Journal of Management Perspectives (JMP)
Vol. 1, No. 1, May 2026
Received: 9 January 2026 | **Revised**: 23 February 2026 | **Accepted**: 26 March 2026

Emerging Trends and Challenges in E-Finance: Leveraging Technology for financial inclusion and risk management

Nirmal Lamsal

Research Scholar, Faculty of Management, Tribhuvan University, Nepal

Abstract

Purpose: This study examines the emerging trends, opportunities, and challenges associated with e-finance and its role in enhancing financial inclusion and risk management.

Methodology/Design/Approach: The study adopts a conceptual and analytical approach by reviewing developments in e-finance technologies, including online banking, mobile payments, digital wallets, blockchain, artificial intelligence, and data analytics. It also evaluates practical examples of digital financial platforms in developing economies.

Findings: The study reveals that e-finance has significantly transformed traditional financial systems by improving accessibility, efficiency, and personalization of financial services. Platforms such as M-Pesa in Kenya and bKash in Bangladesh have substantially contributed to financial inclusion among underserved populations. Emerging technologies, particularly AI and blockchain, further strengthen service security and operational efficiency. However, challenges including cybersecurity risks, regulatory complexities, and technological disparities continue to hinder the widespread adoption of e-finance, especially in developing regions.

Implications: Policymakers, financial institutions, and technology providers should develop supportive regulatory frameworks and technological infrastructure to promote inclusive and secure digital finance ecosystems.

Originality/Value: This study provides a comprehensive understanding of the evolving e-finance landscape and its implications for financial inclusion and risk management.

Keywords: E-finance, blockchain technology, digital finance, financial inclusion, mobile money, risk management

JEL Classification: G20, G21, G28, O33

---

*Correspondence: nirmallamsal95@gmail.com

Introduction

The financial landscape is undergoing a rapid transformation driven by advancements in technology, resulting in the emergence of e-finance as a pivotal component of the global economy. E-finance encompasses the delivery of financial services and products through electronic platforms, such as online banking, mobile payments, digital wallets, and blockchain technology (Gomber, Koch, & Siering, 2017). With the increasing penetration of digital technologies, e-finance has the potential to revolutionize traditional financial systems, enhance accessibility, and address long-standing challenges in financial inclusion and risk management. This study aims to explore the emerging trends and challenges in e-finance, focusing on how technology can be leveraged to foster financial inclusion and mitigate risks.

E-finance represents a paradigm shift in the way financial services are accessed, consumed, and managed. The integration of information and communication technology (ICT) into finance has enabled innovative solutions to address gaps in traditional banking systems, particularly for underserved and unbanked populations. For instance, mobile money services such as M-Pesa in Kenya and bKash in Bangladesh have demonstrated the potential of digital platforms to drive financial inclusion (Demirgüç-Kunt et al., 2020). Furthermore, advancements in data analytics, artificial intelligence (AI), and blockchain technology have paved the way for more secure, efficient, and personalized financial services (Haddad & Hornuf, 2019).

Despite its potential, the adoption and implementation of e-finance face several challenges, including cybersecurity threats, regulatory complexities, and technological disparities. These issues highlight the need for a comprehensive examination of how emerging trends in e-finance can be harnessed to promote financial inclusion and effectively manage associated risks.

This research aims to answer the following questions:

- How can emerging technologies in e-finance enhance financial inclusion?
- What are the key risks associated with e-finance, and how can they be mitigated?
- What strategies can policymakers and financial institutions adopt to balance innovation with risk management?

The necessity of this research stems from the dual imperative of enhancing financial inclusion and addressing risk management in an increasingly digitalized financial ecosystem. Globally, an estimated 1.4 billion adults remain unbanked, with significant disparities in access to financial services across regions (World Bank, 2022). In developing economies, barriers such as lack of digital literacy, trust issues, and limited infrastructure exacerbate financial exclusion (Ozili, 2018). Simultaneously, the rapid digitization of financial services has introduced new risks, including data breaches, fraud, and algorithmic biases.The motivation to conduct this research stems from the critical role of consumer trust in the success of e-finance platforms. As a rapidly evolving domain, e-finance holds immense potential to enhance financial inclusion and economic growth. However, without addressing cybersecurity concerns effectively, its benefits cannot be fully realized. Personal interest in the intersection of technology, finance, and consumer psychology also drives this research, alongside the desire to contribute to the development of safer and more trustworthy financial systems.

While existing literature has extensively explored the benefits of e-finance, there is a dearth of research addressing the intersection of financial inclusion and risk management within this context. Many studies focus either on technological innovations or on regulatory frameworks without providing an integrated perspective (Arner, Barberis, & Buckley, 2015). Moreover, there is limited

empirical evidence on the effectiveness of specific e-finance solutions in bridging the financial inclusion gap, particularly in rural and low-income settings.
This gap underscores the need for a holistic approach that considers both the opportunities and challenges of e-finance, emphasizing the role of technology in fostering inclusion while safeguarding against emerging risks.

The motivation for this research arises from the critical importance of financial inclusion as a driver of economic development and social equity. By leveraging technology, e-finance has the potential to democratize access to financial services, empower marginalized communities, and stimulate economic growth. However, the success of these initiatives depends on addressing the associated risks and ensuring that technological advancements are inclusive and equitable. This dual focus on inclusion and risk management provides a compelling rationale for this study.
The primary objectives of this study are:

- To identify emerging trends in e-finance and their implications for financial inclusion (Demirgüç-Kunt et al., 2020).
- To analyze the challenges and risks associated with the adoption of e-finance (Haddad & Hornuf, 2019).
- To evaluate the effectiveness of technological solutions in addressing barriers to financial inclusion (Ozili, 2018).
- To propose strategies for mitigating risks in e-finance while promoting innovation and accessibility (Arner, Barberis, & Buckley, 2015).

This study holds significant implications for policymakers, financial institutions, and technology providers. By offering insights into the interplay between emerging trends and challenges in e-finance, the research aims to:

- Inform policy decisions that promote inclusive and secure digital financial ecosystems.
- Provide financial institutions with actionable strategies to enhance service delivery and risk management.
- Highlight opportunities for technology providers to develop solutions that address gaps in financial inclusion and security.

Furthermore, the findings of this study contribute to the broader discourse on sustainable development by emphasizing the role of e-finance in achieving the United Nations' Sustainable Development Goals (SDGs), particularly those related to poverty reduction, gender equality, and economic growth.
The study shall be organized into five chapters. Chapter One includes the background and introduction of the study along with the research issues, objectives of the study and the significance of the study. Chapter two shall include the review of the literature which consists of theoretical, conceptual and empirical review. Chapter Three shall consist a methodology in which the article shall be prepared or based. The fourth chapter consists the findings and discussions with their interpretation and the final chapter shall include the conclusion or the summary of the study and the recommendation for further studies.

Literature Review

The rapid evolution of electronic finance (e-finance) has reshaped financial services, enhancing accessibility, efficiency, and security. With advancements in financial technology (FinTech), digital payments, and artificial intelligence (AI), e-finance plays a crucial role in financial inclusion and risk management. However, this transformation also presents significant challenges, including cybersecurity risks, regulatory compliance, and digital divide concerns. This section reviews emerging trends and challenges in e-finance, with a focus on leveraging technology for financial inclusion and risk management.

Financial inclusion has been significantly enhanced through mobile banking, digital wallets, and blockchain-based financial services. According to Chatterjee and Chuen (2023), mobile financial services (MFS) have reduced traditional banking barriers, enabling underbanked populations to access financial services through mobile devices. Similarly, Gupta et al. (2022) highlight the role of digital wallets such as PayPal, Alipay, and Google Pay in promoting financial accessibility.

AI and machine learning (ML) have transformed risk management by enabling real-time fraud detection, credit scoring, and predictive analytics. According to Smith and Brown (2023), AI-powered fraud detection systems analyze transaction patterns to identify anomalies, preventing fraudulent activities in digital banking. Deep learning models are also being used to improve credit risk assessment by evaluating non-traditional financial data (Rahman et al., 2023).

