



Review article

Mapping the intersection of FinTech and sustainable finance: A systematic bibliometric review and emerging research horizons

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HIGHLIGHTS

- This study presents a systematic bibliometric analysis exploring the intersection of fintech and sustainable finance.
- It maps key trends in green finance, financial inclusion, and the use of technologies for sustainable growth.
- Leading contributions come from scholars in China, India, and Saudi Arabia, with Resources Policy as the key source journal.
- The study identifies future research horizons in regulation, ESG integration, and fintech role in enhancing energy efficiency.

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ABSTRACT

The prominence of the coalescence of FinTech and sustainable finance has been a major area of scholarly interest for more than half a decade. To delineate the conceptual evolution at this intersection, the current study aims to conduct a bibliometric review through a hybrid methodical approach by coupling systematic literature review (SLR) with bibliometric techniques – including performance analysis, co-occurrence analysis, thematic mapping – of 227 documents from Scopus database, incorporating not only journal articles but also conference papers, books, book chapters, and reviews from 2018 to 2025 that enriches the results with near-term published articles, quantitative techniques by utilizing VOSviewer and R Studio, and qualitative analysis of the cluster findings from the outcome of these software. Another novelty of this study is the accumulated study of FinTech and a broader multidimensional field - Sustainable Finance - that not only includes addressing the environmental impact, but also incorporates economic development, and governance factors. The findings underscore the evolving trend of research themes in the current area of cross-functional domain progressing from theoretical examination to more functional application of financial technology that catalyzes to establish sustainable finance. The study identifies critical research gaps requiring further investigation, including systematic risks associated with FinTech that may hamper achieving sustainability goals, the formation of a robust regulatory framework supporting the convergence of fintech and sustainable finance across regions, the identification of the role of digital mechanisms in enhancing sustainability reporting of financial institutions. The study also emphasizes the vitality of examining behavioral changes of stakeholders

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involved in this ever-evolving dynamic arena. Therefore, all these serve as actionable insights providing guidance to researchers, policymakers, and practitioners for future studies and implications.

1. Introduction

Transformative technological development in financial services has been offering more flexible, accessible, secure, and efficient digital solutions [1]. With such evolution in financial models, there is an urgent necessity to align the developments of financial technologies (FinTech) with green strategies that promote sustainable finance. Prior scholarly output involved a subsequent amount of FinTech studies using theoretical frameworks such as TAM, UTAUT or each of its extensions [2]. The incorporation of financial innovations to broader circular economy for environmental damage minimization, operational efficiency and resource optimization within the FinTech ecosystem has been studied using ReSOLVE framework [3]. The previous bibliometric mapping of fintech with sustainability encompassed green finance and fintech, fintech and economic development, fintech and financial inclusion, discussed in the literature section of this study. Such a trend reveals identifying the intersection of fintech with sub-domains of finance. Therefore, the current study aims to consolidate this fragmented research landscape by employing a systematic bibliometric review of FinTech with the multiple dimensions of sustainability linked to finance industry by utilizing advanced tools such as VOSviewer or R Bibliometrix for analyzing the 227 documents retrieved from Scopus database which comprises both journal articles and non-journal articles. This fills the gap of including various types of documents that were excluded in previous bibliometric analyses. The thematic mapping and cluster analysis of each data table extracted, and visualization developed through the software uncovers the gaps in the contemporary interdisciplinary research area, therefore, addressing the following research questions:

RQ1: What are the predominant patterns of publication in the nexus of FinTech and Sustainable Finance with respect to time, researchers, associated nations, and organizations?

RQ2: Which theories, theoretical frameworks, contexts, and research methodologies are investigated in the extensive body of literature addressing FinTech and Sustainable Finance?

RQ3: What are the dominant themes, conceptual clusters (via co-occurrence and thematic mapping), and influential authors and regions in the contemporary field?

RQ4: What are the existing knowledge gaps and potential avenues for future study in the nexus of FinTech and Sustainable Finance?

Thus, the study will primarily aim to contribute (ii) theoretically, by consolidating the literature of the intersecting area of fintech and sustainable finance in a broader aspect through bibliometric analysis to understand the pattern; (ii) methodologically, by applying an integrated methodological approach using R Studio (Bibliometrix) and VOSviewer to capture co-citation networks, thematic clusters, and the evolution of research trends over time [4]. Additionally, this research aims to (iii) contribute practically by providing future research directions to investigate fintech trends that catalyze sustainable impact, and identify policy and industry implications of fintech that will further advance SDG agendas.

Literature Review:

The literature review examines the transformation of the financial technology (FinTech) sector as a result of integrating sustainable practices to develop a financial system that leverages technological advancements to enhance financial inclusion, while also complying with green investment strategies — in other words, promoting sustainable finance. Inspecting the prior research involving the analysis of the interaction of FinTech and sustainability, Table 1 provides a glimpse of

the research trends of FinTech, and sustainability is headed towards. It reveals research evolving around the avenues of green finance, FinTech innovation, financial inclusion, energy efficiency, environmental protection and other domains, separately, for achieving sustainable development goals.

In addition to some of the research articles highlighted above, there has been a substantial increase in bibliometric analysis in the finance and sustainability arena. The concentrated areas that have been addressed for bibliometric review previously are listed out in Table 2. It can be observed that a green finance/ green FinTech innovation is a major interest of study for bibliometric analysis due to the increasing research on green finance and FinTech over the years, especially after the COVID-19 outbreak. In addition to this, bibliometric analysis was conducted on the papers that identified the sustainable economic development, including equitable access to finance (Financial inclusion) that stimulated as a result of FinTech innovation. Furthermore, compliant with the research articles provided in Table 1, the bibliometric analysis also revealed this cross-disciplinary literature extensively surrounding around China [11–13]. Other common findings of these bibliometric analyses by Gupta et al. [14], Del Sarto and Ozili [15], Kishor et al. [16], Jaishree and Dogga [17], Bhardwaj et al. [18], Dar et al. [19] highlighted BRICS nations, UK, and USA region to be also dominating in this field of study.

However, a recent comprehensive analysis by Offiong et al. [3] revealed the need to identify a granular approach to understand the contribution level of the emergence of FinTech to sustainable development. While looking intricately into the prior bibliometric analysis, it was discovered that despite the comprehensive reviews of subdomains of sustainability subdomain such as green finance, financial inclusion and FinTech were identified, analysis of a major interdisciplinary domain – FinTech and Sustainable Finance – was scant. Moreover, the prior studies lacked the inclusion of various types of papers. For instance, Sethi and Mahadik [24] explicitly stated that their paper did not include conference papers, reviews, or book chapters. Similarly, Kishor et al. [16], Jaishree and Dogga [17] also omitted conference proceedings and book chapters. Moreover, prior bibliometric analysis was based on papers till 2024 except the one by Salem and Shahimi [2] which looked into the context of overall FinTech and not any interdisciplinary domain. Thus, our current study uncovers the gap by offering a bibliometric mapping of FinTech-sustainable finance encompassing a broader aspect of the interdisciplinary field by including articles published till April 2025 which has the potential to perform further in-depth analysis of FinTech and its role in promoting finance stability while meeting environmental, social, governance, and ethical perspectives which will guide the policy-makers to mandate efficient frameworks to deploy FinTech in several sectors in a way that will lead to fulfilling ultimate sustainable development goals. Moreover, this study is further enriched through the representation of a more holistic view of the research in FinTech and Sustainable Finance arena by including conferences papers, books, book chapters, and reviews along with journal articles.

Materials and Methods

The broad array of our study involving financial technology and the subdomains comprised within sustainable finance requires triangulation techniques to validate the findings. To examine this intersection, our study performed employed an advanced bibliometric technique actuated with systematic literature review.

According to Al Mazroui et al. [25], a systematic approach to the literature review is critical to ensure that the selected studies are both comprehensive and directly relevant to research objectives. Bibliometric analysis is a dynamic technique that summarizes the academic output in terms of institutions, authors, and countries [26], to acquire

Table 1
Glimpse of research trend in the FinTech and Sustainable Finance domain.

