



Towards Industry 5.0: A Bibliometric Analysis of Green Finance, Digital Transformation, and ESG Research

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Abstract

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Purpose: The convergence of green finance, digital transformation, and environmental, social, and governance (ESG) frameworks represents one of the most consequential developments in contemporary financial scholarship, yet its collective intellectual structure remains unmapped. This study aims presents the first comprehensive bibliometric analysis of this tripartite intersection, anchored within the emerging Industry 5.0 paradigm.

Methods: Drawing on a rigorously screened corpus of 121 peer-reviewed articles retrieved from the Web of Science Core Collection, the study employs performance analysis, co-authorship network mapping, keyword co-occurrence analysis, and bibliographic coupling to reveal the field's intellectual architecture.

Results: Findings demonstrate a sharp upward publication trajectory, peaking at 49 documents in 2025, with an average citation rate of 28.38 per document, signaling strong and growing scholarly impact. Seven distinct thematic clusters are identified, centered on digital finance, ESG governance, fintech adoption, and green investment. Emerging economies, particularly China and the Middle East, are driving the research frontier.

Conclusion: The study concludes by proposing a strategic research agenda bridging academic mapping with actionable policy and institutional implications for the transition toward human-centric, sustainable finance.

Keywords: Bibliometric analysis, Green finance, Digital transformation, ESG, Industry 5.0

JEL Classification: Q56, Q55, G30

I. Introduction

A combination of environmental needs, technological disturbance, and the changing social agenda is essentially re-setting the architecture of world finance. Financial systems are increasingly being geared towards sustainability goals as the world struggles to deal with an ever-increasing urgency of climate change, biodiversity loss, and social inequality. The most tangible expressions of this reorientation include the exponential increase in the number of green financial instruments, the popularization of the environmental, social, and governance

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(ESG) standards into investment decision-making, and the massive digitalization of financial services (Xiao et al., 2023; Liu et al., 2025; Zaid et al., 2025). But these changes have mostly taken place on the paradigmatic periphery of Industry 5.0, a period characterized by productivity optimization, technological automation, and productivity through data (Turek et al., 2023; Honchar et al., 2024; Roy & Vas, 2025; Hammad et al., 2025).

The dawn of Industry 5.0 is the indicator of the radical paradigm shift. Industry 5.0 is a term coined by the European Commission to build on the digital focus of the previous concept with three main pillars: human-centricity, sustainability, and resilience (Aheleroff et al., 2022; Grodek-Szostak et al., 2023). This re-imagining goes beyond the perspective of technology being no more than a tool of operational efficiency to one of a systemic facilitator of social welfare and environmental responsibility (McPhearson et al., 2021; Meythaler et al., 2023; Bhambri & Bajdor, 2024; Oeij et al., 2024). In the financial world, such a shift would have the implication of a redefinition of the role of capital, which is no longer the goal of wealth maximization but rather the generation of value, which benefits the people and the planet (Shannon et al., 2022; Dingkuhn et al., 2026). The alignment of green finance, digital transformation, and the research of the ESG however takes up its own intellectual niche: it lies at the crossroads of technological innovation, environmental urgency, and normative reorientation, which is the very spirit of Industry 5.0. The abbreviations commonly employed in the articles are not explained to the audience. The common abbreviations used in the articles are also not made comprehensible to the audience.

Although there is a growing academic attention to this three-way nexus, there is a conspicuously disjointed literature. Scholars have examined the green finance mechanism, digital financial innovation and ESG integration as phenomena in isolation, with limited insights (Arnone & Leogrande, 2024; Lim, 2024; Roy & Vasa, 2025). There is research on the intersection of two or more of these fields, such as how blockchain can be used to improve ESG reporting (Lim, 2023; Garg & Kumar, 2024) or artificial intelligence as a tool to value green bonds (Elhady & Shohieb, 2025;). Nevertheless, a comprehensive, synthesizing mapping of the way green finance, digital transformation, and ESG research are collectively changing towards Industry 5.0 goals is evidently yet to occur (Petrica et al., 2024; Liu et al., 2025). This gap is especially troubling because the transformative potential of this nexus is specifically the interdependence of them: scalable green finance can be realized with the help of digital technologies, and in return, the latter will fund the transformation that the ESG metrics are supposed to measure and manage (Macchiavello & Siri, 2022; Luo et al., 2025).

The fact that this gap should be bridged is further aggravated by a number of modern trends. First, the increasing frequency and intensity of financial disclosures about climate-related topics, such as the first set of standards developed by the International Sustainability Standards Board, require well-developed technological infrastructures to verify the information and prevent greenwashing (Dasinapa, 2024; Sneideriene & Legenzova, 2026). Second, the spread of decentralized finances and tokenized green assets finds a way out of the established regulatory frameworks, and it is unclear how digitally-mediated sustainable finance can be governed in a manner that aligns with the human-centric promises of Industry 5.0 (Naderi & Tian, 2022; Bansal et al., 2024).

Third, the focus on resilient economic systems in post-pandemic times has pre-empted how financial technologies can be used to guarantee the inclusive access to green capital, especially in underserved communities (Mhlanga, 2022; Arnone & Leogrande, 2024; Roy & Vasa, 2025). All these developments highlight the importance of the need to learn how green finance, digital transformation, and ESG research intersect, co-evolve, and combine to make Industry 5.0 a reality.