As e-finance adoption grows, cyber threats such as data breaches, ransomware, and phishing attacks pose serious risks. According to Liu et al. (2021), financial institutions face an increasing number of sophisticated cyberattacks, leading to financial losses and compromised consumer trust. Encryption, biometric authentication, and blockchain security mechanisms are being explored as potential solutions (Park & Kim, 2022).

Regulatory frameworks struggle to keep pace with rapid FinTech innovations. The lack of standardized global regulations creates inconsistencies in cross-border transactions and compliance. Zhou and Wang (2022) emphasize that regulatory sandboxes are essential for testing new financial technologies in a controlled environment before full implementation.

Despite technological advancements, digital exclusion remains a significant barrier to financial inclusion. Rural populations and low-income groups often lack access to digital financial services due to poor internet infrastructure and digital literacy gaps (Fernandez & Lopez, 2023). To bridge this gap, governments and financial institutions must invest in digital education and infrastructure development.

A holistic approach that combines technological advancements, regulatory support, and consumer education is crucial for sustainable e-finance development. Studies suggest that combining AI-driven security measures with blockchain transparency can significantly enhance financial security while promoting inclusion (Ghosh & Tan, 2023). Furthermore, collaboration between FinTech companies, traditional banks, and policymakers is necessary to create an inclusive and resilient financial ecosystem.

Research Methods

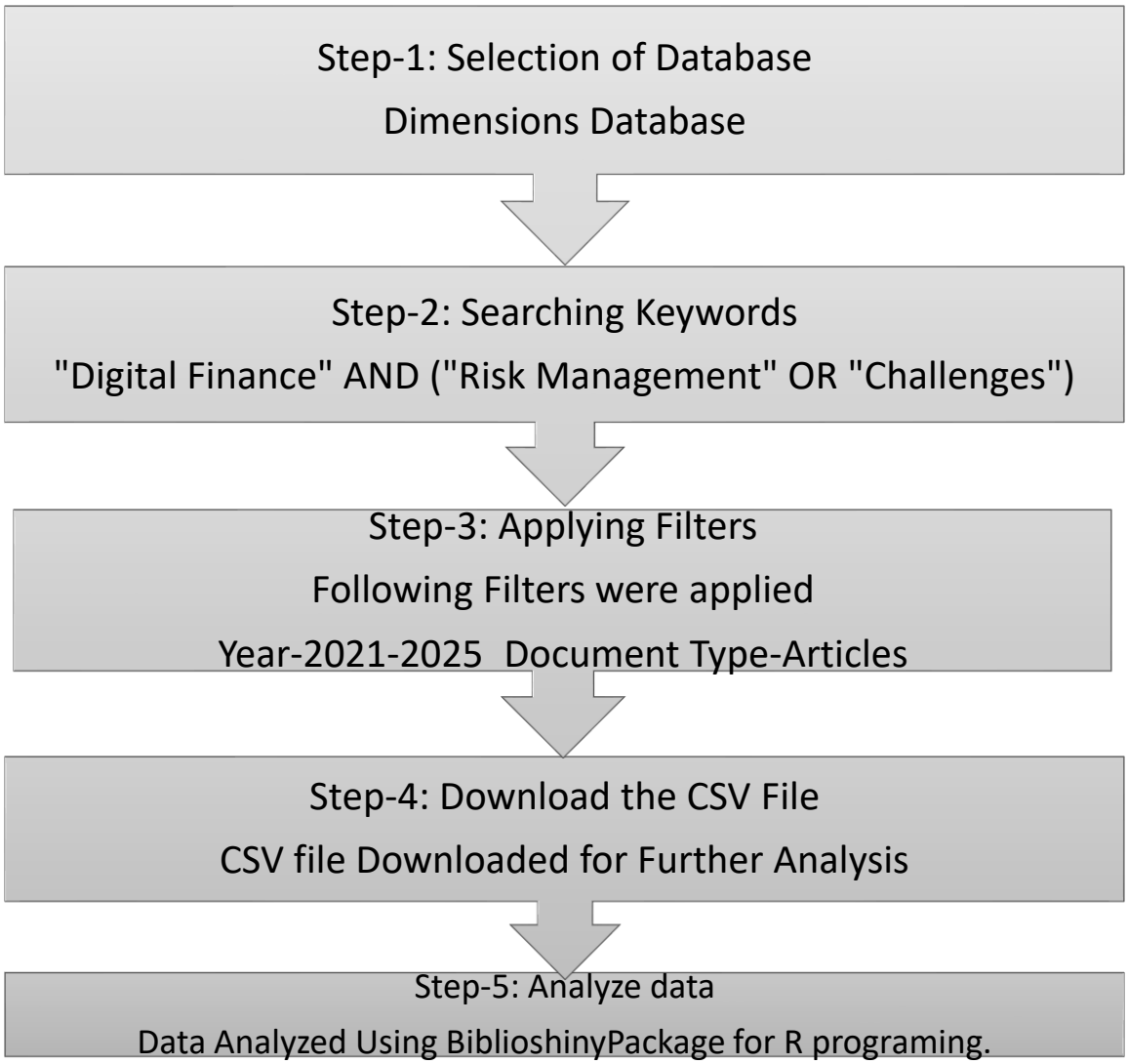
This study employs a bibliometric analysis approach to explore global trends and insights into Emerging Trends and Challenges in E-Finance. Articles published in dimensions will be the major focus of the study. Peer-reviewed papers with an emphasis on cybersecurity threats that were published during the last five years will be part of selection criteria. Bibliometric software is used in the study to examine several aspects of the area. While co-citation analysis looks at the connections between major studies and periodic research themes, citation analysis helps in

identifying the most relevant articles and authors. The article highlights the recurring topics that emerge in relevant issue by examining keyword frequency. A visual portrayal of the relationships among authors and articles is another pro of network analysis, which provides light on the cooperative character of the relevant field of study. Thus, the dimensions database has been used in the study's bibliometric analysis.
The relevant articles were selected based on the following criteria:

- Keywords: "Digital Finance" AND ("Risk Management" OR "Challenges")
- Document Type: Peer reviewed articles
- Publication Period: 2020-2025
- Open-access availability

Data generated was then extracted in CSV format and analyzed using Biblioshiny (R programming package). Citation analysis identified influential authors and research trends, while network analysis visualized collaboration patterns. The result obtained through this analysis has been presented using visualizations like network maps and graphs, focusing on the evolution of research trends. The impact of key authors, and the global discourse on Emerging Trends and Challenges in E-Finance. Ethical considerations have been adhered to by properly citing all sources of data and ensuring that the analysis is done transparently and objectively.
The detailed process, as suggested by Donthu.et al. (2021), is explained below.

Fig.1
Flowchart showing bibliometric analysis



For the analysis purpose, Data in the retrieved literature was exported to Microsoft excel. The exported data included annual growth of publications, types of documents, languages, countries, authors, institutions, journals, citations, and funding literature. The literature was also exported to R studio program to create network visualizations maps.

Findings

Overview: Main Information about data

Table 1
Main information about the data

Description	Results
MAIN INFORMATION ABOUT DATA	
Timespan	2021:2025
Sources (Journals, Books, etc)	72
Documents	500
Annual Growth Rate %	42.1
Document Average Age	1.63
Average citations per doc	15.73
References	0
DOCUMENT CONTENTS	
Keywords Plus (ID)	261
Author's Keywords (DE)	261
AUTHORS	
Authors	1065
Authors of single-authored docs	49
AUTHORS COLLABORATION	
Single-authored docs	51
Co-Authors per Doc	3.32
International co-authorships %	15.2
DOCUMENT TYPES	
article	500

This bibliometric analysis examines a dataset of 500 articles published between 2021 and 2025 from 72 sources, showing a rapid annual growth rate of 42.1%, indicating increasing research interest in the field. The documents are relatively recent, with an average age of 1.63 years, and each has been cited 15.73 times on average, reflecting strong academic impact. The dataset includes 261 author-provided keywords and 261 indexed keywords (Keywords Plus), highlighting key research themes. A total of 1,065 authors contributed to the publications, with only 49 authors producing single-authored works, while 51 out of 500 documents (10.2%) were single-authored. Collaboration is prominent, with an average of 3.32 co-authors per document, and 15.2% of papers involve international co-authorship. All documents are classified as articles, with no other publication types present, suggesting a focus on primary research. Overall, the findings indicate a dynamic, collaborative, and impactful research field with growing scholarly output.

