., 2016) and green remittances (Mills, 2023). Moreover, the market of green bonds has also grown by other factors such as credit rating and liquidity (Dorfleitner et al., 2023; Nabeeh et al., 2021), coupon rate and collateral (Mills, 2023), investor willingness (Bužinskė & Stankevičienė, 2023; Poyser & Daugaard, 2023a; Y. Zhang, 2023) and government and institutional intervention in promoting green bonds and sustainable investment (Desalegn & Tangl, 2022; Flammer, 2021). This momentum growth is due to the growing literature examining the outcome of green bonds in different sectors and markets. Financing natural resource markets is becoming more prompted towards attaining environmental and economic objectives as the globe struggles to implement a sustainable and green recovery (J. Yan & Haroon, 2023). More enterprise participation is encouraged by granting access to green funding and maintaining market openness. This enables them to use green financial services to further their goals for sustainable development. It is ultimately agreed that environmental benefits and economic efficiency mostly contradict, and the only suitable modern solution is to ensure green economic growth.

### *5.2. Sustainable finance and financial technology*

Technology has become the engine of growth due to the increasingly global economy, and fintech, which refers to technology-based financial solutions, has played a significant role in this development (Arner et al., 2015). It has gained wide prominence in international financial markets and businesses and recently became widely used to enhance activities in the finance industry. The initial research on Fintech provided different perspectives, such as blockchain, cloud computing, and big data. etc., However, the application of Fintech and sustainable finance is still limited (Debrah et al., 2023). The COVID-19 pandemic has provided opportunities to rethink and explore the integration of sustainable finance and Fintech. Nevertheless, it has motivated the industrial presence and resource utilization (Hassan & Rabbani, 2020). The adoption of technology by tech firms has improved sustainability performance by increasing green financing and investments (C. Yan et al., 2022; Zhou et al., 2022). Mirza et al. (2023) recently claimed that Fintech is more inclusive and provides additional opportunities for dealing with financial constraints and cutting-edge financial instruments. It not only opens new sources of private cash for the financing of environmentally friendly and sustainable projects, but it can also assist clean technology by encouraging the adoption of voluntary sustainability norms of conduct (Metawa et al., 2022). Furthermore, Liu & You (2023) has explored Fintech's effect on

[1] (https://www.morganstanley.com/ideas/green-bond-boom)

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polluting firms' green finance in China. Xin et al., (2022) have discussed another aspect of financial technology: the digital transaction for sustainable corporate performance. Many studies have identified its favorable outcome regarding secure financial transactions, convenience, and affordability (Liu & You, 2023; Mirza et al., 2023; Zhou et al., 2022). However, there may be concerns that the Fintech is consuming more energy. Therefore, more research is required to reduce environmental costs and operations regarding carbon emissions. Additionally, using blockchain and AI technology, intelligent GF Fintech instruments may be created that serve as a key valuation tool for issuers and investors, reflecting the sustainable finance value in real time.

## 6. CONCLUSION, POLICY IMPLICATIONS, AND THE WAY FORWARD

This study provides a bibliometric and thematic analysis of sustainable finance and highlights the overall trends in research publications on sustainable finance. the keywords co-occurrence and thematic mapping underline the dominance of 'green finance,' 'sustainable finance,' and climate finance' as core research themes, with strong linkages with climate change and environmental sustainability. The findings reflect an increased global emphasis on aligning financial tools with sustainability-linked goals. Specifically, financial instruments such as green bonds and sustainable investment. This study highlights the overall increasing trends in research publications, the findings reflect growing literature of sustainable finance of increased awareness of environmental, social, and governance (Poyser & Daugaard, 2023b). Global collaboration is also explored, with China and the UK contributing immensely. Notably, among the top contributing institutions, eight belong to China. While, other Asian countries remain silent regarding the research on sustainable finance. Furthermore, the statistics from the bibliometric analysis show that the number of publications on sustainable finance has rapidly increased since 2015 and reached its peak in 2023. This could result from the Paris agreement and COVID-19 and other treaties on climate protection. Moreover, the findings of intellectual analysis indicate that Taghizadeh-history has the highest collaboration in the development of the field of sustainable finance. The keyword analysis shows that green finance has gained prominence along with sustainable finance. It ensures that sustainable, climate and green finance are used interchangeably. Moreover, the co-word analysis highlights the significance of keywords in the emerging and developed quadrants; from the results, it is important to note that climate finance adaptation and carbon finance need more attention.

It is important to reallocate financial resources to environmentally responsible and sustainable projects and programs that foster long-term economic growth while reducing the adverse effects of resource depletion and climate change (J. Yan & Haroon, 2023). This allocation must be directed towards sustainable projects and investments that mitigate the adverse effects of global challenges and stimulate long-term economic growth. These sustainable projects include energy efficiency (Pan et al., 2023), climate change adoption (S. L. Cheng et al., 2022), terrestrial and aquatic biodiversity conservation (Agosto et al., 2023), sustainable water conservation, green transportation (H. Cheng & Taghizadeh-Hesary, 2023) and circular economy adoption and the momentum market growth of green buildings (Olubunmi et al., 2016). However, there is debate

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on greenium or green premium, green loans, and green credit in the bond market, and the results are inconclusive because of methodological misspecifications (Debrah et al., 2023).

The findings emphasize the significant role of sustainable finance in achieving long-term ecological and environmental development goals with positive social impacts. This knowledge is valuable for private institutions, market regulators, and governments as they work towards more sustainable financial practices. The study significantly contributes to understanding the current state of sustainable finance research and identifies areas that require further research. It's worth noting that sustainable finance is still in its early stages of development, and there is much room for growth and advancement.

Future research in sustainable finance should concentrate on filling identified gaps and themes, such as circular economy financing, financial mechanisms to support biodiversity conservation, including investments in protected areas, and sustainable land use. Moreover, how can sustainable finance support sustainable practices within global supply chains? Explore the role of blockchain and digital technologies, the social impact bonds, and the integration of sustainable and behavioral finance.

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