Previous efforts to generalize this landscape have been limited by methodological and conceptual shortcomings. Although narrative reviews are useful in developing theory, they are vulnerable to author selection bias and do not allow the intellectual landscape of a fast-developing interdisciplinary area to be systematically charted (Zhang et al., 2024;

Archiwaranguprok et al., 2025; Yang et al., 2025). Systematic literature reviews are more rigorous yet generally study linear relationships, including the effects of digital transformation on green finance, instead of the multidirectional and networked relationships between all three domains (Bansal et al., 2024; Liu et al., 2025; Zaid et al., 2025).

Bibliometric techniques, in its turn are the only ones that can be used to counteract this complexity (Xu et al., 2023). Bibliometric mapping could make visible the unseen intellectual architecture that connects the research on green finance, digital transformation and ESG into a coherent scholarly space by quantitatively analyzing citation networks, co-authorship patterns and key word co-occurrences (Judijanto et al., 2025; Kozar & Warwas, 2025; Peng et al., 2025; Sharma & Jain, 2025). In addition to that, a bibliometric analysis can be used to show the process in which these thematic clusters have changed over time, thereby highlighting the path in which Industry 5.0 is moving towards human-centric and sustainable financial paradigms.

This paper hence takes a thorough bibliometric review of the intersection between green finance, digital transformation and ESG research with a clear within the context of transition towards Industry 5.0. By so doing, it goes beyond descriptive mapping to provide critical interpretive information on how this three-part nexus is being produced, challenged, and established in the field of literature in a scholarly manner.

It is against this background that the current research would set out to chart and critically review the intellectual terrain of scholarship at the nexus of green finance, digital transformation and ESG with particular focus on how this corpus of the scholarship is indicative and connected to the move to Industry 5.0. This research will use bibliometric methods to outline the thematic development, conceptual background, collaborative systems, and areas of research defining this interdisciplinary area, and critically evaluate how technological innovation relates to sustainability demands to transform financial theory and practice along Industry 5.0 principles.

To achieve this objective, the study addresses the following research questions:

RQ₁: What are the publication trends, collaborative patterns, and key contributors shaping research at the intersection of green finance, digital transformation, and ESG?

RQ₂: What are the predominant thematic clusters within the green finance-digital transformation-ESG nexus, and how do these clusters intellectually interconnect?

RQ₃: What emerging research frontiers and knowledge gaps can be identified from the current intellectual structure of this field, and what directions does this suggest for future scholarly inquiry?

This research paper has four important implications to the literature. To begin with, it is the initial systematic literature review focused on the three-way overlap between green finance, digital transformation, and ESG. These areas have been previously studied in pairs, however, none has compiled the intellectual architecture of these areas, as a collective in a single integrated framework. Second, the paper presents a defined Industry 5.0 frame to the bibliometric review of sustainable finance. Locating the findings in the context of the shift to human-centric, resilient, and sustainable industrial paradigms, this study offers a theoretically-founded explanation of the evolutionary path that the field has been taking since the past mapping activities had failed to consider it.

Third, the study methodologically uses a multi-layered analysis method that uses performance analysis, co-authorship relations, bibliographic coupling, and key word co-occurrence analysis. The combination of these methods yields a more detailed insight into the field than any one of the methods alone would give. Lastly, this study allows the cross of the academic mapping and practical application by synthesizing the identified patterns into a strategic research agenda. The results provide practical guidance to policy makers developing ESG regulatory framework, financial institutions moving in the digital directions, and researchers discovering untapped frontiers at the crossing of these two fast moving spheres.

The rest of the paper is organized as follows: Section 2 describes the methodological framework, such as the choice of the database, the search strategy, and PRISMA-based screening measures. Section 3 includes descriptive findings on the topic of publication trends, collaborative patterns, and major contributors. Additionally, discusses the results of thematic mapping, such as the co-occurrence of keywords and bibliographic coupling networks of active research communities and knowledge frontiers. In section 4, an explanation can be found of the theoretical and practical implications of the findings concerning the paradigms of Industry 5.0. Section 5 has concluded with a summarization of major contributions, limitations and development of a prospective research agenda.

II. Methodology

The research applies bibliometric analysis as the framework of mapping the intellectual structure of the research at the intersection of digital transformation, sustainable finance, and ESG. The methodology is based on PRISMA to have a systematic and reproducible process.

Database Selection

The only source of data was selected as Web of Science (WoS) Core Collection. WoS has a high reputation as the most credible citation-based research database (Zhang et al., 2022; Raman et al., 2025). While Scopus offers broader coverage, WoS provides superior metadata quality and standardized author information, which is critical for the citation network analysis and bibliographic coupling techniques you employed. State that using a single, high-quality database ensures internal consistency in citation counts and mapping metrics (Pranckute, 2021; Albalawee et al., 2024). This is necessary because these features are essential in the mapping of bibliometrics. In comparison to Scopus, WoS is more ideal to use when it comes to citation network analysis since it has more rigorous indexing criteria (Birkle et al., 2020; Radic et al., 2025). The deliberate exclusion of Scopus from this study was a methodological decision grounded in the specific analytical requirements of bibliometric citation network analysis. While Scopus offers broader journal coverage, WoS is widely recognized as the gold standard for citation-based studies due to its stricter peer-review indexing standards, richer metadata quality, and longer citation history (Birkle et al., 2020; Pranckute, 2021). For the purpose of co-authorship mapping, keyword co-occurrence analysis, and bibliographic coupling, the precision and reliability of WoS citation data are paramount. Combining both databases, although potentially broadening coverage, would introduce duplicate records and metadata inconsistencies that could distort network visualizations and inflate citation counts (Radic et al., 2025). Nevertheless, the authors acknowledge that restricting the dataset to WoS alone is a limitation of this study, and future research is encouraged to replicate and extend this analysis using Scopus or a multi-database approach to enhance comprehensiveness and reduce potential selection bias.