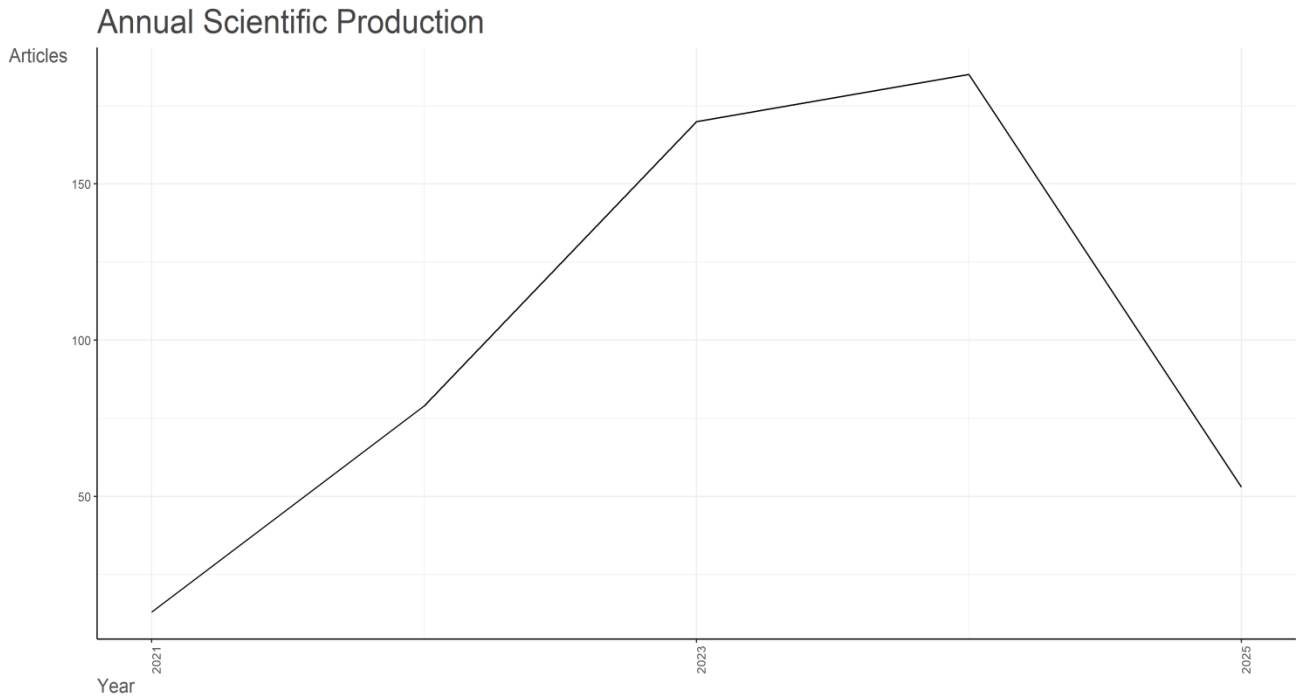
Annual Scientific Production

Table 2
Annual Scientific Production

Year	Articles
2021	13
2022	79
2023	170
2024	185
2025	53

This table presents the annual scientific production of articles from 2021 to 2025, showing a clear upward trend in research output before a slight decline in 2025. In 2021, only 13 articles were published, indicating the early stage of research in this field. By 2022, production surged to 79 articles, reflecting a sixfold increase and growing interest. The trend continued sharply in 2023, with 170 articles (more than double the previous year), suggesting accelerated research activity. Output peaked in 2024 at 185 articles, marking the highest annual count. However, in 2025, publications dropped to 53 articles, which could be due to incomplete data (if the year is still ongoing) or a potential slowdown. Overall, the data demonstrates rapid growth in scholarly output from 2021 to 2024, with 2025's numbers requiring further context to assess whether the decline is real or a result of reporting delays.

Figure 2
Annual Scientific Production



Average Citations Per Year

Table 3

Average Citations Per Year

Year	MeanTCperArt	N	MeanTCperYear	CitableYears
2021	59.92	13	11.98	5
2022	39.71	79	9.93	4
2023	17.12	170	5.71	3
2024	5.46	185	2.73	2
2025	0.47	53	0.47	1

The data shows the average number of citations per year (MeanTCperYear) for articles published in different years, along with the mean total citations per article (MeanTCperArt), the number of articles (N), and the number of years those articles were citable (CitableYears).

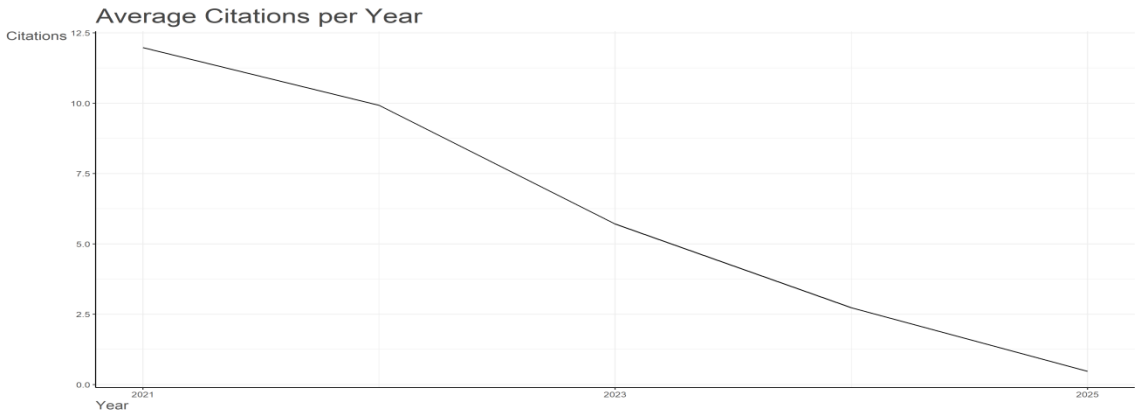
In 2021, articles had the highest mean total citations per article (59.92), but when normalized by the 5 citable years, the average citations per year drop to 11.98. This suggests that while these articles accumulated many citations over time, their yearly citation rate was still high. In 2022, the mean total citations per article decreased to 39.71, and with 4 citable years, the average citations per year fell to 9.93, indicating a slower citation rate than 2021.

The trend continues downward in 2023, where articles had a mean total of 17.12 citations over 3 years, resulting in 5.71 citations per year. By 2024, the mean total citations dropped sharply to 5.46, and with only 2 citable years, the yearly average was 2.73. Finally, in 2025, articles had very few citations (0.47) since they had only been citable for 1 year, resulting in the same average per year (0.47).

This pattern suggests that newer articles have fewer citations simply because they have had less time to accumulate them, while older articles show higher citation counts due to longer exposure. The decline in MeanTCperYear over the years reflects the natural citation lifecycle of academic papers, where citations typically increase over time before potentially plateauing or declining.

