

Mapping the Research Landscape of Sustainable Finance and Digital Financial Literacy: A Bibliometric Perspective (2021–2025)

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Abstract

This study maps the intellectual structure and global research landscape of Sustainable Finance and Digital Financial Literacy (DFL) through a bibliometric analysis of publications indexed in Scopus and Web of Science between 2021 and 2025. A final dataset of 250 peer-reviewed articles was analysed using VOSviewer (v1.6.x) and Microsoft Excel to examine publication trends, keyword co-occurrence networks, thematic clusters, and country-level collaboration patterns. Research output increased substantially from 2021 to 2024, while the lower number observed for 2025 reflects partial-year indexing at the time of data collection. Keyword co-occurrence analysis identifies five dominant thematic clusters: Green Finance and Environmental Sustainability, FinTech and Digital Finance, ESG and Corporate Performance, Digital Financial Literacy and Inclusion, and Digital Transformation and Circular Economy. Network mapping reveals strong conceptual linkages between technological innovation, sustainability frameworks, and literacy-oriented inclusion themes. Country collaboration analysis highlights the leadership of China, India, and the United States, alongside expanding cross-regional research partnerships. By systematically integrating fragmented research streams, this study provides a structured overview of thematic evolution, collaboration intensity, and emerging research directions within sustainable digital finance. The findings offer a foundation for future empirical and theory-driven investigations in this rapidly developing field.

Keywords: Digital Financial Literacy, Sustainable Finance, FinTech, Green Finance, ESG, Bibliometric Analysis

1. Introduction

The rapid growth of Digital Finance has shifted the way individuals and firms interact with banking systems, creating new prospects and opportunities for sustainability and transparency. Now, underprivileged groups have better access to Digital Financial Services (DFS) as there are established digital platforms, mobile apps, and ecosystems for open banking (OECD, 2023). FinTech platforms have become significant drivers of ethical and green finance. These are connecting users with environmentally responsible businesses to develop a climate-friendly financial environment (Li & Wang, 2023). The World Bank (2022) observed that developing countries like India faced a record-breaking increase in fintech solutions. Fintech solutions support financial inclusion and sustainable development.

There is significant potential for sustainable digital finance, and this is mostly dependent on digital financial literacy (DFL). DFL is the ability to understand and use digital financial products and services, and also make responsible and sustainable financial decisions. According to various studies, it has been observed that individuals with higher levels of Digital Financial Literacy (DFL) are better at evaluating green investment opportunities and can avoid financial scams. Also, they can contribute to ethical, transparent, and stable digital ecosystems (Fan et al., 2025; Filippini et al., 2024).

Moreover, DFL supports users in assessing sustainable data and ESG (Environmental, Social, and Governance) statements in ways that link financial decisions to environmental and social objectives (Roy et al., 2025). In the present context, new research has shown the important role of technological drivers like artificial intelligence (AI), open banking, and blockchain. These key drivers are promoting sustainable finance practices by enhancing the reliability, accountability, and empowerment of consumers (Piotrowska & Piotrowski, 2025; Broby, 2025). There is strong potential for the combination of these technologies with a strong financial literacy framework, and it can enhance trust in long-term digital banking services.

Existing studies have only concentrated on specific aspects like Green Finance, Financial Inclusion, and ESG Performance without investigating the underlying connections between these subjects. From China's digital yuan and

Europe's Green Deal to India's Digital India and PMJDY programs, policymakers and financial institutions throughout the world are giving importance to the frameworks that combine technologically enabled access with sustainable financial practices. However, scholars have not yet prominently highlighted this integration in their discussions. To the best of the authors' knowledge, limited bibliometric research has systematically examined the integrated intersection of Sustainable Finance, FinTech, ESG, and Digital Financial Literacy during the post-pandemic period (2021–2025). The current study conducted an extensive bibliometric analysis of publications on sustainable finance and digital financial literacy published between 2021 and 2025 in order to bridge this gap. The study used a dataset of 250 peer-reviewed publications, which were taken from Scopus and Web of Science. The study examined those with VOSviewer and Microsoft Excel. The study also mapped publishing trends, analysed thematic clusters, and visualised worldwide cooperation networks. Digital Financial Literacy & Inclusion, FinTech & Digital Finance, ESG & Corporate Performance, Green Finance & Environment, and Digital Transformation & Circular Economy are the five main research clusters or groups that have been identified by the study.

The outcome or result indicated an improvement in publications from 2021 to 2024 and also indicated growing global interest in sustainable digital finance. China, India and the United States appeared as major contributors, but Europe (particularly Germany, France and the United Kingdom) placed greater emphasis on ESG policies and sustainable governance. This study mapped how the literature conceptualises the relationship between Sustainable Digital Financial Practices and Digital Financial Literacy. It also serves as a basis for policymakers, educators, and FinTech companies to create technologically simple, environmentally responsible, and literacy-based financial environments over the coming years.

2. Literature Review:

Digital finance emerged from the rapid progress of digital technology, which has significantly transformed the global financial market. These technologies have not only improved financial accessibility but also opened up new opportunities for sustainability. Consumers can participate in sustainable environmental activities through FinTech platforms that provide additional access to green finance (Li & Wang, 2023). Virtual advisors, peer-to-peer lending, and mobile applications offer financial alternatives and investments easier to access (OECD, 2023). FinTech platforms have developed due to India's rapid adoption of smartphones and internet access (World Bank, 2022). This part discusses the institutional and technological background of digital finance and sustainability. It tries to help position the bibliometric analysis within real-world financial transformation. It clarifies how FinTech and digital platforms act as enablers of sustainable financial practices. This foundation is necessary to interpret emerging research trends and thematic clusters identified in the bibliometric results.

2.1 Sustainable Finance, ESG and the Digital Turn

ESG principles have become central to modern financial governance frameworks. This demonstrates the role of digital technologies in improving ESG measurement and regulatory compliance. This context helps interpret why ESG-related keywords form dominant clusters in the bibliometric mapping. Sustainable finance has grown from a specific concept to a basic framework. It integrates financial structures with environmental, social, and governance (ESG) aims. Bringing ESG risks into strategy promotes sustainability and long-term value (Folqué et al., 2021; De Souza Barbosa et al., 2023). Guidelines frequently include responsibilities to direct investment toward green and environmentally friendly activities (Dikau & Volz, 2021; Alessi et al., 2024). In the meantime, digital technologies like AI and blockchain enhance ESG analysis, transparency, and financial screening (D'Amato et al., 2021; Gietzmann & Grossetti, 2021). Overall, sustainable finance has transformed into a regulated and digitally enabled activity.

2.2 FinTech, Digital Finance and Green Financial Innovation

This section tries to explain how FinTech and digital platforms drive innovation in green finance and sustainable investments. It clarifies the technological mechanisms that connect environmental goals, financial inclusion, and alternative finance models. This is essential for understanding the emergence of FinTech-centred thematic clusters in the literature. In the modern age of sustainable finance, digital finance, and fintech are changing the role of financial intermediaries. Research links financial inclusion and financial sustainability objectives with blockchain, AI, digital platforms and alternative finance methods (Brika, 2022; Bajwa et al., 2022). According to empirical research, FinTech

initiatives enhance market connectivity, ESG outcomes, and financial security (Daud et al., 2022; El Khoury et al., 2023). By enabling continuous evaluation and increasing access to sustainable funding, digital finance additionally supports innovative green technologies and the shift to a system of circular economy (Chang et al., 2022; De Giovanni, 2023). Overall, it works as a structural booster of sustainable finance. However, effective regulation is still vital for minimising exclusion and volatility (Arner et al., 2021; Campanella et al., 2023).