Search Strategy

As of 02 March 2026, the search has been performed. The author query that was used on WoS Topic Fields (TS) (a search engine that searches titles, abstracts, author keywords, and Keywords Plus) was the following Boolean query:

TS =(("Industry 5.0" OR "fifth industrial revolution" OR digital transformation" OR "smart manufacturing" OR "robotics" OR "fintech" OR "financial technology") AND ("ESG" OR "sustainable finance" OR "green finance" OR "digital finance" OR "climate finance" OR "responsible investment"))

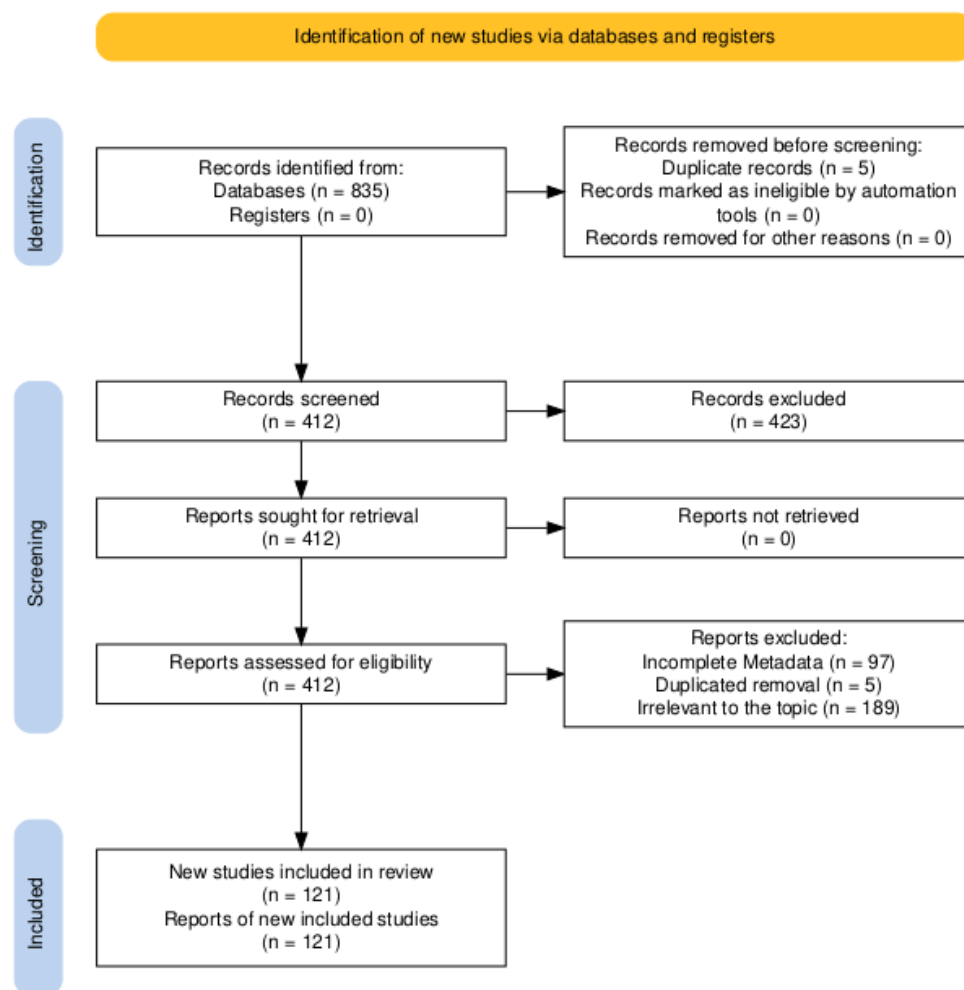
The search query provided a first set of 835 records published during the period of 2010-2025. It is important to note that although the search window spans 2010–2025, the final retained corpus covers only the period 2020–2026. This discrepancy arises because the PRISMA-based screening process, specifically the subject category filter and manual relevance screening, systematically eliminated pre-2020 publications that did not address the specific tripartite nexus of green finance, digital transformation, and ESG within an Industry

5.0 context. Prior to 2020, scholarly output at this precise intersection was either negligible or did not meet the thematic inclusion criteria. This finding itself constitutes a substantive result, indicating that the research field only began to take meaningful shape in 2020, consistent with the post-pandemic acceleration of ESG adoption and sustainable finance policy development.

Inclusion and Exclusion Criteria.

Screenings of records were conducted in several steps according to the PRISMA model (Page et al., 2021; Stea et al., 2023). The screening flowchart is presented in Figure 1 (Haddaway et al. 2022).

Figure 1
PRISMA Flow Chart



Peer-reviewed journal articles and reviews in English were only included. The research concentrated on the publications that fell under the Business, Finance, Economics, Management, Environmental Studies, and Sustainability categories of subjects. Conference

papers, book chapters, editorials, and records in non-English were excluded. Records that lacked author information, abstracts or references were also eliminated.

Table 1

PRISMA Screening Outcomes

Stage	Description	Records Retained
1	Initial WoS retrieval	835
2	Document type filter (articles and reviews only)	630
3	Language filter (English only)	615
4	Subject category filter	412
5	Metadata completeness check	315
6	Duplicate removal	310
7	Manual relevance screening	121

The final dataset contains 121 documents and forms the basis of all analyses in this study.