Author	Title	Methodology	Contributions
Yang et al. [5]	<i>“Nexus between green finance, fintech, and high-quality economic development: Empirical evidence from China”</i>	<ul style="list-style-type: none"> • Generalized Principal Component Analysis (GPCA) — to calculate the green finance development index through analyzing the time series data • Kaiser–Meyer–Olkin (KMO) test — to confirm the correlation strength among the data 	<ul style="list-style-type: none"> • The research expands theoretical understanding of the moderating role of fintech that accelerates the benefits of green finance beyond the environmental dimension, identifying the value-adding aspects
Zhou et al. [6]	<i>“The impact of fintech innovation on green growth in China: Mediating effect of green finance”</i>	<ul style="list-style-type: none"> • Dynamic factor analysis — to calculate the green growth index • Panel regression model was used and on judging its estimation strategies, the fixed effect model was constructed to study the impact of financial technology innovation on green growth • China Digital Financial Inclusion Index (DFI) — to understand the progress of financial inclusion and fintech development in selected regions of China 	<ul style="list-style-type: none"> • The research highlights the inseparable relationship between financial technology and green growth • It identifies that fintech promotes green finance mainly through green investment and green credit. • It further identifies the varying levels of impact of fintech innovation on green growth based on the economic developments of the regions.
Muganyi et al. [7]	<i>“Green finance, fintech and environmental protection: Evidence from China”</i>	<ul style="list-style-type: none"> • The study utilized text analysis and panel data from 290 cities in China • Semi-parametric Difference-in-Differences (SDID) model — to analyze the treatment effects based on non-experimental panel data 	<ul style="list-style-type: none"> • The study is the first to comprehensively understand how green finance policies and fintech resulted in a significant reduction in gas emissions and depletion of sulphur dioxide emissions • The study urges policymakers to promote green consumption through the employment of fintech innovation.
Nenavath [8]	<i>“Impact of fintech and green finance on environmental quality protection in India: By applying the semi-parametric difference-in-differences (SDID)”</i>	<ul style="list-style-type: none"> • The study utilized text analysis and panel data from 28 states and 8 Union India • Semi-parametric Difference-in-Differences (SDID) model was used as it is considered the most appropriate climate quality protection properties created based on panel data 	<ul style="list-style-type: none"> • Although the study highlights the potential of fintech to achieve sustainability through proper resource utilization and by acting as one of the drivers to enhance the protection of environmental quality • However, the paper addresses the risks associated with green finance innovations that may be encountered in the short run. Thus, emphasizing the need to introduce green finance products and initiatives that modify these related risks.
Udeagha and Muchapondwa [9]	<i>“Green finance, fintech, and environmental sustainability: fresh policy insights from the BRICS nations”</i>	<ul style="list-style-type: none"> • Econometric techniques were employed, such as slope coefficient homogeneity and cross-section dependence tests • The CS-ARDL method was used to assess the relationship between the variables 	<ul style="list-style-type: none"> • The study examines the connection among Green Finance (GFN), fintech, and environmental sustainability to guide authorities and policymakers to formulate green financial policies accordingly in BRICS nations
Liu et al. [10]	<i>“Impact of Green financing, FinTech, and financial inclusion on energy Efficiency”</i>	<ul style="list-style-type: none"> • Use of non-parametric mathematical technique where decision-making unit (DMU) is quantified. • CCR model - for computation of environmental energy and total factor 	<ul style="list-style-type: none"> • First research to involve analysis of the nexus of Green financing, FinTech, and financial inclusion, and its sustainable extent that is their roles in fostering efficient consumption of energy through various financial technology tools in E7 economies • Urges the theorists to dive into the transaction system for greater attainment of energy efficiency

valuable insights to provide a direction for future researchers in various fields Allik [27], Barik and Jena [28], Yihua et al. [29], Abdullah et al. [30]. In other words, it provides a robust method for exploring the conceptual landscape of a research domain [4] that will aid the researchers to identify the required field of study. Fig. 1 illustrates the search flow process flowchart.

As illustrated in the flowchart, in the initial step, our study identified the appropriate academic database and refined the article selection based on the relevant keywords for this study. The bibliometric reviews identified in the current literature reveals that the authors placed a

great reliance on the Scopus database for its extensive coverage of peer-reviewed journal articles, conference proceedings, book chapters, and book series across various academic disciplines, including science, technology, and social sciences [31]. According to Montoya et al. [32], Scopus is widely regarded in the academic community for its reliable indexing and its efficiency in providing access to relevant scholarly content. Therefore, the current study screened the Scopus database to extract the articles related to FinTech and sustainable finance to reach multidisciplinary domains spanning finance, technology, environmental policy, financial inclusion, and sustainability, which covers more

Table 2

Concentration areas of bibliometric review in the FinTech and Sustainable Finance domain.

Concentration	Authors	Key areas highlighted/ Areas highlighted to be further investigated	Methodologies
FinTech and Green Finance/ FinTech and Green Finance toward sustainable economic development/Green FinTech Innovation	Kozar and Wodnicka [20].	<ul style="list-style-type: none"> Green transition in the labor market The potential of this association to contribute in the process of shaping the green competence of employees as well as creating green jobs and golden-green jobs 	<ul style="list-style-type: none"> Systematic Literature Review (SLR) Tools used for Bibliometric Analyses: VOSviewer software Qualitative analysis for individual keywords 52 scientific papers were retrieved
	Dar et al. [19].	<ul style="list-style-type: none"> Analyzing individual impact of advanced technologies such as AI and machine learning to understand its extent of contribution towards sustainability Suggestions to use other tools like Biblioshiny, CitNet Explorer, etc. to analyze additional factors of the publications 	<ul style="list-style-type: none"> Tools used for Bibliometric Analyses: VOSviewer software Based on 665 papers published between 2015 to 2023, the analysis was performed
	Jaishree and Dogga [17]	<ul style="list-style-type: none"> Identification of thematic analysis as a future research endeavor Consideration of country-specific factors that enhances the role of green finance in sustainable development Integrating government reports and real-world application literature to add qualitative depth of studies related to the association of this category 	<ul style="list-style-type: none"> Systematic Bibliometric Review was conducted Tools: VOS viewer, Biblioshiny (RStudio), MS Excel 1537 papers were used for data analysis
FinTech and Sustainability/ FinTech for Sustainable Development/ Sustainability in Financial Markets	Ellili [21]	<ul style="list-style-type: none"> FinTech as a catalyst to achieve sustainable development goals of different industries, other than putting sole focus on the banking industry in this linked context of FinTech and Sustainability while emphasizing its disclosure practices Role of FinTech in building economic resilience, and thereby leading to sustainable economic development 	<ul style="list-style-type: none"> Scientific Procedures and Rationales for Systematic Literature Reviews (SPAR-4-SLR) protocol was used to review Tools used for Bibliometric Analyses: VOSviewer; CiteSpace; WordStat 59 articles were retrieved
	[3]	<ul style="list-style-type: none"> Implications of ReSOLVE framework in digital finance context Arising concern over analyzing variables such as region-specific governance quality, infrastructure maturity, and social norms, and then determining the mediating immoact it can between FinTech innovations and sustainability transitions Identify socioeconomic heterogeneity beyond the firm-level 	<ul style="list-style-type: none"> Utilizes the agenda-setting function of Systematic Literature Review (SLR) Bibliographic coupling analysis Tools used for Bibliometric Analyses: VOSviewer
	Gupta et al. [14]	<ul style="list-style-type: none"> Asian countries other than China should also start contributing prominently to highlight the transitions in financial markets due to technological integration Granular approach to understanding the increasingly impactful role of FinTech in sustainability and its subsequent dimensions 	<ul style="list-style-type: none"> Tools used for Bibliometric Analyses: Biblioshiny package of R studio and Vos viewer software (version 1.6.16) 901 publications were retrieved from the Scopus database
Fintech and Financial Inclusion for sustainable development	Huang [22]	<ul style="list-style-type: none"> Address FinTech's transformative role in fostering sustainable development beyond BRICS nation Avenues for further investigation: ethical consideration, policy frameworks, and specific technology-enabled fintech Evaluation of contextual nuances 	<ul style="list-style-type: none"> Study adopts a multi-cluster analytical framework Further analysis was conducted using R for data cleaning, grouping, and importing citation data 526 papers were identified
	Ha et al. [23]	<ul style="list-style-type: none"> Studies involving low-income and unbanked individuals in the fintech landscape to prioritize social well-being over business gains Exploration of risks associated with fintech and its subsequent effect on sustainability 	<ul style="list-style-type: none"> Integrated methodological approach-systematic literature review, bibliometric analysis, and content analysis Systematic literature review methodology guided by the PRISMA framework Tools used for Bibliometric Analyses: VOSviewer
	Del Sarto and Ozili [15]	<ul style="list-style-type: none"> Understand the long-term impact of FinTech on the marginalized people, and overall financial stability Integration of policy insight reports, case studies, and practical application to provide evidence that strengthens theories to support the dynamic FinTech field that evolves rapidly 	<ul style="list-style-type: none"> Tools used for Bibliometric Analyses: VOSviewer 313 papers were retrieved