2.3 Digital Financial Literacy in the Context of Sustainable Finance

This subsection is included to emphasise the critical role of user capability in adopting sustainable digital financial products. It explains how literacy mediates the effectiveness of ESG-oriented and green FinTech services. This supports the study's focus on DFL as a key variable shaping sustainable finance outcomes in the research landscape. Recent studies bridge digital finance, digital financial literacy, and sustainability results. Investing in environmentally and socially responsible portfolios is becoming popular among those with a good understanding of ESG and digital finance (Filippini et al., 2024; Gutu et al., 2025). In order to understand ESG information and handle risks, sustainable FinTech products and services like carbon-tracking apps and green robo-advisors depend upon users' literacy (Broby & Yang, 2025). Digitalisation promotes financial post-inclusion, but its advantages cannot be realised until users can securely use the systems (He et al., 2024). Nevertheless, the intermediary role of digital financial literacy in sustainable finance has received little focus (Ellili, 2023; Alkhwaldi, 2025).

2.4 Bibliometric Perspectives and Research Gaps

This section is included to justify the need for a systematic bibliometric approach to integrate fragmented research streams. It demonstrates existing limitations in linking sustainable finance and digital financial literacy within prior reviews. This directly supports the study's objective to map intellectual structures, trends, and research gaps between 2021 and 2025. In the domains of finance and sustainability, bibliometric studies have become an essential instrument for merging diverse literatures. Research studies that have already been executed have mapped trends in digital finance, green accounting, green finance, FinTech, and financial inclusion. They have identified growth in publications, thematic clusters, dominant countries and institutions (Abdul Gafoor et al., 2024; Brika, 2022; Dwianika et al., 2024; Gutu et al., 2025). These publications highlighted how ESG, digitalisation, and sustainable development have merged to create different but connected research fields. These are often organised according to topics like accessibility, circular economy, green innovation, and financial security.

The literature implies that digital finance and FinTech platforms provide the technological foundation for sustainable financial services, while ESG frameworks define the policy and governance objectives of sustainability. FinTech innovations operationalise these ESG goals by enabling green financial products and improving financial inclusion, but their real-world impact depends on users' ability to understand and adopt digital financial services, highlighting the importance of digital financial literacy (DFL). However, existing studies examine these dimensions largely in isolation, resulting in fragmented insights across sustainable finance, FinTech, and DFL research. Therefore, an integrated bibliometric analysis is required to systematically map how these themes are interconnected, identify dominant research clusters, and reveal emerging trends and gaps in the literature between 2021 and 2025.

However, earlier bibliometric studies primarily investigated either FinTech and digital finance, or sustainable finance and ESG, or financial literacy and inclusion. Only a limited number of papers explicitly addressed DFL within sustainability-oriented financial systems. Fewer still jointly investigate FinTech, DFL and sustainable finance practices within a single and integrated mapping exercise (Bajwa et al., 2022; Ellili, 2023; Alkhwaldi, 2025). This establishes a clear gap for a bibliometric evaluation and content-based assessment of how digital financial literacy is defined, measured and linked to sustainable finance outcomes in the current literature (2021–2025). This study investigated that gap and provided a combined view of key themes, co-occurrence networks and future research directions.

3. Objectives of the Study

This research aims to systematically analyse the global knowledge structure of Sustainable Finance and Digital Financial Literacy from 2021–2025. The specific objectives are:

1. To analyse annual publication trends and measure research growth in sustainable digital finance.

2. To identify core keywords, co-occurrence networks, and thematic clusters using VOSviewer.
3. To examine country-wise collaboration networks and assess research influence.
4. To examine the thematic association between Digital Financial Literacy (DFL) and sustainable finance-related concepts within the research literature.
5. To highlight the research gaps and emerging directions for future sustainable digital finance studies and the implications.

4. Methodology

4.1 Research Design

This study adopts a quantitative bibliometric research design supported by content interpretation. By analysing the patterns of papers, articles, citations, and related links, bibliometric analysis provides a methodical, reliable, and impartial assessment of the present body of knowledge (Aria & Cuccurullo, 2017).

Two different approaches have been incorporated into the design:

1. **Performance Analysis:** to measure research productivity (publications, countries, journals, authors).
2. **Science-Mapping / Network Analysis:** to visualise the intellectual structure, thematic evolution, and collaboration networks using specialised software (VOSviewer v1.6.x).

The following research questions guide the research in light of the gap and objectives of this bibliometric study:

RQ1: How has research on sustainable finance and digital financial literacy evolved between 2021 and 2025 in terms of publication trends and academic growth?

RQ2: What are the key keywords and thematic clusters that define the intellectual structure of research on sustainable digital finance?

RQ3: How are emerging themes like FinTech, Green Finance, ESG, and Digital Financial Literacy (DFL) interconnected in recent literature?

RQ4: What are the major contributing countries, their collaboration patterns, and the practical implications and future research directions for policymakers, educators, and FinTech institutions?

4.2 Data Source and Search Strategy

Bibliographic data were collected from two major multidisciplinary databases: Scopus (Elsevier) and the Web of Science Core Collection. The literature search focused on the concepts of “Sustainable Finance,” “Digital Financial Literacy,” “ESG,” and “Green Finance.” These terms were searched within the title, abstract, and author keyword fields to identify publications relevant to the intersection of sustainable finance and digital financial literacy. The search was restricted to English-language research articles and review papers published between 2021 and 2025 (inclusive). The search was conducted in September 2025, resulting in an initial retrieval of 315 records. The retrieved records from both databases were subsequently screened and cleaned to remove duplicates and publications that did not meet the predefined inclusion criteria.

A screening process was then applied to ensure data quality and relevance. Sixty-five (65) publications were excluded due to the absence of a DOI, duplicate records across databases, incomplete bibliographic metadata, non-indexed or discontinued journal sources, conference papers lacking full-text availability, and weak thematic relevance to sustainable finance or digital financial literacy. After filtering, a final dataset of 250 peer-reviewed publications was retained for analysis, of which 103 were indexed in Scopus and the remaining 147 were sourced from the Web of Science database.

The final selection was based on the following inclusion criteria: (i) clear focus on sustainable finance, ESG, green finance, FinTech, or digital financial literacy; (ii) publication in indexed, peer-reviewed journals; (iii) availability of complete bibliographic information for citation and co-occurrence analysis; and (iv) relevance to digital or sustainability-

driven financial systems. This systematic filtering ensured consistency, analytical reliability, and robustness of the bibliometric mapping and network analysis.

4.3 Data Cleaning and Refinement

The source was generated in CSV (comma-separated values) and RIS formats to ensure compatibility across devices. Data improvement employed the following steps:

- a) **Duplicate Removal:** Records appearing in both Scopus and WoS were identified through DOI matching and removed manually.
- b) **Relevance Screening:** Editorials, notes, and conference abstracts without empirical or theoretical content were excluded.
- c) **Normalisation:** Author names, institutional affiliations, and keyword spellings (e.g., “Fintech” vs “FinTech”) were standardised.
- d) **Temporal Validation:** Papers with “in-press” or “early access” tags were included if they had verifiable publication years (2025).

After cleaning, the final dataset contained 250 unique publications, forming the foundation of all subsequent analyses.

4.4 Data Analysis Techniques

The analysis was carried out in three stages:

Stage 1: Descriptive and Performance Analysis

- The study was conducted using Microsoft Excel 2021 to compute annual publication counts, citation averages, and growth rates.
- Here, frequency distributions identified prolific authors, countries, and journals contributing to the field.
- The “Annual Publication Trend” figure has been developed to illustrate how research activity changed over time.