Figure 3

Average Citations Per Year



Sources of data

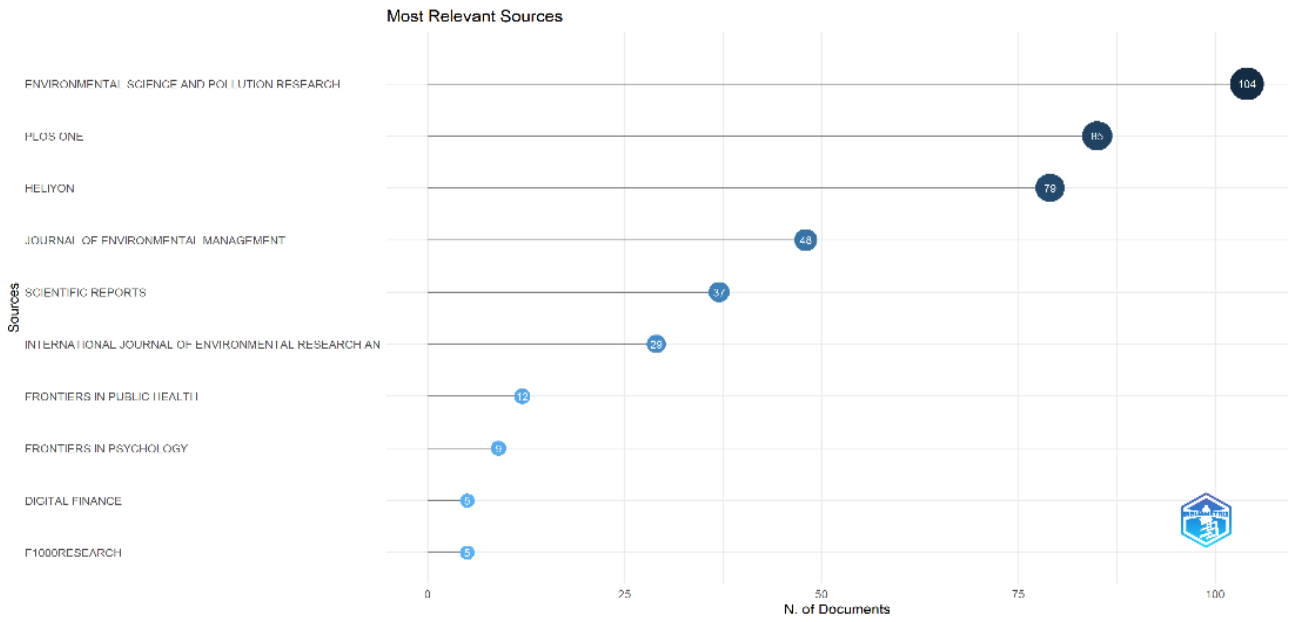
Table 4

Relevant source of data

Sources	Articles
ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH	104
PLOS ONE	85
HELIYON	79
JOURNAL OF ENVIRONMENTAL MANAGEMENT	48
SCIENTIFIC REPORTS	37
INTERNATIONAL JOURNAL OF ENVIRONMENTAL RESEARCH AND PUBLIC HEALTH	29
FRONTIERS IN PUBLIC HEALTH	12
FRONTIERS IN PSYCHOLOGY	9
DIGITAL FINANCE	5
F1000RESEARCH	5

The data presents the distribution of articles across various academic journals, highlighting the prominence of *Environmental Science and Pollution Research* with 104 articles, making it the most frequent source. Following closely are *PLOS ONE* (85 articles) and *Heliyon* (79 articles), indicating their significant contributions to the research landscape. Mid-tier journals such as *Journal of Environmental Management* (48 articles) and *Scientific Reports* (37 articles) also play notable roles, while *International Journal of Environmental Research and Public Health* (29 articles) shows moderate representation. Lower-frequency sources like *Frontiers in Public Health* (12 articles), *Frontiers in Psychology* (9 articles), *Digital Finance* (5 articles), and *F1000Research* (5 articles) suggest more specialized or niche focuses. This distribution reflects broader trends in interdisciplinary research, with environmental science, public health, and psychology being key areas of interest.

Figure 4
Relevant sources of data



Authors Analysis

Author analysis examines the influence, productivity, and collaboration patterns of authors within electronic finance and its challenges. It identifies key contributions, co-authorship networks, and citation impact helping to access an author's academic influence.

Table 5
Most Relevant Authors

Authors	Articles	Articles Fractionalized
LI Y	17	4.98
ZHANG Y	17	5.97
WANG Y	14	4.07
ZHANG W	13	3.87
LI J	12	5.15
LI W	11	3.01
LI X	11	3.20
WANG J	11	3.82
ZHANG X	10	3.59
CHEN Y	9	2.42

The table lists the most prolific authors in a given research field, along with their total article count and fractionalized contributions. Li Y and Zhang Y lead with 17 articles each, but Zhang Y has a higher fractionalized score (5.97 compared to Li Y's 4.98), suggesting greater individual

contribution when accounting for co-authorship. Wang Y follows with 14 articles (4.07 fractionalized), while Zhang W and Li J have 13 and 12 articles, respectively, with Li J showing a higher fractionalized impact (5.15). Other notable contributors include Li W, Li X, and Wang J, each with 11 articles but varying fractionalized contributions, indicating differences in their roles across studies. Zhang X and Chen Y round out the list with 10 and 9 articles, respectively. The fractionalized metrics highlight how authorship distribution affects individual credit, as some researchers (e.g., Zhang Y, Li J) contribute more substantially per article compared to others with similar total counts. This suggests varying levels of involvement, from lead authorship to collaborative roles.

Table 6

Author Productivity through Lotka's Law

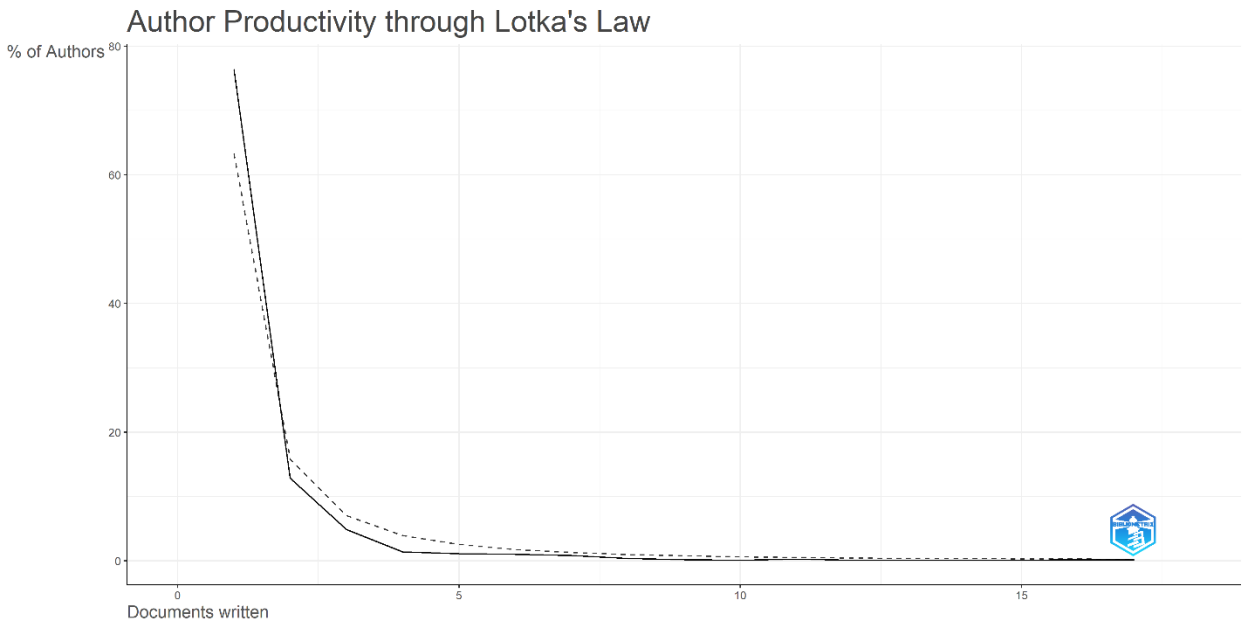
Documents written	N. of Authors	Proportion of Authors
1	814	0.764
2	137	0.129
3	52	0.049
4	15	0.014
5	12	0.011
6	11	0.01
7	9	0.008
8	4	0.004
9	2	0.002
10	1	0.001

This data illustrates author productivity in a given research field, analyzed through Lotka's Law, which describes the frequency of publication by authors in a specific domain. According to Lotka's Law, a small proportion of authors produce the majority of publications, while most contribute only a few works.

The table shows that 76.4% of authors (814 out of 1,066) wrote just one document, indicating that the vast majority are occasional contributors. A smaller fraction—12.9% (137 authors)—authored two documents, while only 4.9% (52 authors) wrote three. As the number of documents per author increases, the proportion drops sharply: very few researchers produced more than five works, with only 1.1% (12 authors) writing five and a mere 0.1% (1 author) reaching ten.