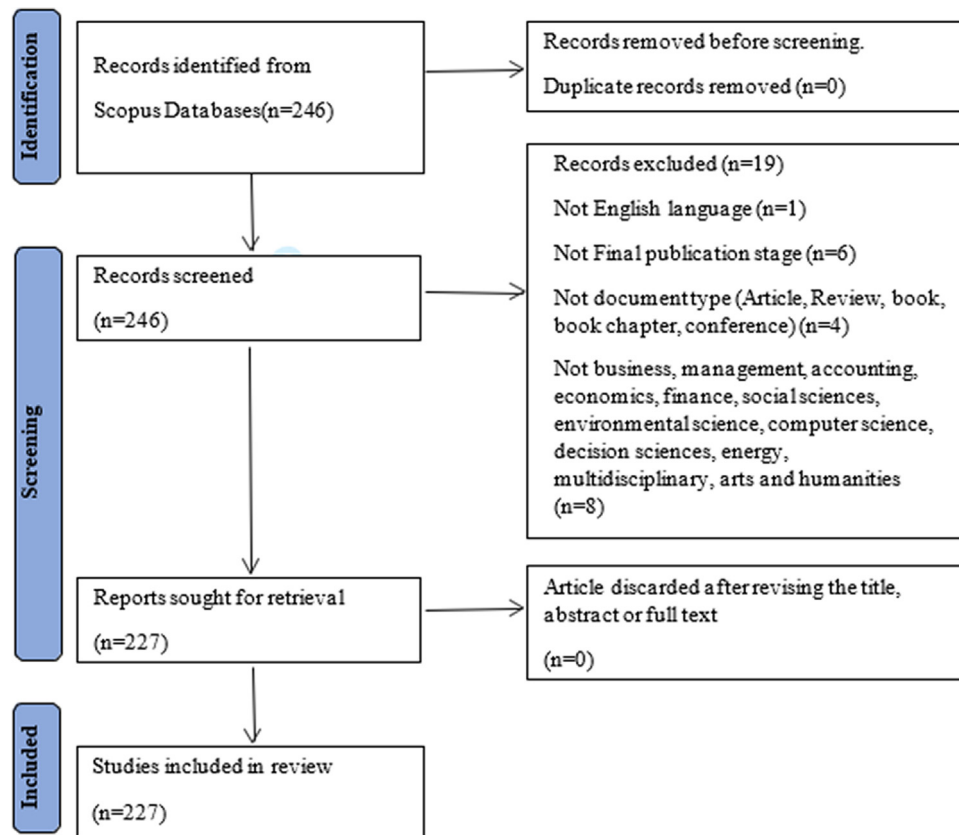


Fig. 1. Search flow process flowchart.

unique titles and a larger number of exclusive journals in all fields than other bibliometric databases like Web of Science (WoS) [33]. Schlögl et al. [34] identified that Scopus encompasses 30% more publications than WoS. The research further states that most of the journals indexed in WoS are included in Scopus, further affirming its suitability to be included by itself for bibliometric analysis.

To perform the Scopus database search, Boolean operations such “AND” and “OR” are typically used to refine research results [35]. In this study, “Fintech” AND “Sustainable Finance” OR “Green Finance” was used as the search query. The query yielded 246 publications from the Scopus database; all published since 2018. In line with the proposed guidelines by Davies and Crombie [36], specific inclusion and exclusion criteria were established for the search, along with a clearly defined search strategy to identify relevant studies. The search was restricted to the title, abstract, and keywords fields to ensure relevance and focus. The study included only the peer-reviewed publications written in English and indexed in Scopus database.

Given the interdisciplinary relevance of fintech and sustainable finance, the search encompassed publications from a broad range of fields, including, business, management, accounting, economics, finance, social sciences, environmental science, computer science, decision sciences, energy, multidisciplinary, arts and humanities. To ensure the relevance and quality of dataset, publications that did not explicitly address fintech and sustainable finance were excluded. In addition, non-English publications, duplicate entries, and documents falling outside the specified publication types like journal articles, book chapters, conference papers, review papers. The final dataset retrieved 227 articles published between 2018 and 2025 to capture the most recent research trend in this ever-evolving associated arena.

In our bibliometric analysis, the next step conducts a quantitative analysis technique by combining R Studio [37] and VOSviewer [38]. This two software were applied to carry out two forms of assessment in the field of fintech and sustainable finance - performance analysis,

and network analysis. The performance analysis addresses publication trends, identification of the most prolific countries, subject area, author, sources and affiliations, countries, and articles. Citations metrics such as total citation, h_index, g_index, m_index, and number of publications was listed out to interpret the results of the performance analysis. Moreover, in this assessment stage, to visualize the structural and conceptual relationships within the targeted interdisciplinary field, network analysis is performed. The network analysis comprises co-occurrence analysis, co-authorship analysis, and cluster analysis. Based on the network analysis, a thematic mapping is conducted to categorize each research theme into clusters. Finally, once the clusters and themes are identified through mapping, to attain our final research aim, research trends were uncovered and analyzed by mapping interconnections to propose a future research agenda through content analysis which is a qualitative analysis that also comprehends the domains associated with each cluster [19,24]. This combination of quantitative and qualitative analysis provides not only empirical objectivity but also provides subjective narrative review of the selected interdisciplinary field [2]. Following this, the constraints and implications of this study are discussed to provide guidance for future researchers as well as for policymakers and institutions.

2. Findings & analysis

Table 1 provides a detail overview of the data collected for conducting this bibliometric analysis. To ensure that the analysis reflects recency, research data on FinTech and sustainable finance domains were extracted from 2018 till April 2025. The contemporary dataset encompassing this time span with the average document age of 1.58 years further affirms that near-term trends in the targeted multifaceted field of study is captured. 2018 was selected as the start year as it was the year when FinTech 4.0 emerged addressing sustainability to be integral element to be considered in making financial strategies [39],

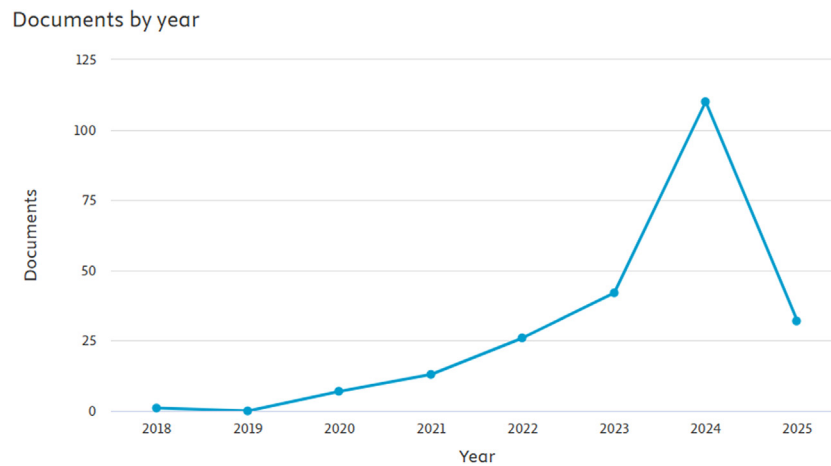


Fig. 2. Yearly publication trends for fintech and sustainable finance (2018 to 2025).

Table 3
Main information of the data.