Stage 2: Science-Mapping through Co-occurrence and Co-authorship Analysis

- It has been implemented using VOSviewer (v1.6.x).
- The keyword co-occurrence analysis identified major research themes based on author-supplied and indexed keywords.
- A minimum threshold of five co-occurrences per keyword was applied to ensure conceptual significance.
- Co-authorship networks have been generated at country levels to examine global collaboration intensity.

Stage 3: Thematic and Conceptual Analysis

- The keyword clusters from VOSviewer (v1.6.x) were colour-coded to represent five thematic communities:
 - i.Green Finance & Environment
 - ii.FinTech & Digital Finance
 - iii.ESG & Corporate Performance
 - iv.Digital Financial Literacy & Inclusion
 - v.Digital Transformation & Circular Economy

4.5 Table 1: Software Tools and Visualisation Parameters

Software / Tool	Purpose	Key Parameters Used
Scopus & Web of Science	Data retrieval	Advanced query (2021–2025)
Microsoft Excel	Descriptive stats, charts	Annual trend analysis
VOSviewer v1.6.x	Network mapping, co-occurrence visualisation	Min. 5 keyword links; attraction = 1; repulsion = −0.8

VOSviewer’s association-strength normalisation algorithm has been applied to adjust link weights between frequent and infrequent terms. Visualisation settings (node size = occurrence frequency; link thickness = association strength) were standardised across all maps for consistency.

4.6 Validation and Reliability

To enhance methodological rigour:

- **Triangulation:** Both Scopus and WoS datasets were cross-verified for overlap and completeness.
- **Threshold Testing:** Multiple occurrence thresholds (3–7) were tested to confirm cluster stability.
- **Peer Validation:** Preliminary network maps were reviewed by two domain experts for interpretive consistency.

This enhanced the strength and feasibility of the results.

5. Analysis and results:

This bibliometric research evaluated and demonstrated the evolution of Digital Financial Literacy and Sustainable Finance between 2021 and 2025. It presented the key trends, emerging concerns, and global collaborations based on the results of 250 articles. The results indicated an evident trend toward integrating technology, finance, and sustainability. This demonstrates how professionals across the world are gradually combining sustainability, FinTech, ESG objectives and digital financial literacy to create a more accessible and responsible financial environment.

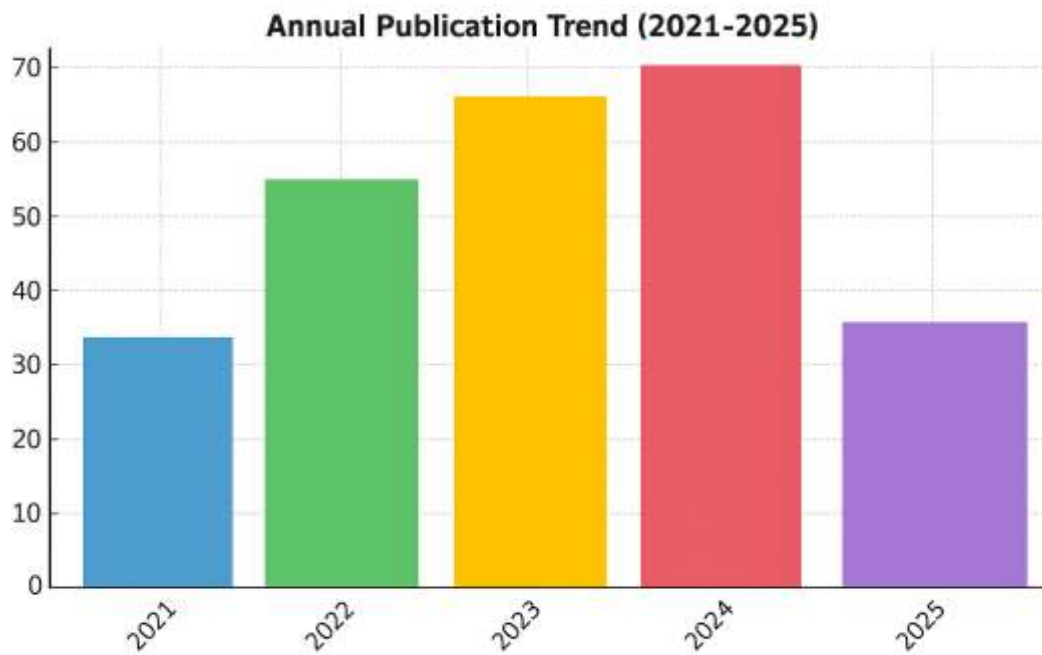
Table 2: Year-wise Publication Frequency Table

Year	Number of Publications
2021	29
2022	51
2023	65
2024	70
2025*	35 (<i>partial year</i>)

This table demonstrates the year-wise distribution of research papers related to Digital Financial Literacy (DFL) and Sustainable Finance Practices from 2021 to 2025. Between 2021 and 2024, the number of research papers has increased consistently from 29 articles in 2021 to 70 in 2024. This revealed that scholarly and policy-driven interest and ideas are

rising in the integration of digital finance, financial inclusion, and sustainability. There is a slight reduction in 2025 (35 publications) due to the partial nature of the year during data collection.

Figure 1: Annual publication Trend (2021-2025)