Data Cleaning

Raw WoS data contains inconsistencies that can affect analysis quality. The following cleaning steps were applied. Author name variants were standardized. For example, "Trotta, A." and "Trotta, Annarita" were unified into a single record. Similarly, synonymous terms were merged into standard forms. Beyond WoS's internal deduplication, records were cross-checked using DOI matching and title similarity to remove any remaining duplicates.

Table 2

Keyword Standardization

Variants	Standardized Term
"fintech", "financial technology", "fin-tech"	fintech
"ESG", "environmental social governance", "ESG criteria"	ESG
"artificial intelligence", "AI", "machine learning"	artificial intelligence
"blockchain", "distributed ledger", "DLT"	blockchain

Analytical Tools and Techniques

Two primary tools were used. 1) Microsoft Excel was used for descriptive analysis including annual publication trends, country-level output, and citation counts. VOSviewer 1.6.20 was used to generate three bibliometric maps:

Table 3*Analytical Techniques*

Technique	Purpose	Parameters
Co-authorship analysis	Author collaboration patterns	Minimum 2 documents per author
Keyword co-occurrence	Thematic structure of the field	Minimum 3 keyword occurrences
Bibliographic coupling	Current research clusters	Minimum 1 citation per document

III. Results and Discussion**Descriptive profile**

Table 4 shows the descriptive profile of the final bibliometric data, which was used in this study. The timeframe of the dataset is 2020-2026, as the research on the intersection of digital transformation, sustainable finance, and ESG is rather new. The articles are all peer-reviewed journal articles, in line with the inclusion criteria used in PRISMA screening.

The authorship patterns show that there is more inclination of collaborative research in this area. There are only 3 papers of single authorship documents and most of the publications included two to five authors. The most common (35 papers) are the triple-authored documents, then four-authored documents (32 papers). Such a trend indicates that investigations in this field are more likely to be conducted in the form of a team, which probably occurs due to the interdisciplinary character of the integration of the financial, technological, and sustainability views. There were 462 distinct authors of the 121 documents, which proves the existence of a wide and active scholarly community.

The dataset consists of 62 distinct journals, meaning that the publications are in a wide variety of sources and are not concentrated in one or two large journals. This diversity is a result of the cross-disciplinary nature of the research field. Obviously, citation impact, the corpus takes 3,433 citation records and an average of 28.38 citations per document. Such an average is quite high, and it is possible to assume that the chosen sources have significant scholarly impact despite the relative youth of the field. The mean age of documents is only 2.08 years, which further reinforces the idea that the intersection of these two fields has gained traction recently with most of the literature concentrating on the 2022-2025 timeframe.

Table 4*Descriptive Profile of the Bibliometric Dataset*

Description	Value
Timespan	2020-2026
Total documents	121
Document type	Article
Single-authored documents	3
Double-authored documents	18
Triple-authored documents	35
Four-authored documents	32
Five-authored documents	18
Six-authored documents	14

More than six-authored documents	1
Total number of authors	462
Number of sources	62
Average citations per document	28.38
Total citations	3,433
Average document age	2.08 years
Abstract available	Yes
DOI available	Yes
Database source	Web of Science

Note. Publications for 2026 may be incomplete due to ongoing database indexing

All documents have abstracts and DOI numbers available, ensuring metadata completeness for network analysis. It should be noted that 2026 publications may be underrepresented due to ongoing indexing delays in the Web of Science database.

Table 5

Annual Publication Trend of the Dataset

Year	Number of publications	Percentage (%)
2020	1	0.83
2021	2	1.65
2022	11	9.10
2023	17	14.04
2024	31	25.62
2025	49	40.50
2026	10	8.26
Total	121	100.00

Note. The lower number of publications in 2026 may reflect incomplete indexing rather than an actual decline in research output.

According to table 5, the level of publication output has been on an upward trend during the study period. The field of research was still underdeveloped in the period between 2020 and 2021 but started growing since 2022. The highest increase was recorded in the year 2024 and 2025 as the highest year with 2025 representing 40.50 percent of the total publications. The reduced number of 2026 is to be viewed with caution since it is not time yet.

Several interconnected factors explain the marked acceleration of research output observed from 2022 onward. First, the post-COVID-19 global recovery period catalyzed an urgent rethinking of financial systems, with policymakers and institutional investors increasingly embedding ESG principles into capital allocation decisions. The pandemic exposed the fragility of conventional financial models, thereby accelerating both academic and practitioner interest in sustainable and digital alternatives (Al-Qudah et al., 2022). Second, the publication of the inaugural International Sustainability Standards Board (ISSB) framework in 2023 marked a watershed regulatory moment, prompting a surge of scholarly inquiry into the technical and governance requirements for ESG compliance and green finance infrastructure (Dasinapa, 2024). Third, the rapid proliferation of fintech platforms and the mainstreaming of digital finance tools in emerging economies, particularly China and the Middle East, opened new empirical research opportunities at the intersection of technology and sustainability (Bansal

et al., 2024; Zaid et al., 2025). Collectively, these converging regulatory, technological, and market forces provide a robust contextual explanation for the exponential growth in publications observed from 2022 to 2025.

Figure 2

Annual Distribution of Publications on Digital Transformation, Sustainable Finance, and Esq (2020-2026).