This distribution aligns with Lotka's inverse square law, which suggests that the number of authors producing *n* publications is roughly proportional to *$1/n^2$*. Here, the exponential decline in author counts with increasing productivity confirms the expected pattern—a small core of highly prolific researchers dominates scholarly output, while most authors contribute minimally. This trend is common in bibliometrics and highlights the unequal distribution of research productivity, where a few "super producers" generate a significant share of publications.

Figure 5
Author Productivity through Lotka's Law



Corresponding Author's Countries

Table 7
Corresponding Author's Countries

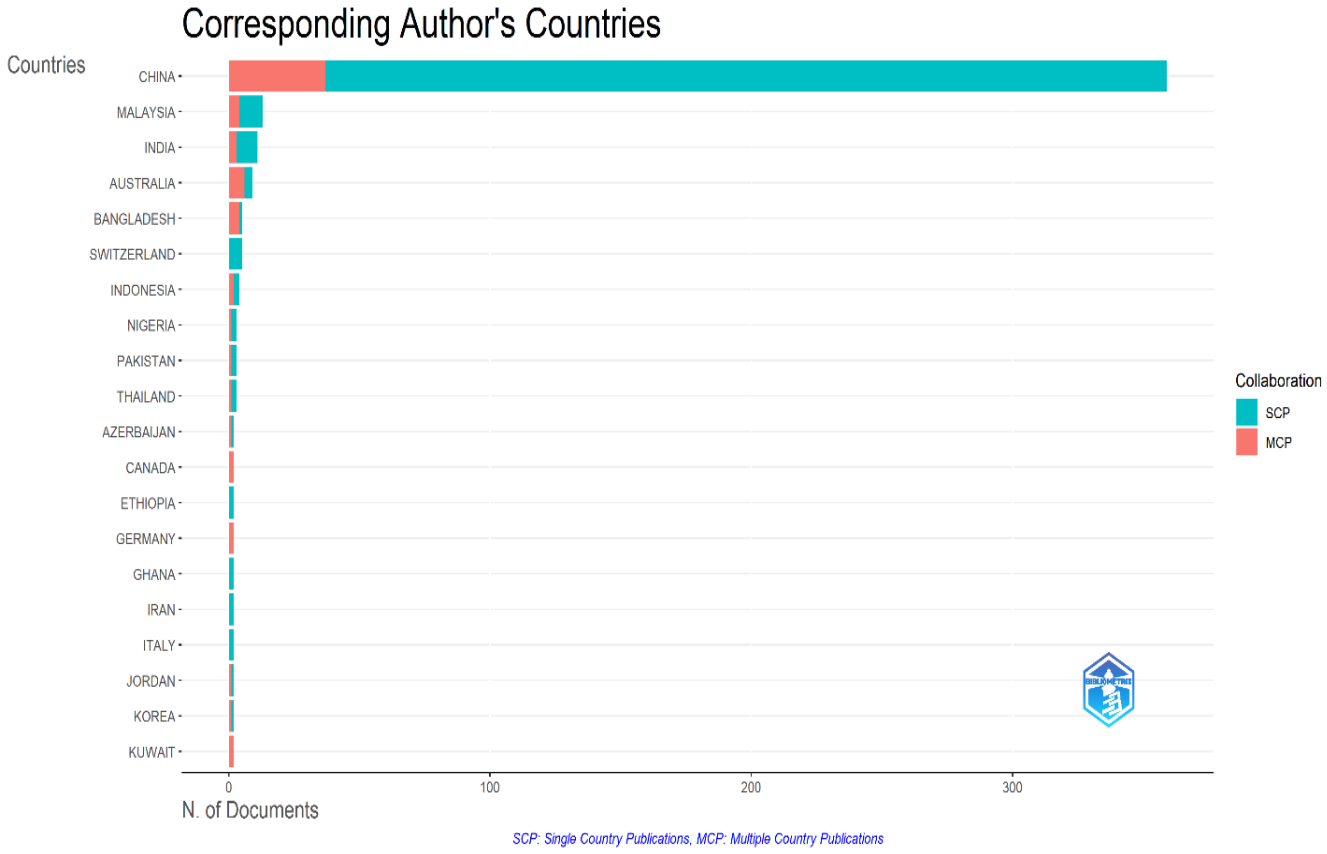
Country	Articles	Articles %	SCP	MCP	MCP %
CHINA	359	71.8	322	37	10.3
MALAYSIA	13	2.6	9	4	30.8
INDIA	11	2.2	8	3	27.3
AUSTRALIA	9	1.8	3	6	66.7
BANGLADESH	5	1	1	4	80
SWITZERLAND	5	1	5	0	0
INDONESIA	4	0.8	2	2	50
NIGERIA	3	0.6	2	1	33.3
PAKISTAN	3	0.6	2	1	33.3
THAILAND	3	0.6	2	1	33.3

The table reveals the geographic distribution of corresponding authors' countries in the analyzed research, with China dominating overwhelmingly at 71.8% (359 articles), indicating its leading role in the field. The high proportion of Single-Country Publications (SCP: 322) suggests that most Chinese research is domestically conducted, while the modest Multi-Country Publications (MCP: 37, 10.3%) reflects limited but growing international collaboration. Malaysia (2.6%) and India (2.2%) follow as secondary contributors, with Malaysia showing a higher MCP ratio (30.8%),

implying stronger cross-border research ties compared to India (27.3%). Interestingly, Australia (1.8%) and Bangladesh (1%) exhibit the highest MCP percentages (66.7% and 80%, respectively), indicating that researchers in these countries frequently collaborate internationally. In contrast, Switzerland (1%) has no MCPs (0%), suggesting purely domestic-focused publications. Smaller contributors like Indonesia, Nigeria, Pakistan, and Thailand (each below 1%) display moderate international collaboration (MCP ratios between 33.3% and 50%). Overall, the data highlights China's dominance in output volume, while smaller nations like Bangladesh and Australia show greater reliance on global partnerships, reflecting differing research strategies and networks.

Figure 6

Corresponding Author's Countries



Countries' Scientific Production

Table 8
Countries' Scientific Production

Country	Freq
CHINA	1075
PAKISTAN	37
INDIA	33
MALAYSIA	33
INDONESIA	16
USA	16
SAUDI ARABIA	15
SWITZERLAND	14
THAILAND	14
UNITED ARAB EMIRATES	13

This data represents the scientific production of different countries in a specific research field, ranked by the number of publications (frequency). China dominates overwhelmingly with 1,075 publications, far surpassing all other nations and highlighting its leading role in this area of research. The next highest contributors—Pakistan (37), India (33), and Malaysia (33)—are significantly behind, indicating a substantial gap between China and other Asian countries.
Indonesia, the USA, Saudi Arabia, Switzerland, Thailand, and the United Arab Emirates follow with much lower frequencies (ranging from 13 to 16 publications), suggesting limited but notable contributions. The presence of both developing nations (e.g., Pakistan, India, Indonesia) and developed countries (e.g., USA, Switzerland) indicates global interest in the field, though with stark disparities in research output.
The data suggests that China is the primary driver of scientific production in this domain, possibly due to heavy investment in research, a large academic workforce, or targeted funding priorities. Meanwhile, other countries—despite some activity—appear to play minor roles comparatively. This imbalance reflects broader trends in global research, where a few nations lead while others contribute sporadically.