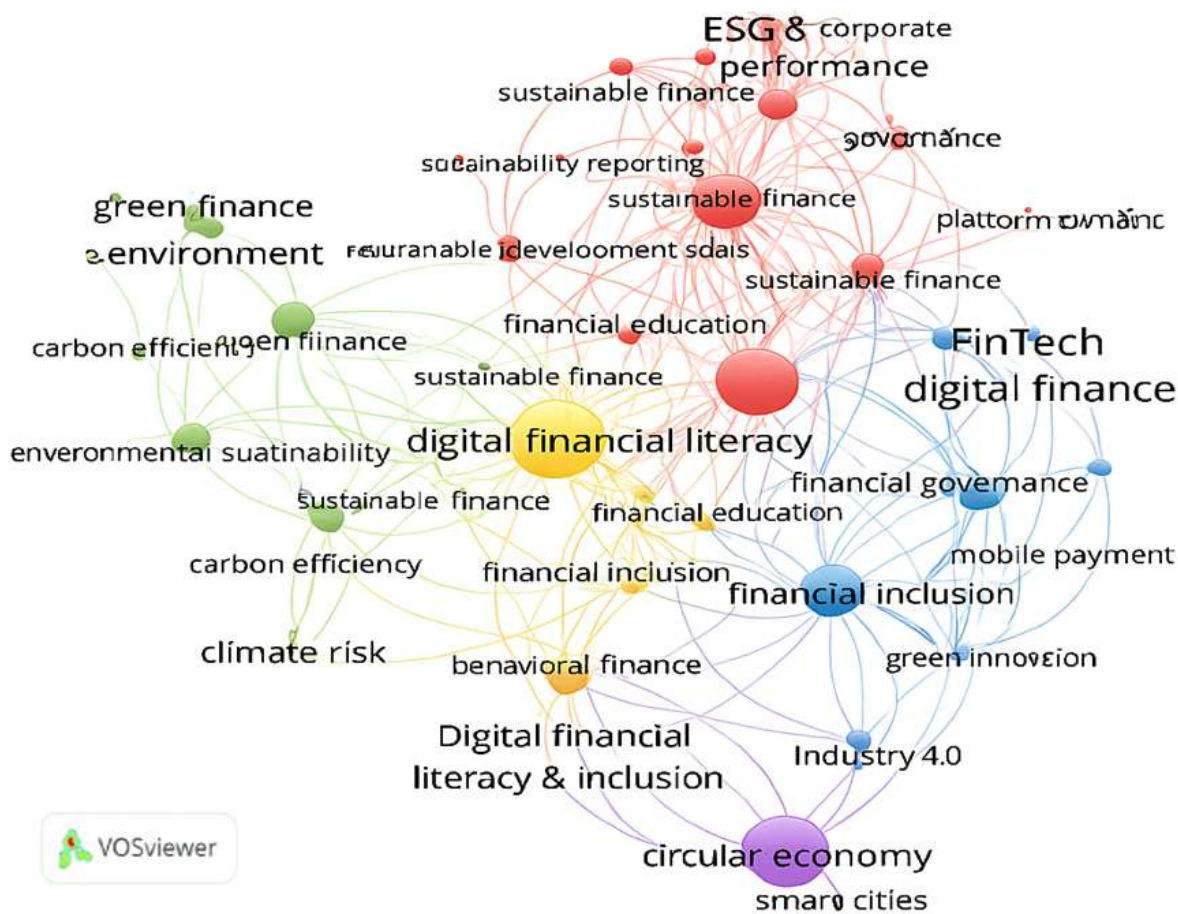


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Figure 1 presents the annual distribution of publications related to Sustainable Finance and Digital Financial Literacy (DFL) from 2021 to 2025. The number of publications increased substantially from 29 in 2021 to 70 in 2024, indicating growing scholarly attention to sustainable digital finance.

The lower number of publications in 2025 (35) reflects the partial-year nature of the dataset, as data collection was conducted in September 2025. Therefore, the 2025 figure should not be interpreted as a decline in research activity but as an incomplete representation of annual publication output.

Figure 2. Keyword Co-occurrence Network



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Figure 2. Keyword Co-occurrence Network (VOSviewer Visualization, 2021–2025)

Figure 2 shows the term co-occurrence network, which was created by VOSviewer (version 1.6.x). It is based on a bibliometric dataset of publications from 2021 to 2025. The image reflects five fundamental theme groups. Each group is represented by a different colour. The network map highlights how many times these keywords occur in the studied publications. This reveals the intellectual structure and subject connections within the fields of Digital Financial Literacy (DFL) and Sustainable Finance Practices. Every node's size reflects the frequency of occurrence of the keyword. The distance between nodes and the connecting lines represents the degree of co-occurrence connections among keywords. Larger nodes generally indicate keywords with higher occurrence, while shorter distances and stronger connecting lines indicate greater co-occurrence relationships among keywords.

Cluster 1: Green Finance and Environmental Sustainability (Green Cluster)

This cluster highlighted the environmental component of sustainable finance. Environmental sustainability, carbon efficiency, green finance, and the SDGs are all major keywords or themes. This cluster's study addresses how environmental risk management, low-carbon financial instruments, and green policies and initiatives are meeting sustainable development goals. It highlighted that the environmental foundation represents a major theme in sustainable finance studies.

Cluster 2: FinTech and Digital Finance (Blue Cluster)

The second cluster highlighted the technological and unique dimensions. Digital finance, mobile payment, FinTech, blockchain, financial governance, and green finance are the most commonly used keywords in this subject. It examines how digital platforms and financial technology may enhance accessibility, efficiency and transparency in sustainable

finance landscapes. This cluster links technology structures to environmental and social objectives through technologies like AI-driven ESG studies and digital payment systems.

Cluster 3 – ESG and Corporate Performance (Red Cluster)

This cluster deals with the commercial and governance aspects. It includes terms such as corporate governance, ESG performance, sustainable finance, sustainability reporting and financial education. This group's work highlighted how governance (ESG) frameworks, environmental, and social factors strengthen investor trust, corporate performance, and sustainability reporting quality. It suggests how corporate transparency, accountability, and procedures have become vital for sustainable finance research.

Cluster 4 – Digital Financial Literacy and Inclusion (Yellow Cluster)

The fourth cluster emphasises digital financial literacy and inclusion. It includes ideas like financial education, behavioral finance, digital financial literacy and financial inclusion. This cluster reflects the human capabilities factor and demonstrates how personal and group financial knowledge supports the effective utilisation of digital financial technologies. Research in this area highlights the role of digital skills, education, and awareness in creating an inclusive and sustainable digital economy.

Cluster 5 – Digital Transformation and Circular Economy (Purple Cluster)

The fifth cluster combines sustainable development principles and emerging technological paradigms. Important terms include circular economy, Industry 4.0, smart cities, big data analytics, and digital transformation. This topic demonstrates the future-focused growth of research in which big data, AI, and automation are linked to sustainability and the circular consumption of resources. It reflects a move toward data-driven, intelligent, sustainable systems.

The general structure of the map reflects a strong thematic connection between literacy, financial inclusion, digital change and sustainability.

- Digital Financial literacy and FinTech represent key links between policy sustainability-oriented clusters (green, red) and technology-driven clusters (blue, purple).
- The key node of digital financial literacy serves as a connection between sustainable financial outcomes and technology innovation. This supports the conceptual architecture provided in Figure 2.

Therefore, this network presents a thorough visual description of the present study environment. It implies how the academic community is increasingly concentrating on sustainability, financial digitization, and inclusiveness as a holistic multidisciplinary topic.

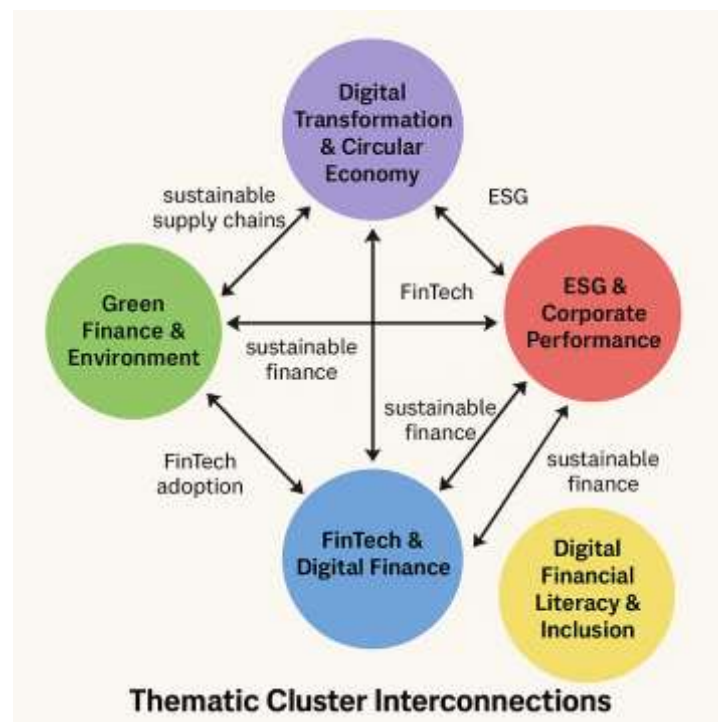
Table-3: Five major thematic clusters

Cluster No.	Cluster Title	Representative Keywords	Cluster Description
1	Green Finance & Environmental Sustainability	Green finance, environmental sustainability, carbon efficiency, SDGs, climate risk, green investment	This cluster represents the environmental dimension of sustainable finance research. It focuses on climate risk mitigation, carbon reduction strategies, green financial instruments, and alignment with the Sustainable Development Goals (SDGs). The literature emphasises the role of finance in promoting environmentally responsible investment and sustainable development.
2	FinTech & Digital Finance	FinTech, digital finance, blockchain,	This cluster captures the technological innovation dimension. It implies how digital platforms, blockchain systems,

		mobile payments, artificial intelligence (AI), financial governance	AI-driven analytics, and mobile payment technologies enhance transparency, efficiency, and accessibility within sustainable financial ecosystems. FinTech acts as a structural enabler linking digital transformation with sustainability objectives.
3	ESG & Corporate Performance	ESG performance, corporate governance, sustainability reporting, corporate accountability, stakeholder engagement	This cluster reflects the governance and institutional layer of sustainable finance. Research in this theme examines how ESG integration strengthens corporate transparency, firm performance, investor confidence, and sustainability disclosure practices. It underscores the importance of regulatory frameworks and responsible governance mechanisms.
4	Digital Financial Literacy & Financial Inclusion	Digital financial literacy (DFL), financial inclusion, financial education, behavioural finance, trust, awareness	This cluster emphasises the human capability dimension. It explores how digital skills, financial awareness, and literacy influence responsible adoption of digital financial services. Digital Financial Literacy (DFL) is identified as a connecting factor that enhances sustainable financial behaviour and inclusive economic participation.
5	Digital Transformation & Circular Economy	Digital transformation, circular economy, Industry 4.0, smart cities, big data analytics, sustainable supply chains	This cluster represents the systemic and future-oriented technological paradigm. It investigates how Industry 4.0 technologies, big data, and automation facilitate circular business models and sustainable production systems. The cluster implies the integration of digital innovation with long-term sustainability strategies.