Description	Results
MAIN INFORMATION ABOUT DATA	
Timespan	2018:2025
Sources (Journals, Books, etc.)	134
Documents	227
Annual Growth Rate %	64.07
Document Average Age	1.58
Average citations per doc	18.07
References	12 411
DOCUMENT CONTENTS	
Keywords Plus (ID)	685
Author's Keywords (DE)	504
AUTHORS	
Authors	609
Authors of single-authored docs	31
AUTHORS COLLABORATION	
Single-authored docs	31
Co-Authors per Doc	2.99
International co-authorships %	38.53
DOCUMENT TYPES	
article	141
book	17
book chapter	45
conference paper	10
review	14

thus, causing a shift from being a niche concept to a core research theme for researchers [40]. For instance, the results in Table 1 reveals that the annual publication growth rate stands at 64.07% and average citations per document lies at 18.07 indicating an accelerating scholarly interest in this cross-functional area. The study retrieved a total of 227 documents related to FinTech and sustainable finance were extracted of which the majority was comprised of journal articles, which is 62.1%, followed by book chapter (19.8%), book (6.2%), review (18.1%), and conference papers (4.4%). In terms of the authorship, there are 609 authors contributing to the field of which 31 documents are single authored. The prevalence of the exploration on this multifaceted area of study is evident by the collaboration data that shows 38.53% of the documents involving co-authorships with an average of 2.99 co-authors per document (see Table 3).

2.1. Descriptive attributes of fintech and sustainable finance publications

Fig. 2 illustrates the annual publication trends at the intersection of FinTech and Sustainable Finance. The upward movement since 2019 continued till 2024 with notable growth occurring since 2020 when the COVID-19 pandemic catalyzed the importance of financial technology in conducting transactions in every sector while considering the environmental, social, and governance factors associated to ensure sustainability for a positive long-term impact. A sharp rise in publications in the domain of current study occurred from 2023 to 2024 with nearly half of the extracted publication (48.5%) being published in the year 2024. The reason for this rise can be viewed from two aspects: (i) sudden increase in demand for FinTech solutions to meet the sustainable development goals, (ii) requirement of sustainability reporting mandated for companies with a significant concern over factors such as biodiversity, carbon reduction targets, etc., [41,42]. However, a dip in research trend is noticed from January 2025 to April 2025. This maybe due to the shift towards critical scrutiny of greenwashing problem addressed in the Global Institutional Investor Survey 2024 [43] and concerns over systematic risks associated with FinTech [23]. Another reason for this decline could be the amount of time required to review and publish journal article, i.e., the papers related to FinTech, and sustainable finance may be under review.

2.2. Most productive countries or territories

According to Smith [44], the production of publications and number of citations are considered as indicators for significant impact. Fig. 3 depicts the top 10 productive countries according to the overall published articles. China is ranked as the topmost productive country in the fintech and sustainable finance arena with 70 documents followed by India (39 documents) and Saudia Arabia (23 documents). Other significant contributors include Malaysia and the United Kingdom (19), Malaysia and the United Kingdom with 19 documents each, with Bangladesh being tenth on the list with 8 published documents in this cross-functional arena.

The findings of the top 10 most productive countries reveals that half of this list is dominated by developing countries with India and China being at the top. This indicates the concern over long term economic impact as a result of environmental issues being continually faced by these countries. For instance, the rapid industrialization and urbanization in China drives the need to opt sustainable activities, such as public and private funding in green finance, promoting green credit, etc., to combat negative effects associated with it [17]

Documents by country or territory

Compare the document counts for up to 15 countries/territories.

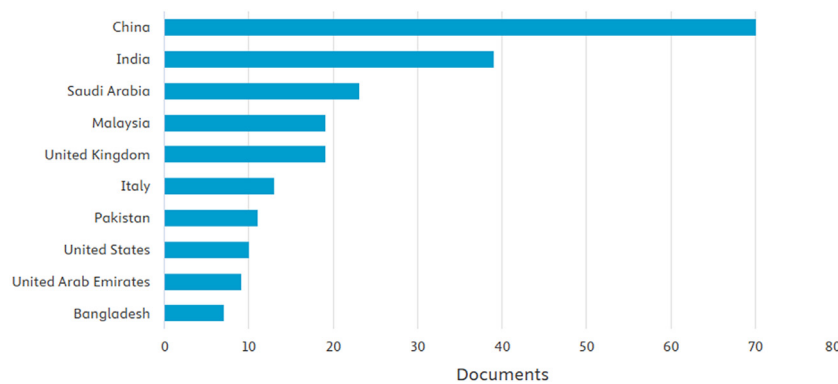


Fig. 3. Most productive countries.

Documents by subject area

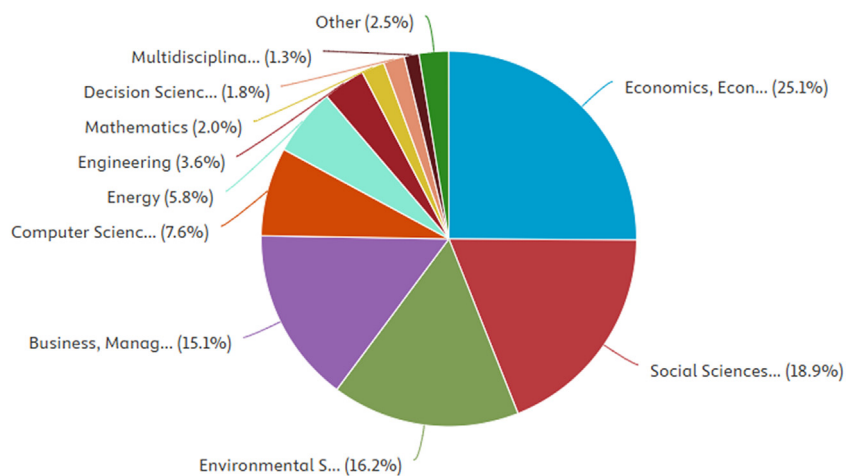


Fig. 4. Distribution of publications in different fields.

2.3. Most productive subject area

Fig. 4 illustrates the split of scholarly publications across diverse disciplines. The predominant proportion of articles is in Economics, Econometrics, and Operations Research (25.1%), followed by Social Sciences (18.9%) and Environmental Sciences (16.2%) as well. Other notable areas are Business, Management, and Accounting (15.1%), Computer Science (7.6%), Energy (5.8%), and Engineering (3.6%). The remaining disciplines possess lesser proportions, comprising Mathematics (2.0%), Decision Sciences (1.8%), Multidisciplinary (1.3%), and Other (2.5%). The figure demonstrates the fintech and sustainable finance domain is dominated by Economics, Econometrics, and Finance, followed closely by Social Sciences, Environmental Science, and Business/Management. This indicates the interconnection between financial transactions and economic stability coupled with compliance with environmental standard.

2.4. Author production overtime

The overview of individual authors' production overtime in the FinTech and sustainable finance areas has been displayed in Fig. 5. The figure shows the top 10 most productive (represented in y-axis) over a time span (x-axis). The size of bubbles interprets the number

of articles with larger bubbles meaning more production of articles. Subsequently, the color of the bubbles represents the average number of times the articles were cited annually with darker blue circles can be comprehended as authors with impactful publications. From this figure it can be deduced that Udeagha, M.C. has been the most impactful author in the year 2023 with the highest number of publications in the year 2023 followed by Lui L., Delina L.L., Khan S., and Kumar S.. However, the Udeagha's production of articles was limited to this specific time period while number of articles publishing in this subject arena by Lui L. and Delina L.L. with publication line extending to one year each. Further comparing between them, it can be seen that Liu L. had a greater average number of citations per article per year. Further analyzing the publication line, it can be observed that Khan S. has been the most consistent in producing articles from 2020 to 2024 related to the current study area, followed by Kumar S. with publication line extending to a time span of two years. In contrast, although the article production line of Taghizadeh-Hesary F. extended from 2022 to 2025, the author's production in the area of study decreased over time with a light blue bubble representing lower citations counts despite of longer period of activity. A similar case is evident in the case of Wang F. as well.

Table 4 that represents authors with the highest local impact only further validates the results of Udeagha, M.C., Akbar, M.W., Al-Kasasbeh, and Delina L.L. in Fig. 5. For instance, Udeagha, M.C. is the

Table 5
Most relevant sources.