Figure 7
Countries' Scientific Production

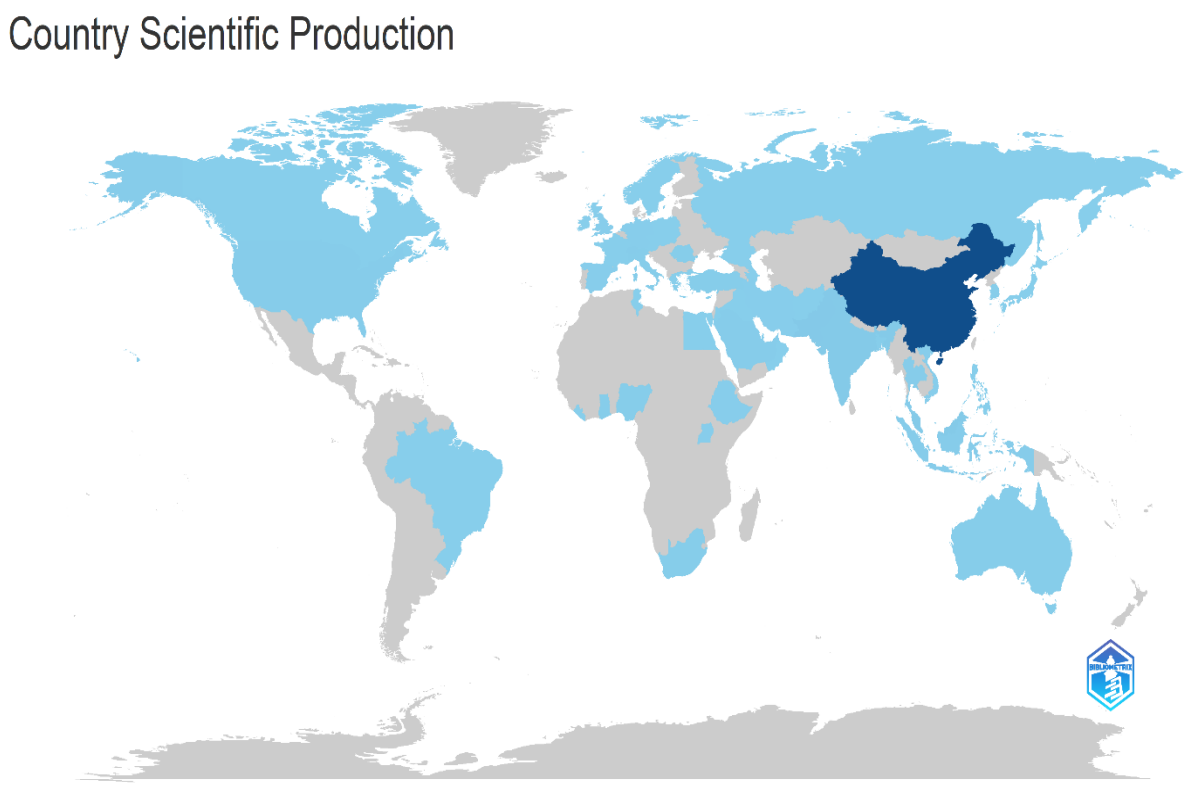


Fig.7. Countries' Scientific Production

Countries' Production over Time

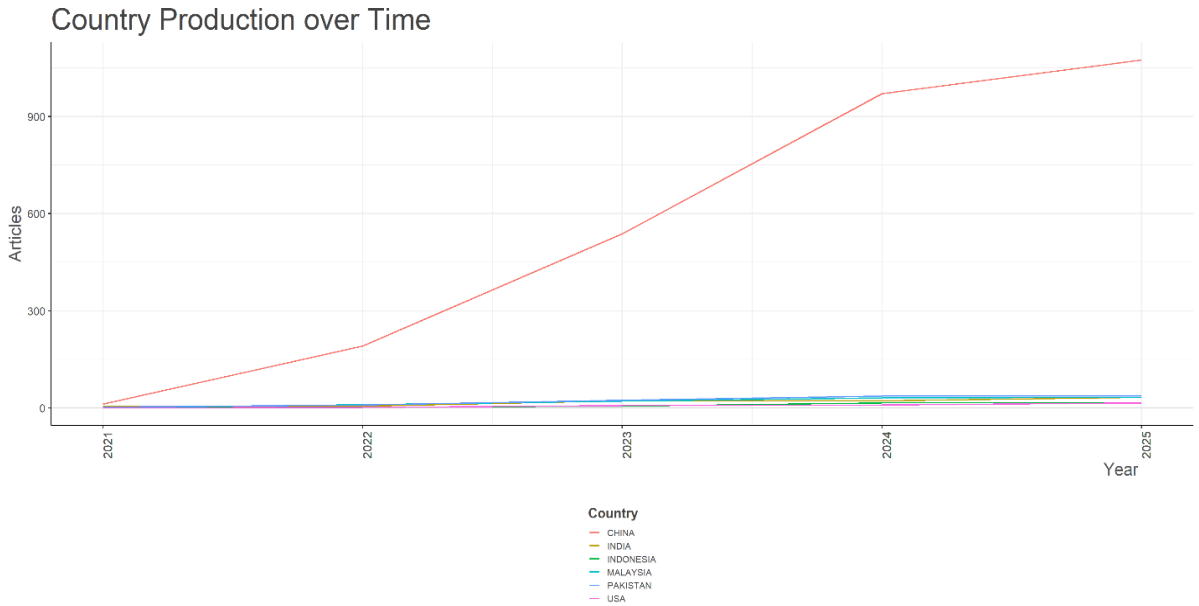
Table 9
Countries' Production over Time

Country	Year	Articles
CHINA	2021	12
CHINA	2022	191
CHINA	2023	538
CHINA	2024	971
CHINA	2025	1075
INDIA	2021	5
INDIA	2022	6
INDIA	2023	22
INDIA	2024	22
INDIA	2025	33

The data illustrates a striking upward trend in research output over time for both China and India, with China experiencing exponential growth and India showing a more gradual increase. In China, publication numbers surged from just 12 articles in 2021 to an overwhelming 1,075 in 2025, reflecting a massive acceleration in research productivity. The most dramatic rise occurred between 2023 (538 articles) and 2024 (971 articles), suggesting a possible expansion in funding, institutional support, or academic priorities. By contrast, India's growth was steadier but significantly smaller, starting at 5 articles in 2021 and reaching 33 in 2025, with a notable uptick in 2023 (22 articles) that stabilized in 2024 (22 articles) before rising again in 2025 (33 articles). While China's output dwarfs India's in sheer volume, both countries demonstrate increasing engagement in research, though at vastly different scales. China's explosive growth may indicate strategic investments in academia and research, whereas India's more modest trajectory suggests slower but consistent development. The widening gap between the two nations highlights China's dominant role in global research output during this period.