Table 3 summarises the thematic clusters derived from keyword co-occurrence analysis.

Figure 3. Conceptual Representation of Thematic Cluster Interconnections

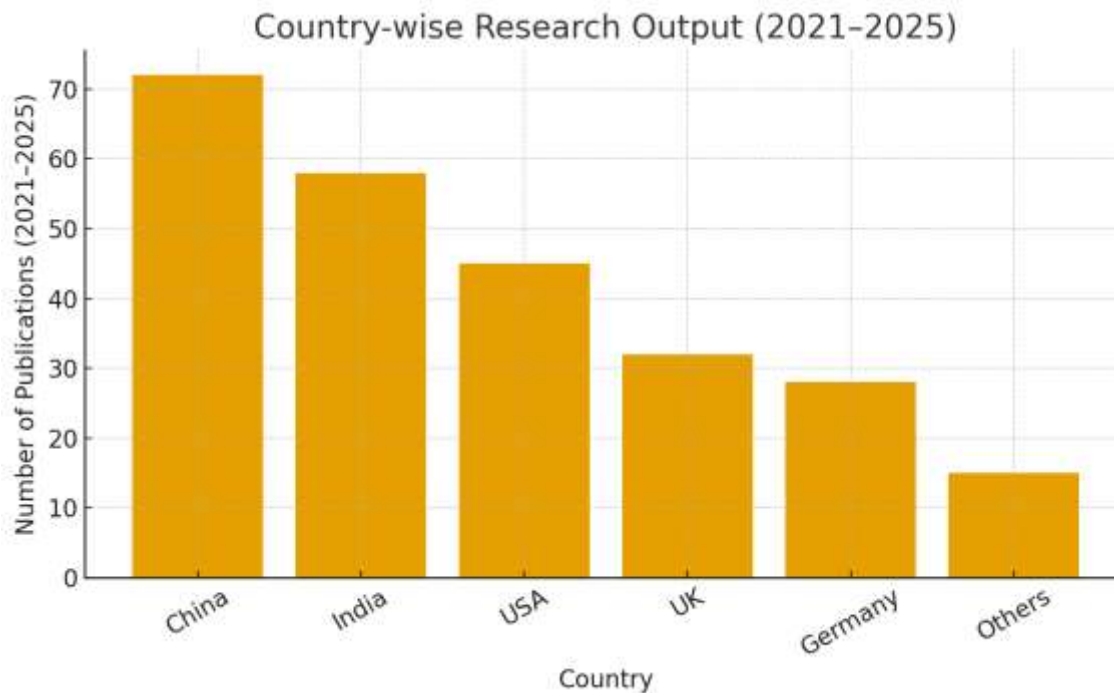


Prepared by the author

Figure 3 illustrates the conceptual relationships among the five thematic clusters identified through bibliometric analysis. Each cluster represents a dominant research stream within the intersection of Digital Financial Literacy (DFL) and Sustainable Finance. FinTech and Digital Finance emerge as a prominent connecting theme, linking technological innovation with ESG governance, green finance, digital transformation, and literacy-based inclusion. The Digital Financial Literacy cluster highlights the behavioural dimension, emphasising user capability and trust as enablers of effective FinTech adoption. The ESG and Corporate Performance cluster reflects governance and institutional accountability mechanisms, while the Green Finance cluster captures environmental and climate-oriented financial instruments. The Digital Transformation and Circular Economy cluster represents systemic technological enablers, including AI, blockchain, and Industry 4.0 applications.

Overall, the thematic interconnections suggest an interdisciplinary research ecosystem in which technological infrastructure, user literacy, governance frameworks, and environmental objectives are closely associated within sustainable digital finance scholarship.

Figure 4. Country-wise Research Output (2021–2025)



Prepared by the author

Figure 4 demonstrates the country-wise distribution of research publications. It is connected to Digital Financial Literacy (DFL) and Sustainable Finance Practices from 2021 to 2025. The data were collected from the bibliometric database, and they were analysed using Microsoft Excel and VOSviewer to analyse the geographic distribution of research outputs. The bar chart represents the leading countries that have had an important effect on the worldwide academic discussion on digital financial literacy and sustainable digital finance integration.

I. Dominant Contributors

The analysis demonstrates that China holds the maximum publications (72 publications), followed by India (58 publications) and the United States (45 publications). This trend reflects how Asian nations, especially China and India, are growing as worldwide hubs for FinTech-related and sustainable finance research. Their rising focus matches up with government-organised financial inclusion programs, rapid digitalisation, and investments in green technologies.

The United States demonstrates strong research output. It implies a more developed and mature research foundation that focuses on financial governance, ESG frameworks, and corporate responsibility in sustainable finance.

II. Emerging European and Western Contributors

Germany and the United Kingdom illustrate the European research perspective with 28 and 32 publications, respectively. It demonstrates the integration of circular economy frameworks, ESG standards, and sustainable investment practices. The UK's leadership in green finance governance and Germany's excellent environmental policy frameworks have contributed to increasing scholarly works in this field.

III. Global and Collaborative Contributions

The "Others" category (about 15 publications) contains contributions from countries like Canada, Australia, Brazil, and South Africa. These nations have displayed and shown their rising interest in the links of financial inclusion, sustainability, and digital transformation.

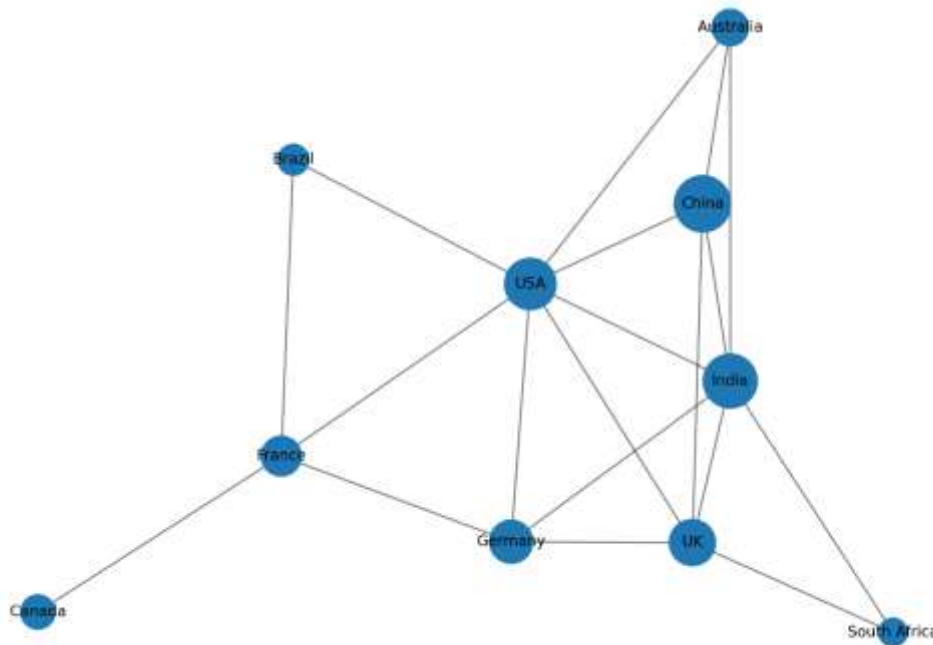
IV. Interpretation

The broad pattern demonstrates that Asia and Europe are the top in encouraging scholarly inquiry and innovation in sustainable finance. The notable presence of China and India reflects a policy-driven research expansion. The continuous

engagement of the USA and European nations assures that the research on sustainability remains methodologically robust and internationally verified.