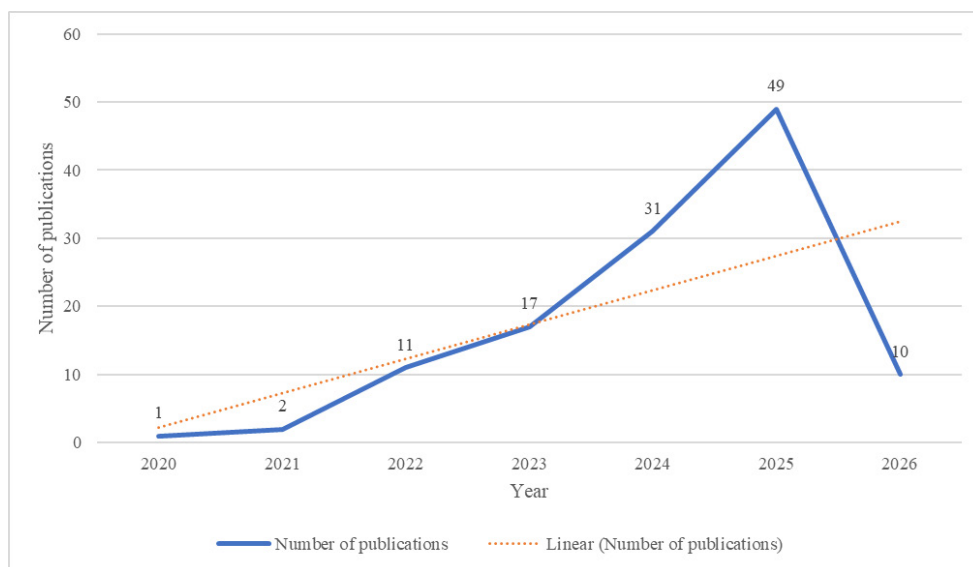


Figure 2 shows the trend of the final data published annually. Even though the first search has been conducted on the publications published between 2010 and 2026, the filtered corpus covers the period between 2020 and 2026. Prior to 2020 data had been deleted in the process of subject category filtering and manual relevance screening, meaning that significant scholarly output at this intersection of research only commenced to appear in 2020.

It began its humble start in 2020 with 1 publication and has steadily increased to 11, 17, and 31 publications in 2022, 2023, and 2025 respectively. This is a steep rise in growth in ESG, fintech and sustainable finance as the world shows increased interest in these areas after the post-pandemic. The dotted linear trend line affirms that there was a general strong positive direction through the observation window. This surge (40.50% of total publications in 2025) is driven by the post-pandemic emphasis on 'Build Back Better' and the implementation of the European Green Deal. And the introduction of International Sustainability Standards Board (ISSB) standards, which necessitated digital tools for verifiable ESG reporting.

The fall to 10 publications in 2026 is not a sign of actual reduction. It is only because of the lack of full indexing of the Web of Science at the time of accessing the data (March 2, 2026). This number will only continue to grow significantly as indexing advances over 2026, which also follows the general trend of growth in the area.

Table 6*Most Productive Journals in the Dataset*

S.N.	Journal / Source title	Number of publications	Percentage (%)
1	Finance Research Letters	16	13.22
2	Journal of Environmental Management	8	6.61
3	International Review of Economics & Finance	6	4.96
4	Technological Forecasting and Social Change	5	4.13
5	International Review of Financial Analysis	4	3.31
6	Resources Policy	4	3.31
7	Business Strategy and the Environment	3	2.48
8	Corporate Social Responsibility and Environmental Management	3	2.48
9	IEEE Transactions on Engineering Management	3	2.48
10	Journal of Cleaner Production	3	2.48

Note. Percentages are calculated based on the total dataset of 121 publications.

Table 6 indicates that publication output is concentrated in a relatively small group of journals. Finance Research Letters is the most productive outlet with 16 publications, representing 13.22% of the dataset, followed by Journal of Environmental Management with 8 publications and International Review of Economics & Finance with 6 publications. This distribution suggests that the field is primarily anchored in finance, sustainability, environmental management, and technology-oriented journals.

Table 7*Most Influential Documents in the Dataset*

S.N.	Article title	First author	Year	Journal	Total citations
1	How does digital finance influence green technology innovation in China? Evidence from the financing constraints perspective	Lin	2022	Journal of Environmental Management	444
2	Digitalization transformation and ESG performance: Evidence from China	Lu	2024	Business Strategy and the Environment	283
3	Corporate transformation toward Industry 4.0 and financial performance: The influence of environmental, social, and governance (ESG)	Alkaraan	2022	Technological Forecasting and Social Change	271
4	Digital finance and green growth in China: Appraising inclusive digital finance using web crawler technology and big data	Razzaq	2023	Technological Forecasting and Social Change	228
5	Mobile payment adoption in the time of the COVID-19 pandemic	Al-Qudah	2024	Electronic Commerce Research	169

6	Sustainable strategic investment decision-making practices in UK companies: The influence of governance mechanisms on synergy between Industry 4.0 and circular economy	Alkaraan	2023	Technological Forecasting and Social Change	133
7	Digital transformation, financing constraints, and corporate environmental, social, and governance performance	Yang	2023	Corporate Social Responsibility and Environmental Management	115
8	Digital transformation and corporate ESG: Evidence from China	Zhao	2023	Finance Research Letters	105
9	Robo advisory and its potential in addressing the behavioral biases of investors: A qualitative study in Indian context	Bhatia	2020	Journal of Behavioral and Experimental Finance	90
10	Enterprise digital transformation and ESG performance	Cai	2023	Finance Research Letters	85

Table 7 shows that the most influential documents in the dataset are concentrated around digital finance, digital transformation, ESG performance, and green innovation. The most cited article is Lin's 2022 study in *Journal of Environmental Management*, with 444 citations, followed by Lu's 2024 article in *Business Strategy and the Environment* with 283 citations and Alkaraan's 2022 article in *Technological Forecasting and Social Change* with 271 citations. These highly cited publications indicate that the intellectual core of the dataset is strongly shaped by research on digital-financial transformation, sustainability performance, and ESG-related corporate change.