Figure 8

Countries' Production over Time



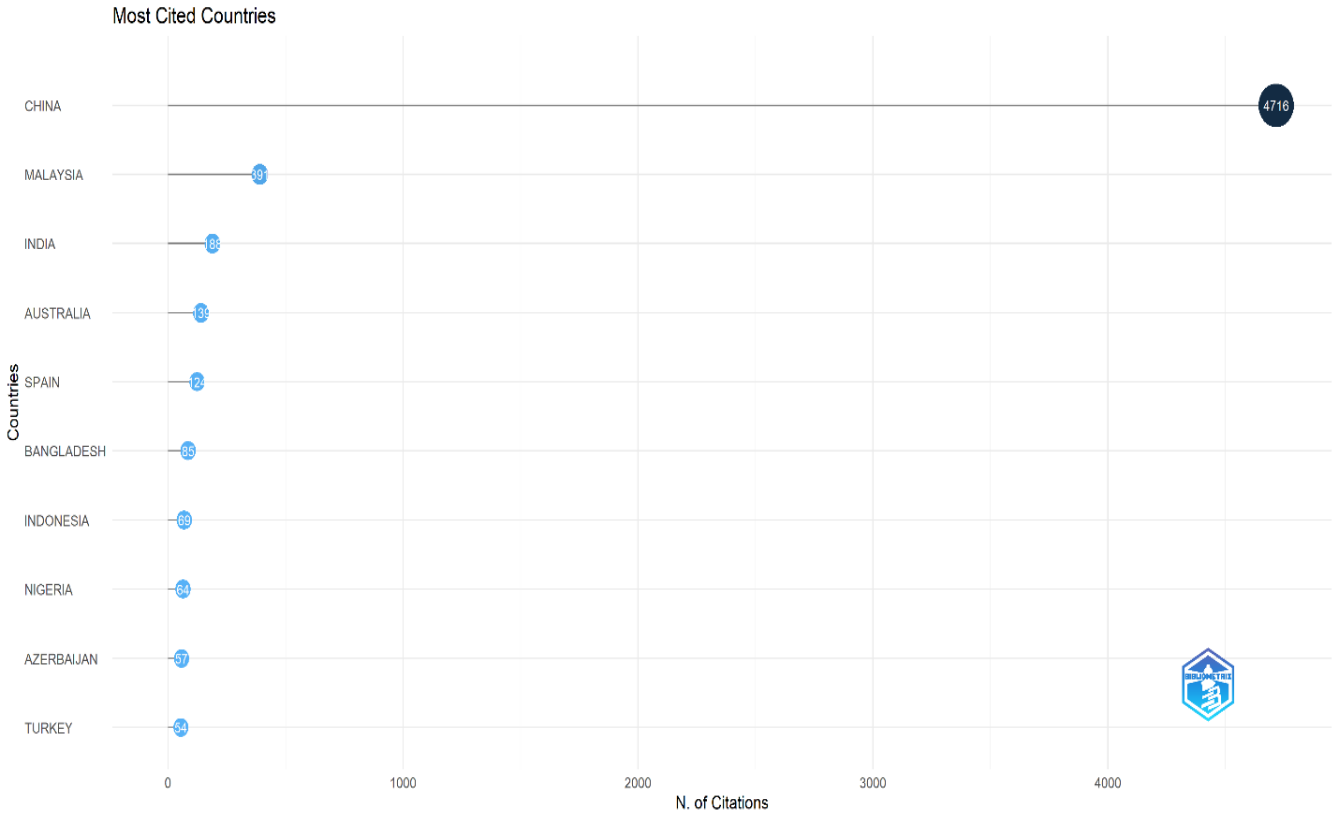
Most Cited Countries

Table 10
Most Cited Countries

Country	TC	Average Article Citations
CHINA	4716	13.10
MALAYSIA	391	30.10
INDIA	188	17.10
AUSTRALIA	139	15.40
SPAIN	124	62.00
BANGLADESH	85	17.00
INDONESIA	69	17.20
NIGERIA	64	21.30
AZERBAIJAN	57	28.50
TURKEY	54	27.00

The data reveals significant differences in citation impact across countries, with Spain emerging as the most influential on a per-article basis, boasting an exceptional 62.00 average citations per article despite a relatively modest total citation count (TC) of 124. This suggests that Spanish research, though less voluminous, produces highly impactful work. Malaysia also demonstrates strong scholarly influence with 30.10 average citations, the second-highest rate, supported by a TC of 391—indicating consistent recognition in the field. While China dominates in sheer output (TC: 4,716), its average citation rate (13.10) is comparatively lower, reflecting its high volume of publications, which may include both highly cited and lesser-cited works. Smaller research producers like Azerbaijan (28.50 average citations) and Turkey (27.00) punch above their weight in citation impact, outperforming larger players like India (17.10) and Australia (15.40). Notably, Nigeria (21.30) and Bangladesh (17.00) also show strong per-article influence relative to their output. The trends suggest that while some countries prioritize quantity (e.g., China), others achieve outsized academic visibility through higher-impact, though less frequent, publications (e.g., Spain, Malaysia). This dichotomy highlights the varying research strategies and global recognition across nations.

Figure 9
Most Cited Countries



Documents

Table 11
Most Global Cited Documents

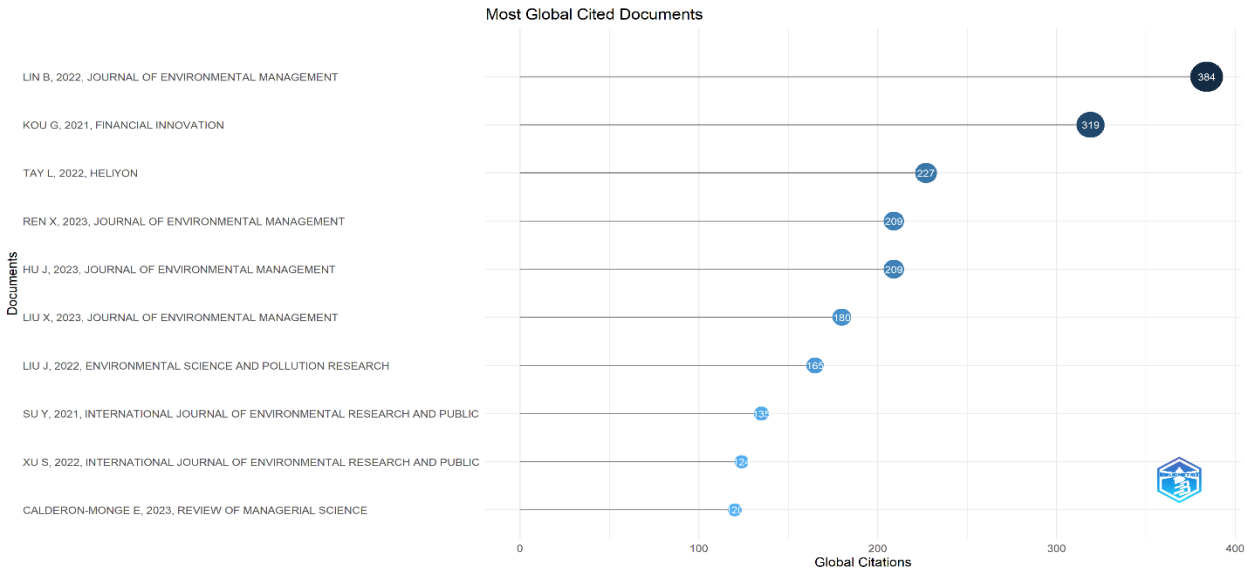
Paper	DOI	Total Citations	TC per Year	Normalized TC
LIN B, 2022, JOURNAL OF ENVIRONMENTAL MANAGEMENT	10.1016/J.JENVMAN.2022.115833	384	96.00	9.67
KOU G, 2021, FINANCIAL INNOVATION	10.1186/S40854-021-00256-Y	319	63.80	5.32
TAY L, 2022, HELIYON	10.1016/J.HELIYON.2022.E09766	227	56.75	5.72

REN X, 2023, JOURNAL OF ENVIRONMENTAL MANAGEMENT	10.1016/J.JENVMAN.2022.117125	209	69.67	12.21
HU J, 2023, JOURNAL OF ENVIRONMENTAL MANAGEMENT	10.1016/J.JENVMAN.2023.117755	209	69.67	12.21
LIU X, 2023, JOURNAL OF ENVIRONMENTAL MANAGEMENT	10.1016/J.JENVMAN.2023.117525	180	60.00	10.51
LIU J, 2022, ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH	10.1007/S11356-022-18667-4	165	41.25	4.16
SU Y, 2021, INTERNATIONAL JOURNAL OF ENVIRONMENTAL RESEARCH AND PUBLIC HEALTH	10.3390/IJERPH18168535	135	27.00	2.25
XU S, 2022, INTERNATIONAL JOURNAL OF ENVIRONMENTAL RESEARCH AND PUBLIC HEALTH	10.3390/IJERPH19095074	124	31.00	3.12
CALDERON-MONGE E, 2023, REVIEW OF MANAGERIAL SCIENCE	10.1007/S11846-023-00647-8	120	40.00	7.01

The table highlights the most globally cited documents in the dataset, with Lin B (2022) leading by a significant margin with 384 total citations and an impressive 96.00 citations per year, reflecting its substantial impact in Journal of Environmental Management. The paper also has the highest normalized TC (9.67), indicating its influence relative to other works in the same field and time period. Following closely is Kou G (2021) in Financial Innovation with 319 citations, demonstrating strong interdisciplinary reach, though its normalized TC (5.32) suggests slightly less field-weighted influence. Several 2023 publications—Ren X, Hu J, and Liu X—all in Journal of Environmental Management, show remarkably high TC per year (69.67, 69.67, and 60.00, respectively) and normalized TC values (12.21, 12.21, 10.51), signaling rapid and outsized academic recognition. Meanwhile, Tay L (2022) in Heliyon and Liu J (2022) in Environmental Science and Pollution Research exhibit strong but comparatively lower citation metrics, with normalized TC values of 5.72 and 4.16, respectively. The presence of multiple papers from Journal of Environmental Management and International Journal of Environmental Research and Public Health underscores these journals' roles in disseminating high-impact research. Overall, the data reveals that environmental science and management dominate the most-cited works, with a few

exceptions like finance (Kou G) and managerial science (Calderon-Monge E), highlighting interdisciplinary contributions. The high TC per year and normalized TC values for recent publications (2022–2023) suggest accelerating scholarly attention in these fields.