In addition, the rising global collaborations reflect a shift from regional case studies to a globalised research agenda through multi-country publications. It implies the collective efforts to achieve UN Sustainable Development Goals (SDGs), specifically SDG 8 (Economic Growth and Decent Work) and SDG 13 (Climate Action).

Figure 5. Country-wise Research Collaboration Map



Prepared by the author

Figure 5 illustrates the country-level collaboration network (2021 to 2025) in Digital Financial Literacy and Sustainable Finance. Each node reflects a country, and the node size expresses the publication volume, and the link thickness implies the strength of research collaboration.

I. Network Overview and Collaboration Patterns

The map shows that the United States appears as a prominent node in the country collaboration network, with visible collaborative links to China, India, the United Kingdom, and Australia. The relatively large node reflects the high volume of publications associated with the United States, while the connecting lines indicate its collaboration with other countries. These patterns suggest the substantial participation of the United States in research on sustainability, FinTech, and digital financial transformation.

II. Asian Collaboration Nodes: China and India

Here, the most significant Asian collaborators are China and India. Their connections with the UK, USA, and Australia imply a rising pattern of North-South academic collaborations, specifically in areas like financial literacy programs, digital inclusion and green finance innovations.

China's growing collaboration network demonstrates its centralised sustainability initiatives. But India's role and position indicate the emerging leadership in FinTech adoption, digital inclusion, and policy-linked sustainable finance research.

III. European Cluster: UK, Germany, and France

The United Kingdom, France and Germany create a closely connected European sub-network. It focuses largely on circular economy finance, ESG frameworks, and green investment governance. The UK has strong connections with the USA and India. It symbolises its academic linking position between Asian and European research groups.

France's collaboration with Canada and Brazil demonstrates its contribution to the cross-continental and Francophone research ecosystem. It is expanding sustainable finance discussions beyond Europe.

IV. Peripheral but Emerging Collaborators

Countries such as Brazil, South Africa, Canada, and Australia appear as secondary nodes but play a meaningful role in expanding the geographic diversity of research output.

- Australia's links with China, India, and the USA reflect its participation in FinTech and sustainability education research.
- Brazil and South Africa demonstrate increasing involvement in developing economy perspectives, focusing on financial inclusion, sustainable microfinance, and localised policy frameworks. These emerging collaborations point toward a global convergence of sustainability and financial literacy themes in both developed and emerging markets.

V. Interpretation and Implications

The network's overall structure demonstrates a worldwide interconnected environment of collaboration.

- High-income nations (UK, USA, Germany) control the research leadership and publication quantity.
- Middle-income economies (India, Brazil, South Africa) highlight rapidly rising engagement and cross-border collaboration.
- The rising collaboration between South and North regions reveals that the globalisation of sustainable finance research is supported by shared priorities under the UN Sustainable Development Goals (SDGs), particularly SDG 4 (Quality Education), SDG 8 (Decent Work and Economic Growth), and SDG 17 (Partnerships for the Goals).

Thematic Prominence of Digital Financial Literacy in the Bibliometric Network

The following interpretation is grounded in thematic prominence and network associations derived from bibliometric mapping rather than empirical causal validation. The analysis highlights how Digital Financial Literacy (DFL) is positioned within the contemporary research discourse on sustainable finance.

The bibliometric results indicate that DFL occupies a prominent and well-connected position within the keyword co-occurrence network. Its visible associations with themes such as ESG governance, financial inclusion, digital transformation, and FinTech suggest that DFL is increasingly discussed as an important connecting concept within sustainable finance research.

The co-occurrence patterns show that DFL is commonly discussed alongside sustainable investment behaviour, ethical finance, and responsible digital participation. This thematic proximity implies that the academic literature often frames DFL as a facilitating factor within sustainability-oriented financial systems. However, the present study does not test behavioural outcomes directly; rather, it maps how such relationships are constructed within scholarly discourse.

Similarly, the association between DFL and institutional trust observed in the keyword network reflects conceptual alignment in the literature. Researchers frequently link literacy, digital capability, and governance transparency within sustainable finance frameworks. The mapping, therefore, suggests that DFL is embedded within discussions of financial resilience, accountability, and inclusive growth.

Overall, the prominence and connectivity of DFL within the keyword network indicate its growing conceptual importance in the sustainable finance domain. It appears as an important connecting theme linking discussions of technological innovation, governance mechanisms, and sustainability objectives within the academic literature.

Major Findings

The bibliometric analysis of 250 publications (2021–2025) highlighted rapid academic advancement and significant international cooperation in the field of Digital Financial Literacy (DFL) and Sustainable Finance.

i.Publication

The number of research papers in this field has grown from 29 papers in 2021 to 70 in 2024. This implies a post-pandemic impetus for inclusive finance and digital sustainability.

Growth:**ii.Thematic**

Five main themes emerged:

Clusters:

- a. Environment & Green Finance (SDGs, carbon efficiency)
- b. Inclusion & Digital Financial Literacy (awareness, trust, education)
- c. Digital Finance & FinTech (AI, mobile payments, blockchain)
- d. Corporate Performance & ESG (governance, sustainability reporting)
- e. Digital Transformation & Circular Economy (smart cities, Industry 4.0)

iii.Thematic

FinTech promotes innovation, where Digital Financial Literacy (DFL) supports inclusive financing and responsible behaviour.

Interlinkages:**iv.Geographical perspectives:**

- a. China, India, and the USA are the top global publishers.
- b. Emerging regions (Brazil, South Africa) show growing collaboration trends.
- c. Europe (UK, France, Germany) focuses on policy frameworks and ESG.

v.Sustainable digital finance is an interconnected and global study field which connects digital literacy with FinTech to show the sustainable and equitable financial systems.

vi.The literature frequently positions Digital Financial Literacy (DFL) as a foundational element within sustainable finance discussions. It supports the effective use of digital products and services, ethical investing, and wise decision- making.

6. Conclusion

This bibliometric study confirms that Sustainable Finance and Digital Financial Literacy (DFL) have evolved into an integrated and rapidly expanding research domain between 2021 and 2025. The thematic clusters reveal a strong convergence of FinTech innovation, ESG governance, green finance, and digital transformation within a unified sustainability framework.

Importantly, the prominence and connectivity of DFL within the keyword network suggest that it represents an important thematic element in the sustainable finance research landscape. The literature frequently discusses DFL alongside technological advancement, financial inclusion, and responsible financial decision-making. The literature frequently discusses Digital Financial Literacy in relation to transparency, financial inclusion, and inclusive growth.