Table 8
Most Productive Authors in the Dataset

Rank	Author	Number of publications	Total citations
1	Hussainey, Khaled	3	441
2	Al-Okaily, Manaf	3	247
3	Alkaraan, Fadi	2	404
4	Venkatesh, V. G.	2	404
5	Cai, Cen	2	99
6	Tu, Yongqian	2	99
7	Ren, Yuheng	2	54
8	Kumar, Anil	2	27
9	Luthra, Sunil	2	27
10	Safi, Adnan	2	25

Note. Authors are ranked by number of publications. Total citations are included as a complementary indicator of author influence.

Table 8 identifies the most productive authors in the dataset based on publication output. Hussainey, Khaled and Al-Okaily, Manaf emerged as the most productive contributors, with three publications each. Several other authors, including Alkaraan, Fadi, Venkatesh, V. G.,

Cai, Cen, and Tu, Yongqian, contributed two publications each. When citation counts are considered alongside output, Hussainey, Khaled, Alkaraan, Fadi, and Venkatesh, V. G. appear particularly prominent within the dataset. A closer examination of these authors' contributions reveals substantively distinct thematic orientations. Hussainey, Khaled, a leading scholar in corporate disclosure and ESG reporting, has contributed research at the intersection of digital transparency, sustainability governance, and accountability in financial markets, with a focus on how institutional mechanisms shape ESG disclosure quality. His work collectively underscores the governance dimension of the digital-sustainability nexus, particularly in the context of emerging market firms striving to meet international ESG benchmarks. Al-Okaily, Manaf, by contrast, has concentrated his contributions in the domain of fintech adoption and digital financial services, examining behavioral and institutional determinants of mobile payment and digital banking uptake in the Middle Eastern context. Together, these two high-productivity authors represent complementary pillars of the field: governance-oriented ESG scholarship and technology-driven financial behavior research, both of which are central to the Industry 5.0 transition toward human-centric sustainable finance.

Table 9

Most Influential Authors in the Dataset

Rank	Author	Total citations	Number of publications
1	Lin, Boqiang	444	1
1	Ma, Ruiyang	444	1
2	Hussainey, Khaled	441	3
3	Alkaraan, Fadi	404	2
3	Venkatesh, V. G.	404	2
4	Lu, Yuzhong	283	1
4	Sun, Yanqi	283	1
4	Xu, Cheng	283	1
4	Zhu, Bingsheng	283	1
5	Albitar, Khaldoon	271	1

Note. Authors are ranked by total citations using full citation counting, whereby each coauthor receives the full citation count of a jointly authored paper.

Table 9 presents the most influential authors in the dataset based on total citation counts. Lin, Boqiang and Ma, Ruiyang were the most influential authors, each receiving 444 citations from a single highly cited publication. Hussainey, Khaled ranked next with 441 citations across three publications, indicating both strong visibility and higher productivity. Authors such as Alkaraan et al (2021). also demonstrated substantial influence, each accumulating 404 citations from two publications.

The exceptional citation impact of Lin, Boqiang and Ma, Ruiyang stems from their 2022 landmark study in the *Journal of Environmental Management*, which empirically investigated how digital finance, proxied through the Peking University Digital Finance Index, influences green technology innovation in China from a financing constraints perspective. Their research demonstrated that digital finance significantly reduces financing constraints for firms, thereby enabling greater investment in green technology innovation. The findings were particularly salient for small and medium-sized enterprises and firms in regions with weaker financial development, highlighting the redistributive potential of digital financial infrastructure. This work has become a foundational reference in the field, synthesizing digital finance theory with green innovation literature and offering one of the first rigorous empirical treatments of the finance-technology-sustainability nexus in the Chinese context. The high citation rate of this

study reflects both its methodological rigor and its policy relevance in the broader discourse on sustainable industrial transformation. The influence of Alkaraan, Fadi and Venkatesh, V. G. similarly stems from their joint work examining how corporate digital transformation and Industry 4.0 adoption interact with ESG performance and strategic investment decision-making, providing theoretical grounding that connects the governance and technological dimensions of sustainable finance.

Table 10

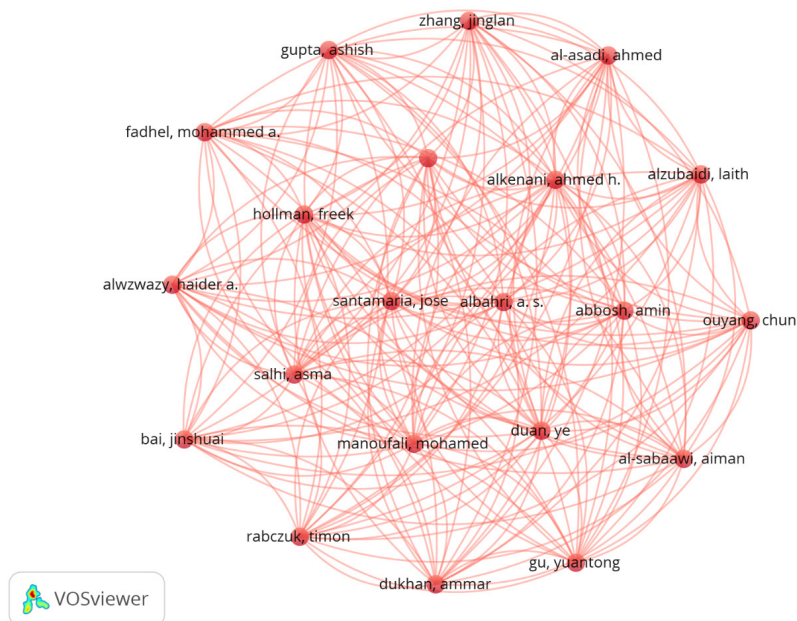
Most Productive Countries in the Dataset

Rank	Country	Number of publications	Total citations
1	China	47	1,721
2	India	8	195
3	UAE	4	253
4	Taiwan	4	88
5	Malaysia	4	36
6	Vietnam	3	14
7	United Kingdom	2	404
8	Jordan	2	72
9	Morocco	2	38
10	Pakistan	2	29

Note. Country was assigned based on the primary institutional affiliation address. Publications with multiple country affiliations were counted under the primary/first institutional country.