Sources name	No. of articles
Resource Policy	32
Sustainability (Switzerland)	13
Economics, Law, and Institutions in Asia Pacific	9
Environmental Science and Pollution Research	8
Finance Research Letters	4
Research in International Business and Finance	4
IGI Global (The Sustainable Fintech Revolution: Building a Greener Future for Finance)	4
Discover Sustainability	3
Economic Analysis and Policy	3
Palgrave Macmillan (Springer Nature, Fintech and Sustainability)	3

Table 6
Most relevant affiliations.

Affiliation	Articles
Shenzhen University	9
The Hong Kong University of Science and Technology	9
The Hong Kong Polytechnic University	7
King Saud University	6
Liaoning University	6
Spiru Haret University	6
University of Strathclyde	6
Chongqing Technology and Business University	5
Universitas Merdeka Malang	5
Universitas Padjadjaran	5

Table 7
Analysis of the 10 most cited countries.

Country	Total citation	Average article citations
China	2030	33.80
South Africa	271	90.30
Spain	190	95.00
Pakistan	184	92.00
Italy	149	21.30
India	133	8.90
United Kingdom	95	11.90
Saudi Arabia	70	17.50
Colombia	54	27.00
Romania	52	26.00

may be because the studies are published recently or the studies are highly focused on local context. According to Bharti and Kharbanda [48], studies addressing highly specific local context tend to have lower global citations.

2.7. Influential articles

The influential articles in the field of fintech and sustainable finance highlights that achieving sustainable development goals through sustainable practices has become an integral part of FinTech application. Table 8 suggest findings that the top most influential articles shows the growing scholarly interest on establishing direct link between FinTech/ Green finance and environmental improvements consequently. For instance, Muganyi et al. [7] (401 citations) and Zhou et al. [6] (384 citations) both concentrated on the contributions of FinTech strategies and green finance polices in combatting environmental damage. This argument is further solidified by Yang et al. [5] where the paper mentions the ability of green FinTech in facilitating high-quality economic development. These papers are from Environmental Science and Ecotechnology, Ecological Economics, Resources Policy indicating that

researches are embedded in environmental studies and resource management policy. While these publications are based in China, influential articles by Udeagha and Muchapondwa [9] (106 citations) and Liu et al. [10] (184 citations) shifts the focus to BRICS nations and E7 economies to analyze the findings varying across regions. The study by Nenavath [8] (112 citations) concludes the similar results as those of China, thus, concluding the significance of the generalizing their findings to other large developing economies like India. Other notable works like Chueca Vergara and Ferruz Agudo [45] (190 citations) and Macchiavello and Siri [40] (107 citations) emphasize the role of governance and regulations in ensuring effective green fintech practices, while addressing any conceptual gaps that may be present in existing frameworks like those of EU. Among these influential articles, the paper by Wang et al. [49] presents a systematic review analyzing the prior findings and providing future research agenda emphasizing the need for research on the integration between specific technological advancements such as blockchain with sustainable finance. Finally, Hassan et al. [50] (121 citations) highlights FinTech as an adaptive tool that sustains even across different financial systems such as Islamic finance.

2.8. Thematic relationships within the literature

2.8.1. Co-occurrence network analysis

The VOS (“visualization of similarities”), developed for visualizing the patterns within the data, [51] offers a text mining functionality that extracts the keywords from the scientific literatures [52]. This keyword co-occurrence network shows the frequency of linkages among co-occurring terms [53]. Fig. 6 illustrates a keyword co-occurrence network produced with VOSviewer where the size of the nodes represents the frequency of the terms while the thickness of the line depicts the strength of co-occurrence. The keyword “fintech” and “green finance” has the largest node with the thickest line interconnecting them. This indicates that most of the research in the domain of the current study emphasizes the interdependence between these two terms making it a high-frequency co-occurrence of the entire analysis. Fig. 6 further represents the three different clusters with red, green, and blue color.

The first cluster (red color) includes the key terms fintech, green finance, natural resources, and environmental sustainability. This cluster reveals studies encompassing the role of fintech in minimizing the environmental problems while enhancing the management of resources more efficiently.

The second cluster (green color) includes the keywords sustainable finance, financial inclusion, sustainable development, and financial technology. This cluster is centred on addressing the social and economic dimensions of sustainability targeted towards eradicating the inaccessibility issue to formal financial services through financial technology among the marginalized people to serve broader societal goals leading to higher economic development.

The third cluster (blue color) comprises of blockchain and sustainability. This cluster is associated with the other two clusters specifying

Table 8

Evaluation of the highest cited articles.

Source: Bibliometrix.

	Author	Key area	Main results	Source title	citations
1	Muganyi et al. [7]	Impact of Fintech and Green Finance	China's green finance policies significantly reduced industrial gas emissions; fintech development helps decrease sulphur dioxide emissions and boosts environmental protection investment.	Environmental Science and Ecotechnology	401
2	Zhou et al. [6]	Effect of Fintech and Green Growth	Fintech and green finance significantly promote green economic growth in China, with more potent effects in eastern regions; fintech promotes green growth through green credit and investment.	Ecological Economics	384
3	Yang et al. [5]	Green Finance and FinTech Integration	Green finance facilitates high-quality economic development across the ecological environment, economic efficiency, and structure; fintech enhances green finance's effects on the environment and structure but has a limited impact on efficiency.	Resources Policy	308
4	Chueca Vergara and Ferruz Agudo [45]	Governance and Regulations	Fintech promotes sustainability and supports green finances by making financial businesses more sustainable; regulations are crucial for protecting consumers and ensuring green authenticity.	Sustainability (Switzerland)	190
5	Liu et al. [10]	Sustainable Finance, Energy Efficiency, and Fintech Transaction	Green financing, financial inclusion, and fintech improve energy efficiency in E7 economies, with green financing being the most effective; suggests improvements in fintech transaction systems for better support.	Environmental Science and Pollution Research	184
6	Wang et al. [49]	Sustainable finance, fintech, big data, and blockchain integration	Systematic review of green finance and energy policy research identifies green bonds, government subsidies, and carbon emission topics as future research opportunities; recommends integration with fintech, big data, and blockchain.	Energy Policy	131
7	Hassan et al. [50]	Challenges and Benefits	COVID-19 posed unique challenges for Islamic finance; fintech innovations are essential to adapting and creating a sustainable financial system post-pandemic.	Journal of Economic Cooperation and Development	121
8	Nenavath [8]	Policies and Environmental Protection	India's green finance policies have significantly decreased industrial CO2 emissions; fintech growth supports the reduction of SO2 emissions and promotes environmental protection investments.	Renewable Energy	112
9	Macchiavello and Siri [40]	Addressing the gap between Sustainable Finance and Fintech	Combining digital finance or fintech with sustainable finance could address gaps in the current EU sustainable finance frameworks; calls for more integrated research on "Green Fintech".	European Company and Financial Law Review	107
10	Udeagha and Muchapondwa [9]	FinTech and Environmental Sustainability	In BRICS countries, fintech, green finance, and energy innovation promote environmental sustainability, while economic growth and natural resource rents harm it; a bidirectional causality between CO2 emissions and green finance and fintech has been observed.	International Journal of Sustainable Development and World Ecology	106

the technological mechanisms such as distributed ledger technology being an enabler of each of the cluster's targeted sustainable goals.

These findings underscore the thematic diversity of the subject and its progression towards integrative, cross-disciplinary methodologies that tackle both financial innovation and global sustainability objectives.