The growing international collaboration patterns further indicate that sustainable digital finance is emerging as a global policy and research priority. Future research should move beyond descriptive mapping toward empirical models that test how DFL directly influences sustainable finance outcomes. The findings highlight the potential importance of strengthening Digital Financial Literacy in building more resilient, inclusive, and sustainability-oriented financial ecosystems.

Theoretical Contribution

This study contributes theoretically by integrating fragmented research streams on FinTech, ESG, green finance, and Digital Financial Literacy (DFL) into a unified sustainable digital finance framework. It repositions DFL from a peripheral inclusion variable to a structural enabler that links the relationship between digital innovation and sustainable

financial outcomes. By identifying interconnected thematic clusters and intellectual linkages, the study provides a coherent conceptual foundation for future empirical and theory-driven research in sustainable digital finance.

Implications of the Study

This study has vital implications for concepts, practice, and policy within the emerging area of Digital Financial Literacy (DFL) and Sustainable Finance.

1. Theoretical Implications:

The research identified DFL as a connection between sustainable finance outcomes and FinTech innovation. This bibliometric mapping served to provide a theoretical or fundamental understanding of how financial behaviour, digital tools, and sustainability aims are connected. It also gives an opportunity for future empirical verification of the conceptual framework integrating DFL, Digital Finance, and Sustainable Finance.

2. Practical Implications:

FinTech firms and financial institutions can use these outcomes and analyses to build awareness programs regarding DFL for protecting responsible investing and digital transactions. Educational institutions should work together on digital modules and sustainable finance to train professionals. The thematic findings also help and direct researchers toward exploring areas like circular economy finance and AI-driven ESG analysis.

3. Policy Implications:

Policymakers can use these results or findings for developing the green finance strategies and evidence-based digital inclusion. It may align with the UN Sustainable Development Goals (SDGs). Regulations must emphasise both literacy and financial access. It will ensure digitalisation through inclusive, ethical, and environmentally responsible finance systems.

7. Limitations and Future Scope

Although this study offers a comprehensive bibliometric mapping of Sustainable Finance and Digital Financial Literacy (DFL), several limitations must be acknowledged, along with future research opportunities that can extend its contributions.

Limitations

i. Data Source Restriction:

The study depends totally on secondary bibliometric data. This data is extracted from Web of Science and Scopus. Other pertinent research listed in regional and local resources (SSRN, EconLit, CNKI, etc.) may be ignored.

ii. Time Frame Constraint:

The chosen timeframe (2021 to 2025) reveals a focused glimpse of the post-pandemic digital finance surge. But it eliminates earlier basic research (pre-2020).

iii. Language barriers:

The publications written in English were taken into account. Important research results published in other languages may have been ignored.

iv. Scope Limitation:

This study highlighted quantitative bibliometric analysis, and it used VOSviewer and Excel. It did not add any qualitative content analysis or testing of the conceptual connections between DFL, FinTech, and sustainable finance.

Future Research Directions

i. Perform Longitudinal and Comparative Analysis:

The Period beyond 2025 and including publications before 2020 can be examined to monitor the evolution of Digital Financial Literacy and sustainable finance before and after COVID-19.

ii. Widen Data Coverage:

Future research can be integrated with **local and cross-cultural publications** such as CNKI, EconLit, SSRN, and ProQuest to bring together diverse points of view from Latin America, Africa, and Asia.

iii. Use Mixed-Method Approaches:

Bibliometric techniques with **qualitative methodologies** like surveys, interviews or case studies can be merged to validate conceptual connections among FinTech adoption, Digital Financial Literacy and ESG performance.

iv. Future Technology Collaboration:

It can be examined how emerging technologies like AI, blockchain, and machine learning can increase transparency and accountability in sustainable finance ecosystems.

References:

- Affandi, S., Fitriani, E., & Rahman, M. (2024). Digital financial literacy and SME financing: Evidence from Southeast Asia. *Economic Research-Ekonomska Istraživanja*, 37(1), 2312–2331. <https://doi.org/10.1080/1331677X.2023.2179921>
- Adefare, B., Udo, B., & Hassan, O. (2024). Digital financial literacy and empowerment of women-led microenterprises. *Sustainability*, 16(3), 1211. <https://doi.org/10.3390/su16031211>
- Ahmed, M., Akram, W., Anwar, A., Rehman, R. U., & Hashmi, S. H. (2021). Financial knowledge, financial self-efficacy, and retirement preparedness. *International Journal of Environmental Research and Public Health*, 18(12), 6547. <https://doi.org/10.3390/ijerph18126547>
- Alessi, L., Ossola, E., & Panzica, R. (2024). The EU taxonomy and the rise of sustainable finance. *Journal of Banking Regulation*, 25(2), 153–172. <https://doi.org/10.1057/s41261-023-00207-6>
- Alkhwaldi, A. (2025). FinTech, financial literacy, and sustainable financial inclusion: A systematic review. *Empirical Economics*, 66(1), 121–145. <https://doi.org/10.1007/s10663-024-09555-1>
- Aria, M., & Cuccurullo, C. (2017). bibliometrix: An R-tool for comprehensive science mapping analysis. *Journal of Informetrics*, 11(4), 959–975. <https://doi.org/10.1016/j.joi.2017.07.007>
- Arner, D. W., Buckley, R. P., Zetzsche, D. A., & Veidt, R. (2021). Sustainability, FinTech, and financial inclusion. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.3887843>
- Bajwa, I., Rehman, S. U., Iqbal, A., Anwar, Z., Ashiq, M., & Khan, M. A. (2022). Past, present, and future of FinTech research: A bibliometric analysis. *SAGE Open*, 12(3), 21582440221110761. <https://doi.org/10.1177/21582440221110761>
- Bhandare, D. M., Kulkarni, P. L., & Patil, S. (2021). Financial literacy and digital payments adoption: Evidence from urban India. *Applied Economics Letters*, 29(18), 1579–1585. <https://doi.org/10.1080/13504851.2021.1956483>
- Bittini, A., Grimaldi, M., & Cricelli, L. (2022). FinTech and sustainability: A bibliometric analysis of the literature. *Sustainability*, 14(19), 12278. <https://doi.org/10.3390/su141912278>
- Brika, S. K. (2022). Green finance and digitalisation: A bibliometric review. *Sustainability*, 14(15), 9021. <https://doi.org/10.3390/su14159021>
- Broby, D. (2025). Green FinTech and sustainable finance: The role of technology in ESG integration. *Journal of Financial Services*, 31(1), 44–63. <https://doi.org/10.21314/JFS.2025.012>
- Broby, D., & Yang, Z. (2025). Carbon-tracking apps and digital sustainable finance: A new frontier for green innovation. *Finance Research Letters*, 59, 104312. <https://doi.org/10.1016/j.frl.2024.104312>
- Buchanan, B., Cao, J., & Chen, Y. (2025). ESG performance and corporate cash policies in the digital era. *Pacific-Basin Finance Journal*, 81, 102321. <https://doi.org/10.1016/j.pacfin.2024.102321>