Figure 3

Co-Authorship Network of Authors

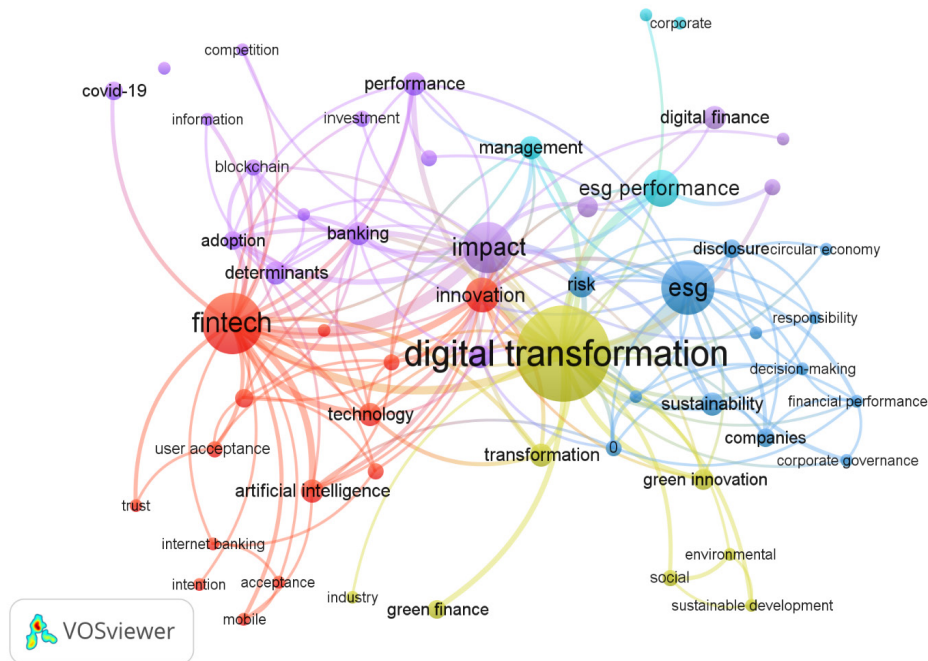


Note. Minimum number of documents per author = 2. Node size represents number of publications; line thickness represents strength of collaboration.

Table 10 shows the geographic distribution of publications in the dataset. China dominated the research output with 47 publications and 1,721 total citations, indicating that the field is heavily shaped by Chinese scholarship. India ranked second with 8 publications, followed by UAE, Taiwan, and Malaysia each contributing 4 publications. The United Kingdom, while producing only 2 publications, ranked prominently in citation impact with 404 total citations, suggesting high scholarly influence relative to output volume.

Figure 3 presents the co-authorship network of authors with a minimum of 2 publications. The analysis identified authors meeting the threshold, forming a single interconnected cluster. Prominent authors include Ouyang, Chun; Alkenani, Ahmed H.; Zhang, Jinglan; and Gupta, Ashish, indicating active collaborative ties across institutions and disciplines. The network reflects multidisciplinary collaboration spanning finance, management, information systems, and engineering domains, consistent with the interdisciplinary nature of digital transformation research.

Figure 4
Keyword Co-Occurrence Network.



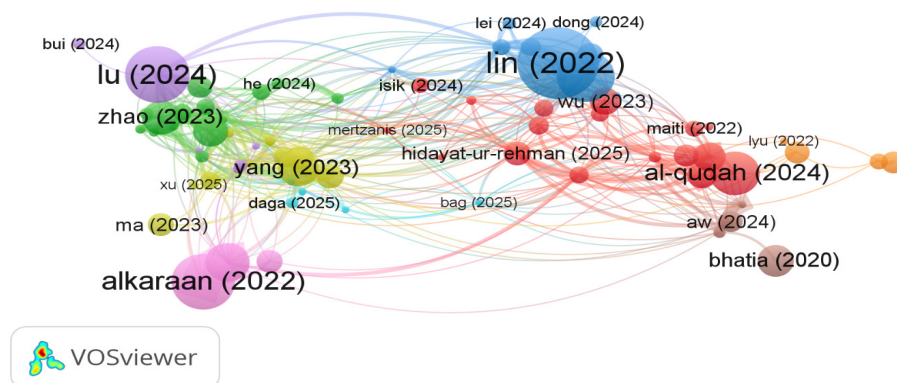
Note. Minimum number of keyword occurrences = 3. Node size represents frequency of keyword occurrence; line thickness represents strength of co-occurrence links. Different colors represent distinct research clusters.