2.8.2. Thematic mapping

The thematic map illustrated in Fig. 7, demonstrates the key themes and their development across relevance (centrality) and development (density) by fitting each research content in either of the four quadrants: Motor themes, Basic themes, Niche themes, and Emerging or Declining themes. Such categorization not only gives a comprehensive

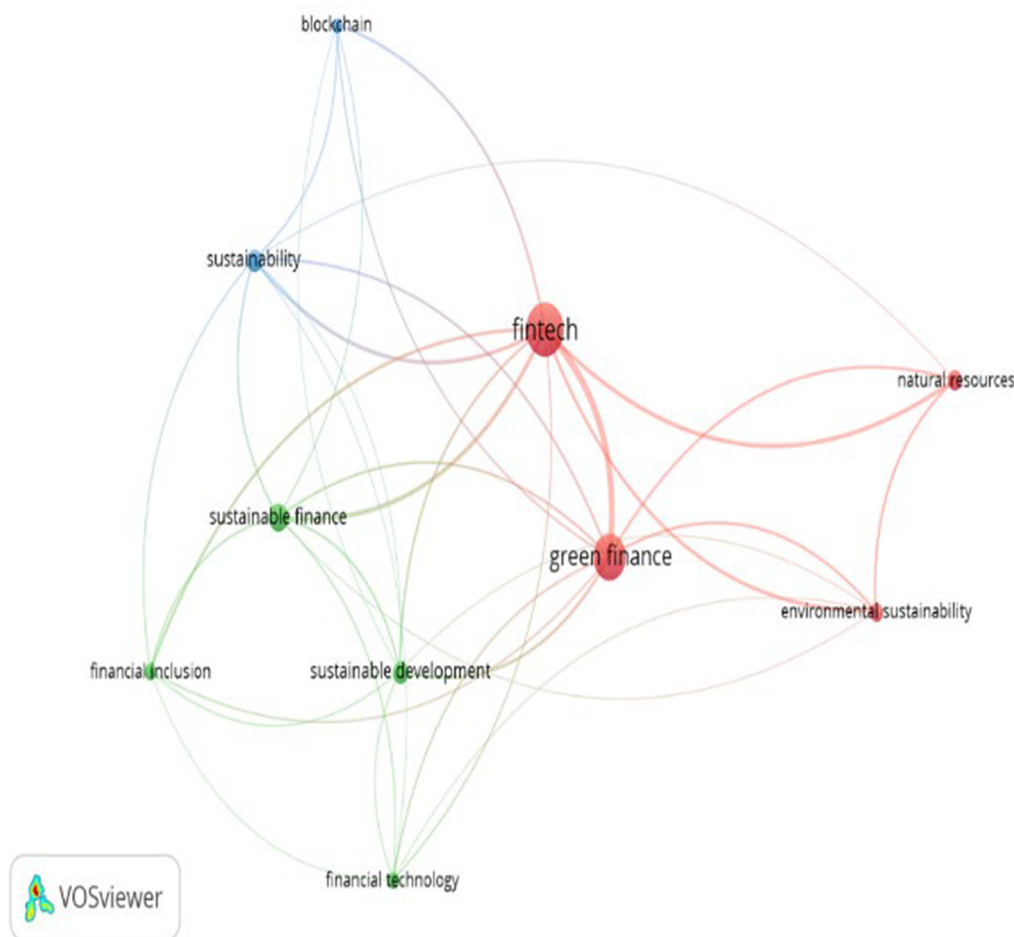


Fig. 6. Most frequent word & co-occurrence networks of author keywords.
 Source: VOS viewer.

b=view on each of the research area’s importance and maturity but also directs future research.

In the Motor themes quadrant, prominent themes like “green finance”, “economic growth”, “economic analysis”, “sustainable development”, “sustainability”, “finance”, “decentralized finance”, “green development”, and “sustainable development goals”, appear. These are highly relevant and highly developed themes, underscoring the significant linkage between finance and macro-economic development while achieving sustainability/ sustainable development goals. through technological solutions contemporary research.

Key terms “golden-green job”, “green financial technology” and “green jobs” are positioned in the Niche themes quadrant. These themes focuses on the sub-domains with weak connection with the core themes stating the themes highly developed with less relevance, making it relevant for internal specialization of institutions in this discipline.

Adjacent to Niche themes, Emerging or Declining themes are located that includes the themes “capital market”, “machine learning”, “fintech”, “europe”, and “credit provision”. This quadrant present less developed themes with low relevance. The presence of the keyword “fintech” in this quadrant is the most striking finding. Despite being a highly frequent term, it is not the central theme of sustainable development focus but rather a mechanism to come to conclusions of the Motor themes. Similarly, “machine learning” is an emerging concept in this specific field with weak body of literature. The quadrant also involves “capital market” and “credit provision” themes. This may be due the authors’ shift of focus from these general terms to “green bonds” [49] or “green credit” [6] that aligns well with the sustainability concept. Likewise, the term “Europe” is too broad to address the current research topic rather it is specified to selective geographical policies [40].

Additionally, it can be observed that the placement of the keywords “bibliometric”, “corporates”, and “green innovations” in between Basic themes and Declining themes represents unfocused (low density) themes with fading centrality. For instance, “bibliometric” is a methodical tool and not a central theme. Researchers use it to analyze ongoing and future trends. The theme “green innovations”, although a broad relevant term, it requires more specific approach of study (e.g. green bonds, etc.). Similarly, “corporates” are unlikely to be the subject of research question in the contemporary research, rather corporate actions e.g. – ESG disclosure, green innovations, etc. are likely to be potential themes for study.

Lastly, “covid-19”, “banking”, and “human” are also seen in the middle of Motor themes and Basic themes which can be characterized as themes that have moderate to high density with high centrality. Therefore, the placement indicates that covid-19, a major external shock, is a crucial theme that disrupted the traditional financial system by establishing financial technology (FinTech) which eventually shifted human behavior to adapt to these new financial innovations which eventually led to rapid expansion of FinTech market, necessitating the accumulations of the sustainability factors in this field.

2.8.3. Co-authorship network analysis

The Co-authorship Network is visualized in Fig. 8 depicting the collaboration network among nations. It is evident that China is in the red cluster group of five countries making it the most dominant contributor in research collaborations with other countries. Thus, conforming to Table 7 and Table 8 where it is interpreted China to be the country with most citations and number of publications. Following