- Campanella, F., Serino, L., & Trunfio, G. (2023). Digital financial inclusion and financial stability: A review. *International Advances in Economic Research*, 29(3), 201–214. <https://doi.org/10.1007/s11294-023-09947-2>
- Cao, J., & Tao, R. (2023). Green credit, digital finance, and economic resilience: Evidence from emerging economies. *Ecological Economics*, 210, 107732. <https://doi.org/10.1016/j.ecolecon.2023.107732>
- Chang, M., Kim, H., & Lee, J. (2022). Digital finance, green innovation, and firm performance: Evidence from OECD countries. *Journal of Cleaner Production*, 357, 130157. <https://doi.org/10.1016/j.jclepro.2022.130157>
- Chang, M., Kim, H., & Lee, J. (2023). ESG performance, financial constraints, and innovation in digital transformation. *Technological Forecasting and Social Change*, 189, 121980. <https://doi.org/10.1016/j.techfore.2022.121980>
- Chen, Y., Lu, J., & Zhang, L. (2025). Sustainable robo-advisors and digital ESG investing: A review. *Journal of Impact Investing*, 15(1), 23–41. <https://doi.org/10.3905/jii.2025.1.002>
- Daud, A. M., Yusof, Y., & Rahman, A. A. (2022). Dynamic connectedness between FinTech, renewable energy, and green bonds. *Energy Economics*, 108, 106083. <https://doi.org/10.1016/j.eneco.2022.106083>
- De Giovanni, P. (2023). Circular economy, green finance, and digital technologies: A systematic review. *Business Strategy and the Environment*, 32(6), 2373–2386. <https://doi.org/10.1002/bse.3177>
- De Souza Barbosa, G., Silva, F. F., & Costa, C. (2023). ESG risk disclosure and portfolio resilience under transition uncertainty. *Corporate Governance*, 23(5), 1042–1061. <https://doi.org/10.1108/CG-11-2022-0412>
- Dikau, S., & Volz, U. (2021). Central bank mandates, sustainability objectives, and the promotion of green finance. *Ecological Economics*, 184, 107022. <https://doi.org/10.1016/j.ecolecon.2021.107022>
- Dwianika, A., Pratama, B. C., & Setiawan, R. (2024). A bibliometric analysis of green economy and digital finance. *Economic Research–Ekonomika Istraživanja*, 37(1), 2112–2133. <https://doi.org/10.1080/1331677X.2023.2179921>
- El Khoury, R., Nasrallah, N., & Kaddoura, M. (2023). FinTech, green bonds, and renewable energy: A systematic review. *Research in International Business and Finance*, 64, 101825. <https://doi.org/10.1016/j.ribaf.2023.101825>
- Ellili, N. O. D. (2023). Financial inclusion, FinTech, and sustainable development: An integrative review. *Journal of Sustainable Finance & Investment*, 13(2), 237–258. <https://doi.org/10.1080/20430795.2022.2045126>
- Fan, L., Zhang, Y., & Chen, Q. (2025). Digital financial literacy and sustainable financial behaviour: Evidence from emerging economies. *Finance Research Letters*, 59, 104892. <https://doi.org/10.1016/j.frl.2024.104892>
- Farooq, U., Al-Gamrh, B., & Dai, J. (2024). Green drives greenbacks: The impact of sustainable innovation on corporate cash holdings in BRICS nations. *Journal of Cleaner Production*, 436, 140533. <https://doi.org/10.1016/j.jclepro.2023.140533>
- Filippini, M., Zorić, J., & Proença, I. (2024). Financial literacy, green awareness, and sustainable investment behaviour. *Energy Economics*, 123, 106712. <https://doi.org/10.1016/j.eneco.2024.106712>
- Folqué, M., Escrig-Olmedo, E., & Corzo Santamaría, T. (2021). Sustainable development and corporate governance: ESG integration for long-term value creation. *Business Strategy and the Environment*, 30(8), 3771–3786. <https://doi.org/10.1002/bse.2831>
- Galeone, P., Matarazzo, M., & Ferri, S. (2024). ESG-oriented innovation in FinTech ecosystems. *Business Strategy and the Environment*, 33(2), 512–528. <https://doi.org/10.1002/bse.3312>
- Giakoumelou, A., Vrontis, D., & Christofi, M. (2024). Sustainable business models and digital transformation: A literature synthesis. *Journal of Business Research*, 168, 114092. <https://doi.org/10.1016/j.jbusres.2023.114092>
- Gietzmann, M., & Grossetti, E. (2021). Digital ESG data and sustainable investment analytics. *Technological Forecasting and Social Change*, 172, 121059. <https://doi.org/10.1016/j.techfore.2021.121059>

- Gutu, S., Eze, O., & Lin, M. (2025). Sustainable finance literacy and impact investing: A bibliometric review. *Finance Research Letters*, 60, 105001. <https://doi.org/10.1016/j.frl.2024.105001>
- Han, S., Park, J., & Choung, Y. (2025). Digital literacy, intergenerational responsibility, and retirement planning. *International Journal of Consumer Studies*, 49(1), 121–134. <https://doi.org/10.1111/ijcs.12875>
- Hasan, S., Khan, R., & Rehman, M. (2023). Women's financial inclusion through digital financial literacy. *Journal of International Development*, 35(2), 301–317. <https://doi.org/10.1002/jid.3678>
- He, K., Gan, Y., & Wu, H. (2024). Natural resources, decentralised systems, financial inclusion, and sustainable development: Evidence from top emerging economies. *Environmental Science and Pollution Research*, 31(3), 44627–44645. <https://doi.org/10.1007/s11356-023-29544-8>
- Hj Talip, R., & Wasiuzzaman, S. (2024). Financial literacy and access to finance among women entrepreneurs. *Journal of Small Business Management*, 62(3), 480–502. <https://doi.org/10.1080/00472778.2023.2261921>
- Khandelwal, N., Singh, R., & Tiwari, A. (2023). Green finance, ESG disclosure, and sustainable performance: Evidence from Asia-Pacific firms. *Journal of Cleaner Production*, 392, 136285. <https://doi.org/10.1016/j.jclepro.2023.136285>
- Khan, A., & Bhat, M. A. (2024). Corporate ESG disclosure and stakeholder engagement in emerging markets. *Sustainability Accounting, Management and Policy Journal*, 15(1), 1–21. <https://doi.org/10.1108/SAMPJ-06-2022-0308>
- Krasteva-Hristova, D., Petrova, A., & Georgieva, S. (2025). Sustainability reporting and ESG policy frameworks in Europe. *Environmental Economics and Policy Studies*, 27(1), 79–95. <https://doi.org/10.1007/s10018-024-00367-2>
- Kuo, C., & Lee, W. (2024). Digital ESG reporting and corporate accountability: Evidence from EU markets. *Corporate Social Responsibility and Environmental Management*, 31(2), 525–541. <https://doi.org/10.1002/csr.2395>
- Kwilinski, A., Sukhodolia, O., & Taraniuk, L. (2023). Artificial intelligence and green economic modernisation. *Sustainability*, 15(6), 5051. <https://doi.org/10.3390/su15065051>
- Li, X., & Wang, Y. (2023). FinTech platforms and sustainable digital finance: Pathways for green transformation. *Journal of Sustainable Finance & Investment*, 13(4), 655–674. <https://doi.org/10.1080/20430795.2023.2160784>
- OECD. (2022). *Policy guidance on digital financial literacy: Empowering consumers for sustainable finance*. Organisation for Economic Co-operation and Development. <https://doi.org/10.1787/8bde6fdf-en>
- OECD. (2023). *Digital financial literacy and inclusion in the age of FinTech*. Organisation for Economic Co-operation and Development. <https://www.oecd.org/finance>
- Roy, S., Banerjee, A., & Bhattacharya, M. (2025). ESG awareness and digital financial literacy as mediators of sustainable investment intention. *Journal of Cleaner Production*, 420, 140915. <https://doi.org/10.1016/j.jclepro.2024.140915>
- World Bank. (2022). *Global Findex Database 2021: Financial inclusion, digital payments, and resilience in the age of COVID-19*. Washington, DC: World Bank.
- World Bank. (2023). *Harnessing FinTech for green and inclusive growth*. Washington, DC: World Bank.
- Yuan, T. (2025). AI-enabled sustainability analytics and green finance adoption. *Journal of Sustainable Finance & Investment*, 15(1), 23–41. <https://doi.org/10.1080/20430795.2024.2250673>