The network of key words co-occurrence was created with the help of 121 selected publications and is shown in Figure 4. The keywords that were used in the analysis were those which had at least 3 instances, with the five thematic clusters identified. The highest ranking node, which is the digital transformation, ensures its key place in the literature and is strongly co-occurring with ESG, FinTech, green innovation, and financial performance. Cluster 1 (red) represents the theme of FinTech adoption and artificial intelligence. Cluster

2 (yellow) absorbs digital transformation and green financial research. Cluster 3 (blue) is ESG and corporate sustainability stream. Cluster 4 (purple) entails banking performance and blockchain themes. Cluster 5 (cyan) identifies ESG disclosure and digital finance. These clusters have the overall effect of describing the multidimensional intellectual frame of the field.

Figure 5

Bibliographic Coupling Network of Documents.



Note. Minimum citations per document = 1. Node size represents number of citations; line thickness represents coupling strength. Colors represent distinct research clusters.

The bibliographic coupling network of documents in Figure 5 shows seven different research clusters when compared. The biggest and the most referred node is Lin (2022), which serves as a hub of Cluster 1 dedicated to the digital finance and green technology innovation in China. Alkaraan (2022) falls under Cluster 5, which deals with Industry 5.0, and strategic investment decision-making. Al-Qudah (2024) is the head of Cluster 6, which reflects FinTech adoption studies in the Middle East. The clusters by Lu (2024) and Zhao (2023) overlap with each other and are based on the ESG performance and digital transformation of Chinese listed companies. The network helps one to realize that, despite the interconnection of the field, there are distinct thematic boundaries between the digital finance, ESG governance, and FinTech adoption research streams.

Discussion

Publication Trends

There are 121 peer-reviewed articles created from 2020 to 2026, a list of 462 scholars in 62 journals (Table 4). Though the search window was 2010-2026, all search results retained are dated 2020-2026, and it has been confirmed that the intersection of digital transformation, fintech, and sustainable finance is not only an emergent but also a rapidly solidifying area of interest.

Figure 2 shows that there is a strong upward publication trend with one document in 2020 and a high point of 49 in 2025. This exponential trend is in line with the general acceleration of ESG adoption, green financial policy structures, and the spread of fintech that is observed worldwide in the after-pandemic era (Al-Qudah et al., 2022; Lin, 2022). The fact that the

average citation rate is 28.38 per document in spite of the mean age of documents is 2.08 years, is also indicative of a high level of scholarly activity and shows that this domain is intellectually healthy. The decrease in 2026 ($n = 10$) is due to the fact that the Web of Science is not indexing as many articles as it should at that point in time, as opposed to the actual decline in the level of research activity.

Collaborative Structure

The network of co-authorship (Figure 3) shows that working in this area is strongly based on collaboration. More than half of the publications are represented by documents written by three authors ($n = 35$) and documents written by four authors ($n = 32$). This tendency indicates the interdisciplinary nature of the discipline that relies on studies of finance, technology, governance, and sustainability at the same time (Roy and Vasa, 2025; Roy and Zaher, 2025; Zaher and Roy, 2025). Major collaborative groups that focus on researchers in China, the Middle East, and Southeast Asia may indicate that the emerging economies are setting the axon on this research focus and may be motivated by the pace of fintech adoption and the development of national ESG policies (Biju et al., 2024; Dawood et al., 2025; Roy and Vasa, 2025; Sethi et al., 2025).

Thematic Structures and Research Clusters.

The use of keyword co-occurrence network (Figure 4) and bibliographic coupling map (Figure 5) can be considered together and identify seven different yet overlapping clusters of research. The leading group with Marie et al. (2024) at its center dwells upon the digital finance and green technology innovation. Neighboring clusters deal with ESG performance and corporate governance (Zhao and Cai, 2023), fintech adoption behavior (Al-Qudah et al., 2022), and Industry 5.0 investment decision-making (Alkaraan, 2022). The presence of the terms like ESG, fintech, green finance, and digital transformation in several clusters proves that the mentioned themes are not isolated, but they become a coherent paradigm of interdisciplinary research. This line of convergence identifies a maturing area in which the notion of financial sustainability and technological innovation are increasingly converging into coherent theoretical systems (Bansal et al., 2024; Roy and Zaher, 2025).

IV. Conclusion

The given research is the first systematic bibliometric mapping of the research on the crossroads of digital transformation and sustainable finance and ESG through the prism of the Industry 5.0. Based on a thoroughly filtered corpus of 121 peer-reviewed articles found in the Web of Science, the analysis shows that the field is both young in terms of age, though it has achieved significant impact, with its growth in publications, the intensity of its citation, and the interdisciplinary cooperation being high. The fintech adoption, green finance, ESG governance, and human-centric technological innovation networks presented above all show that they are not talking parallel to each other anymore, and they are becoming one scholarly paradigm. The developing economies, especially China and the Middle East are becoming the leading frontiers of this agenda, and this echoes the pressing need of policy as well as market demand of these regions. These results have significant implications on researchers, policymakers, and financial practitioners who want to support strategy digital innovation with sustainability requirements. Future studies must be extended to multilingual databases, include longitudinal citation tracking, and come up with coherent theoretical frames, which are holistic and reflect the dynamism in this area of study.

Future Research Directions

This paper provides a number of avenues in future research. First, introducing the search to Scopus and non-English databases would help to include the scholarship of underrepresented areas and decrease the geographic bias. Second, longitudinal studies that can trace the cite and thematic development through time would indicate how this discipline may grow beyond the emergent period. Third, the scholars of the future are encouraged to strive to reach

integrated theoretical frameworks to make digital transformation, fintech and sustainable finance formal components of the industry 5.0 paradigm instead of viewing them as distinct constructs. Fourth, industry-specific research on the banking, insurance, or capital markets would provide a more specific and practical information. Lastly, systematic literature reviews to supplement the bibliometric findings would bring out the qualitative richness that can only be achieved by structural mapping.

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