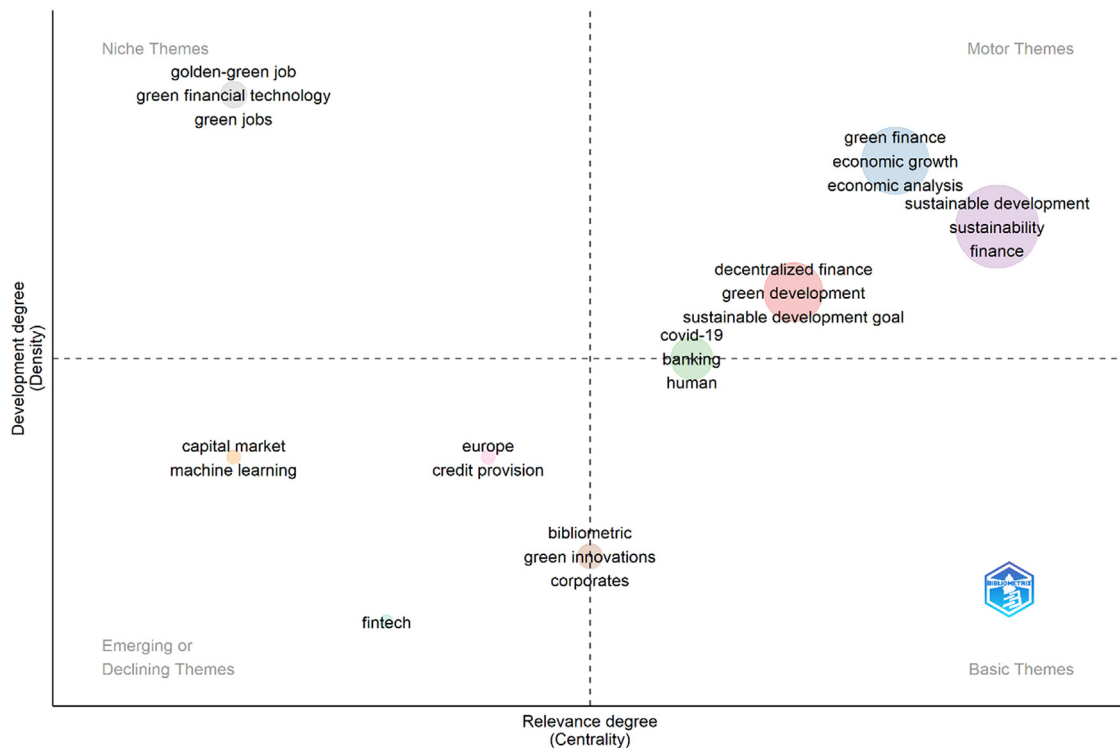


Fig. 7. Thematic map.
Source: Bibliometrix

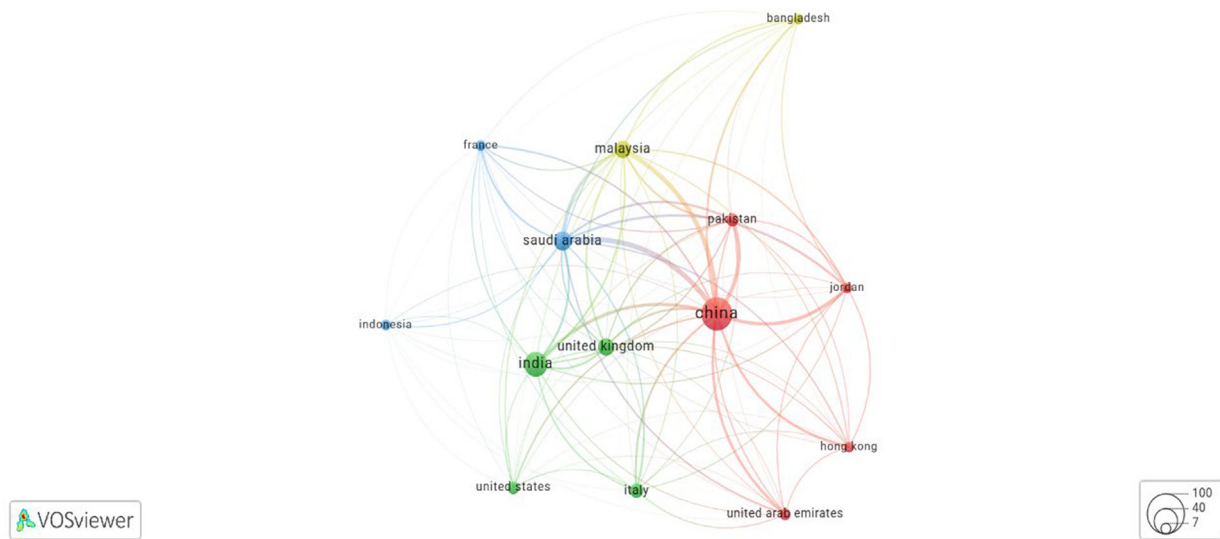


Fig. 8. Country network of co-authorship.

this, the second largest cluster in this group includes four countries with research collaborations among emerging economies like India and Western countries like United Kingdom, United States, and Italy. The third cluster (blue) has the most diverse collaboration consisting of European, Middle Eastern, and Southeast Asian institutions. Finally, the fourth cluster (yellow) comprises of only two South-Asian countries — Malaysia and Bangladesh.

2.8.4. Clusters by document coupling

Fig. 9 represents document coupling by plotting clusters of documents based on their impact and (Y-axis) and centrality (x-axis). The upper-right quadrant is overwhelmed with research themes such

as “green finance”, “sustainable finance”, “sustainable development”, “fintech adoption”, “natural resources”. Each cluster within this quadrant has either the term fintech, green finance/ fintech, and sustainable finance. According to Table 6, the most cited paper had the term green finance and fintech and sustainable development confirming the main focus of the field surrounding environment and economic application.

The key terms “Financial Technology” (27.3% confidence), “Climate Risk” (50% confidence), “Biodiversity Conservation” (100% confidence). This suggests that these themes have high impact however, it is placed in the middle of centrality which maybe due to the gradual transition from being general concepts to being an enabler of sustainable themes in the FinTech and Sustainable Finance discipline.

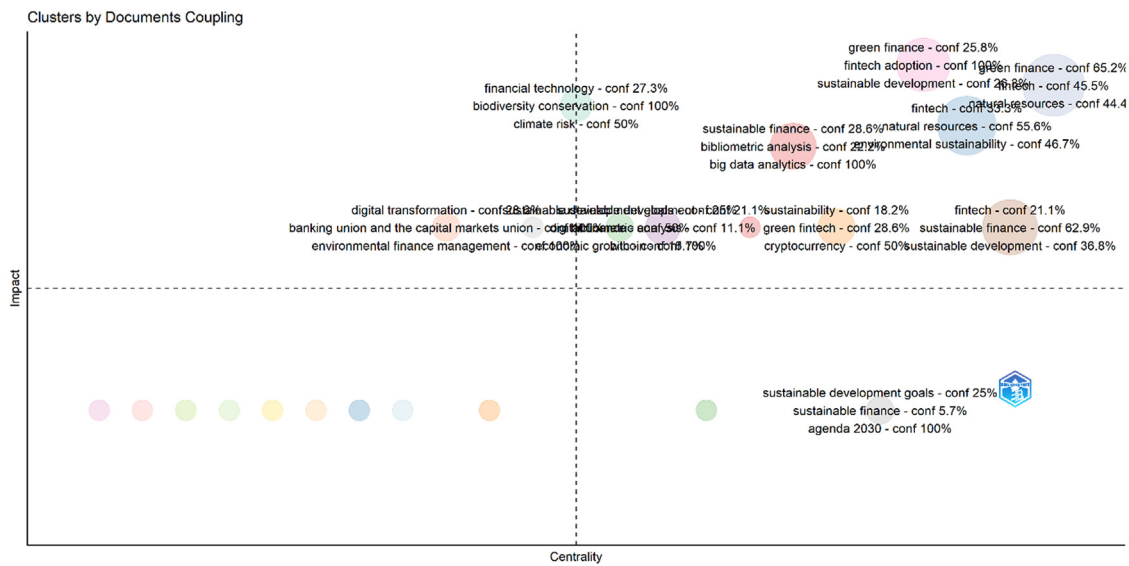


Fig. 9. Cluster analysis of document coupling.

Similarly, the terms are “Digital Transformation, Cryptocurrency, Banking Union, Environmental Finance management, Digital Finance, and Topic Growth” respectively. However, it suggests that there is an opportunity for future research, particularly in connecting them to more central themes.

In the lower right quadrant, the cluster comprises the themes of “sustainable development goals”, “agenda 2030”, and “sustainable finance”. These documents are strongly linked (High Centrality), i.e., the documents reference or are referenced by the high-impact literature. However, their citation count is still low (Low Impact) which may be due to the recency of the papers or the documents maybe serving as policy frameworks rather than presenting empirical findings.

2.9. Discussions and implications

The study contributes significantly by explicitly focusing on FinTech and sustainable finance. Such a review comprises financial technology and investigates the sustainability from multiple value-adding dimensions of environmental impact, economic development, and governance. Therefore, extending the scope which previous bibliometric review lacked where fintech was linked to only specific sub-domains like green finance, financial inclusion, etc. The study further enhances the scope by retrieving 227 papers from Scopus database including non-journal article such as conference papers, book, book chapters, and reviews to conduct the bibliometric analysis. Furthermore, the inclusion of articles published in 2025, precisely till April 2025, and analyzing data dating back to the start year of FinTech 4.0, the bibliometric review provides overview of the near-term trends and highlights the transition of the areas of study within the contemporary research area.

Overviewing the clusters, it is revealed that although FinTech is a core theme, it is categorized as Declining theme. In contrast, “Green Finance” and “Green FinTech” is positioned as a high impact theme with high centrality. This finding suggest that FinTech has surpassed the theoretical study to evaluate the functional applications of FinTech in providing sustainable solutions. Additionally, a significant dominance of Asian nations, especially China in terms of number of publications, citations, and collaborations is identified with a few other regions like South Africa, Spain, United Kingdom, and United States being on the list. This indicates that high-output nations like China heavily influence policy environments as well as frameworks for studying over

the cross-functional, FinTech and sustainable finance, domain. This skewed geographical distribution of the study raises concern over the applicability of the findings to different regions. However, the positive impact experienced are likely to be similar like results of India and China. Thus, it can be inferred that the timeframe of benefits gained due to sustainable finance through FinTech solutions will vary depending on the extent of acceptance of new innovations by policymakers, institutions, and consumers as well as the extent of suitability of employing advanced tools like AI/Blockchain applications in FinTech to achieve sustainability depending on the organization-readiness and other macro-economic factors. Further analysis involved diving into the difference in published articles, where it is noticed that while developed countries conducts their studies around regulatory frameworks, ethical issues, and fintech integration in other sectors, emerging countries focus on the scale and accessibility of FinTech adoption catalyzed by sustainable practices leading to enhanced financial inclusion, lower emissions, etc.

The mapping of Fintech and Sustainable Finance intersection through bibliometric review has several implications for academicians and researchers, regulators and policymakers, and financial institutions.

Implications for Researchers

The current study provides a detailed analysis of the network analysis that reveals the importance of transitioning research focus to understanding the alterations in transaction processing due to FinTech and its associated systematic risks occurred as a result of digitalized financial process. Furthermore, it guides the researchers to examine individual technological mechanisms like machine learning, AI, and blockchain to assess their extent of functionality in fostering economic benefits complying with sustainable factors. Moreover, the analysis of regional clusters urges the researchers to challenge the generalizability of the current models across regions to calculate the strength of linkages between FinTech and sustainable finance of different countries. Finally, moderate centrality and moderately development of basic themes like human indicates the relevance and impact of understanding stakeholders’ perception of FinTech developments and its consequent impact on sustainable development goals. Researchers should conduct large-scale surveys on SMEs and retail investors to explore their willingness on investing in green fintech products and consequently understand consumers’ perception on adopting this green fintech products. Exploring

Table 9
Research Gaps and Potential Research Areas with research questions requiring attention.

Research gap	Potential research areas/ Topics	Research questions
Integration of specific emerging technologies with green fintech to establish standardized global metrics	AI/ Blockchain for ESG Reporting, Verification, and non-financial disclosure in the fintech industry	<ul style="list-style-type: none"> • How the utilization of AI/ Blockchain can aid in digital ESG reporting, verification, and non-financial disclosure in the fintech industry?
Balancing Systematic financial Risks associated with FinTech that promotes sustainable finance	Role of RegTech (Regulatory Technology) in minimizing the risks associated with FinTech innovation	<ul style="list-style-type: none"> • How RegTech can minimize the risks such as data abuse, illegal transactions, greenwashing, etc. by ensuring real-time regulatory monitoring? • How the supervisory technologies should be structured that will manage the risks associated with FinTech innovations that will also align with sustainability mandates?
Despite high impact potentiality and confidence percentage, there is lack of FinTech implementation frameworks that addresses “biodiversity conservation” and “climate risks”	The causal effect of implementing effective financial instruments such as green bonds, green derivatives, and other valuation methods are effective in financing biodiversity/ reducing climate risk projects in the fintech domain	<ul style="list-style-type: none"> • Which financial instruments (e.g. green derivatives, green bonds) and valuation methods are effective in financing biodiversity/ reducing climate risk projects in the fintech domain? • How the effectiveness of financing biodiversity/ reducing climate risk projects through utilizations of valuation methods in the fintech domain varies by specific regions?
Post External-Shock FinTech Strategy	The magnitude of change in sustainable investment practices and preferences in the finance industry derived by the enactment of policies after an external shock	<ul style="list-style-type: none"> • What policy changes during COVID-19 pandemic altered the sustainable practices and preferences in the finance industry? What was the extent of alteration? • Is the policy adopted after a certain external shock, e.g. COVID-19 outbreak, will be applicable to other forms of external shocks, e.g. macro-economic fluctuations or global repercussions like 2008 global credit crunch, in the finance industry?

these two perspectives are crucial as otherwise the sustainable developments goals associated with FinTech such as reduction of inequality, protection of environment, financial and economic stability, would not be fulfilled holistically,

Implications for Regulators

The bibliometric review highlights the high impact and centrality of themes like Green Finance/FinTech, sustainability/ sustainable finance. This mandates the regulators to establish green regulatory sandboxes to examine the stability of green FinTech infrastructure alongside the systematic risks underlying this such as cyber vulnerability, discrepancy in digital financial literacy of the population with the extent of advanced FinTech applications. In addition to this, apart from the practice of green reporting, regulators of each region must establish digital taxonomy for all ESG reporting to gain insights on the effectiveness of FinTech infrastructure in accelerating sustainable practices to achieve the broader macro-economic objective.

Implications for Practitioners/ Financial Institutions

The findings also provide pathway for financial institutions to invest in technological solutions that will automatically relate digital financial systems such as portfolio management, credit risk management, etc. with digital taxonomy to ensure compliance with regulations. Thus, reducing the workload for financial institutions while enabling real-time monitoring of the sustainable impact of various existing and new FinTech products. To ensure smooth application and adoption of new FinTech products, financial institutions can engage in partnerships and move R&D investments in Asia, where FinTech is widespread and is a emerging concept, to perform pilot testing of green fintech tools. However, to ensure successful transferability to other regions, the financial institutions must be careful in separating technological mechanisms with policy environments. The scope of the bibliometric review also extends to non-financial institutions such as e-commerce and retail where embedment of FinTech services like Buy-Now-Pay-Later (BNPL) increases accessibility and consumption, thus, yielding economic benefits for firms as well as which lowering the sales cycle with a high turnover rate [54] while ensuring sustainable practices such as creating a cashless society.

2.10. Future research lines

The discussion of quantitative data and network analysis along with implications opens several avenues for future research. Table 7 identifies the research gap, potential research areas with potential research questions (see Table 9).

In addition to the identified gaps, another potential research area for study would be human behavior. For example, “*What are the perception of the authorities, policy makers, and fintech institutions on RegTech on combatting issues?*”, “*What are the key behavioral and psychological factors that predict the successful adoption of green FinTech platforms by consumers and small and medium-sized enterprises (SMEs)?*”

3. Conclusion

The study maps the intersection of FinTech and sustainable finance through a bibliometric extending the current literature by involving broader dimensions of sustainability in the finance domain as well as involving both quantitative analysis of data and qualitative review through content analysis to analyze the relationships of words, themes, or concepts of each network generated. The Study is further enriched by the inclusion of conference papers, books, book chapters, and reviews along with journal articles. Summarizing the data interpretations, it was revealed that Asian nations like China and authors affiliated to this nation are the major contributors and collaborators in the contemporary research field. Among the research themes, “Green Finance” and “Sustainability”/ “Sustainable Development” are found to be the core area of study followed by investigation of FinTech regulatory frameworks and its conceptual gaps, mostly in developed countries. On the contrary, sustainable factors such as financial inclusion and FinTech are observed to be major area of concern for African and Asian countries. Additionally, the cluster reveals the themes that has the potentiality to transform into core themes that were previously positioned in the niche category. Furthermore, the findings further reveal the emphasis put by researchers on outcome, i.e. – Green Finance or sustainable economic development, rather than focusing on the

technical mechanisms that drives this impact. Thus, representing the gap of treating these technical mechanisms like machine learning, AI, and blockchain as auxiliary, which is highlighted to be considered as the fundamental subject analysis for future research. Other potential future research areas identified include studying varying sustainable FinTech implementation frameworks, examining and balancing external shocks and systematic risks through regulatory financial strategies and technologies.

Despite the comprehensive view, the bibliometric reviews pose some limitations. First, it relies solely on the Scopus database for data extraction, which may have excluded relevant publications available in other databases or sources not indexed in Scopus. This limits the generalizability of the findings, as studies published in other prominent databases like Web of Science or PubMed may not have been captured. Additionally, the study focused only on English language publications and excluded non-English articles potentially overlooking important resources published in other languages. Moreover, there is presence of grey literature, i.e. exclusion of documents such as “central bank policy”, “national regulatory proposal”, etc. that reside outside the traditional academic publishing cycle. Future research could expand beyond the Scopus database to provide a more comprehensive view of the literature and include publications that might not be captured in Scopus. Such a multi-database approach would also help mitigate any biases associated with relying on a single source.

CRediT authorship contribution statement

Md Sharif Hassan: Writing – original draft, Visualization, Formal analysis, Conceptualization. **Fatema Tuz Zahra:** Writing – original draft, Methodology, Investigation. **Mohammad Abul Kalam Azad:** Writing – original draft, Resources, Data curation. **Mohammad Bin Amin:** Writing – review & editing, Supervision, Software, Project administration, Methodology. **Sadia Afrin:** Writing – original draft, Validation, Methodology. **Judit Oláh:** Writing – review & editing, Supervision, Project administration, Methodology, Investigation, Funding acquisition.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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