Figure 10
Most Global Cited Documents



Most Frequent Words

Table 12
Most Frequent Words

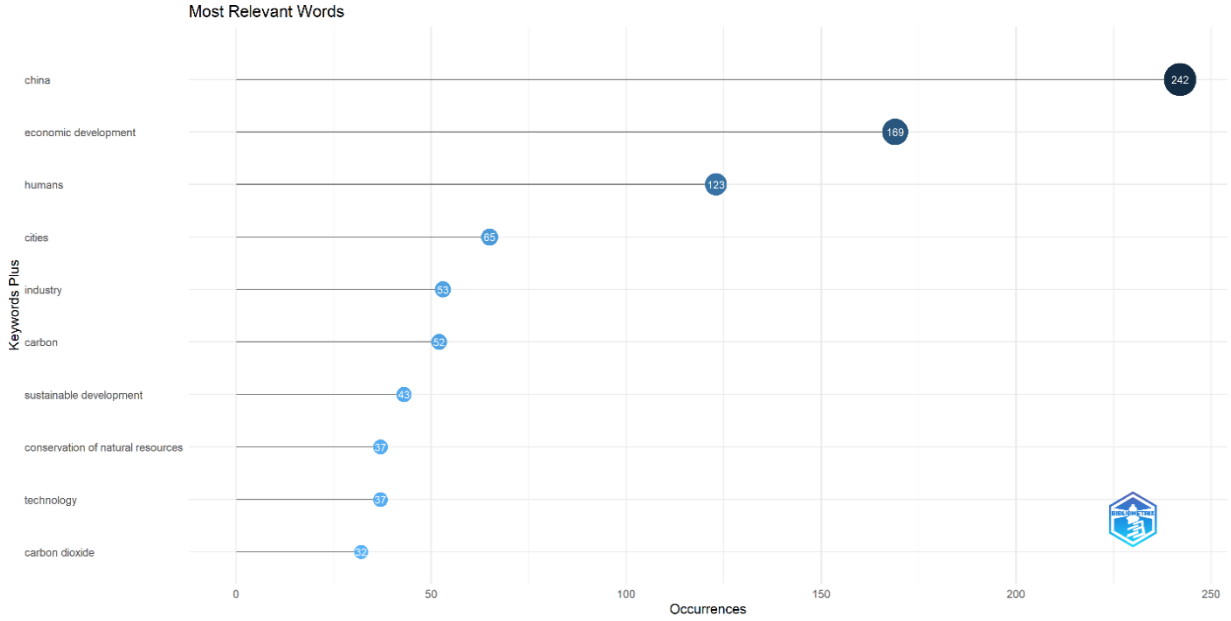
Words	Occurrences
china	242
economic development	169
humans	123
cities	65
industry	53
Carbon	52
sustainable development	43
conservation of natural resources	37
technology	37
carbon dioxide	32

The most frequent keywords in the dataset highlight key research themes and priorities, with "China" (242 occurrences) dominating the discourse, reflecting the country's central role in the studied academic literature. This aligns with earlier findings showing China's overwhelming contribution to research output. The second most common term, "economic development" (169 occurrences), underscores the strong intersection between economic growth and environmental or social research, suggesting that studies often examine sustainability through an economic lens. The

presence of "humans" (123 occurrences) indicates a focus on societal impacts, likely in areas like public health or environmental policy. Meanwhile, "cities" (65 occurrences) and "industry" (53 occurrences) point to urban and industrial dimensions in sustainability research, emphasizing urbanization and industrial practices as critical areas of study. Environmental concerns are evident in terms like "Carbon" (52 occurrences), "sustainable development" (43 occurrences), and "carbon dioxide" (32 occurrences), highlighting climate change and decarbonization as major research themes. Additionally, "conservation of natural resources" (37 occurrences) and "technology" (37 occurrences) suggest a dual focus on ecological preservation and technological solutions. Overall, the keyword analysis reveals a research landscape centered on China's economic and environmental challenges, with strong emphasis on urbanization, industrial impacts, carbon management, and sustainable development, reflecting global academic priorities in balancing growth with ecological and societal well-being.

Figure 11

Most Frequent Words



Word Cloud

Table 13

Word Cloud

Words	Occurrences
china	242
economic development	169
humans	123
cities	65
industry	53
Carbon	52

sustainable development	43
conservation of natural resources	37
technology	37
carbon dioxide	32

The word cloud generated from the dataset visually emphasizes the dominant themes in the research, with the most frequently occurring terms appearing in larger, bolder fonts. "China" stands out as the most prominent word, reflecting its overwhelming focus in the literature, consistent with its leading role in research output. Following closely are terms like "economic development" and "humans," highlighting the intersection between socio-economic progress and human-centric studies, likely in fields such as sustainable development and public health. Urban and industrial themes are also prominent, as seen with "cities" and "industry," indicating significant research interest in urbanization and industrial impacts. Environmental concerns are strongly represented by keywords like "Carbon," "sustainable development," and "carbon dioxide," pointing to a focus on climate change and sustainability. Additionally, terms such as "conservation of natural resources" and "technology" suggest a dual emphasis on ecological preservation and technological innovation. The word cloud effectively captures the research priorities, with larger terms like "China" and "economic development" dominating the visual field, while smaller yet recurring words like "technology" and "carbon dioxide" fill in the broader context. This visualization reinforces the centrality of China in the research landscape, alongside key themes of economic growth, environmental sustainability, and urban-industrial challenges.

Figure 12
WordCloud

TreeMap

Table 14
TreeMap

Terms	Frequency
china	242
economic development	169
humans	123
cities	65
industry	53
carbon	52
sustainable development	43
conservation of natural resources	37
technology	37
carbon dioxide	32

The treemap visualization of keyword frequencies provides a clear hierarchical representation of research focus areas, where the size of each rectangular block corresponds to the term's occurrence frequency. "China" dominates the visualization with the largest block (242 occurrences), immediately conveying its central role in the research corpus. This is followed by substantial blocks for "economic development" (169) and "humans" (123), forming a secondary tier of research emphasis that highlights the interconnectedness of socioeconomic progress and human-focused studies.

The mid-sized blocks reveal key sub-themes: "cities" (65), "industry" (53), and "carbon" (52) demonstrate significant attention to urban development, industrial systems, and climate-related research. Meanwhile, slightly smaller but equally important blocks like "sustainable development" (43) and "conservation of natural resources" (37) emphasize environmental sustainability as a recurring priority. The presence of "technology" (37) and "carbon dioxide" (32) further refines the focus, suggesting that technological innovation and specific carbon emission concerns are active subfields within the broader discourse.

By organizing terms spatially based on frequency, the treemap efficiently communicates that research is heavily centered on China's economic and environmental dynamics, with strong secondary clusters around urbanization, industrial impacts, and carbon management. This visualization not only highlights the most prominent keywords but also allows for quick identification of thematic relationships and relative importance across the research landscape.

Node	Cluster	Betweenness	Closeness	PageRank
humans	1	228.803	0.018	0.093
income	1	3.101	0.013	0.021
rural population	1	1.958	0.012	0.021
covid-19	1	1.83	0.012	0.014
family characteristics	1	0.609	0.012	0.012
poverty	1	0.065	0.011	0.01
farmers	1	0.522	0.012	0.011
bibliometrics	1	0.163	0.011	0.005
pandemics	1	0	0.011	0.007
urban population	1	0.025	0.011	0.007

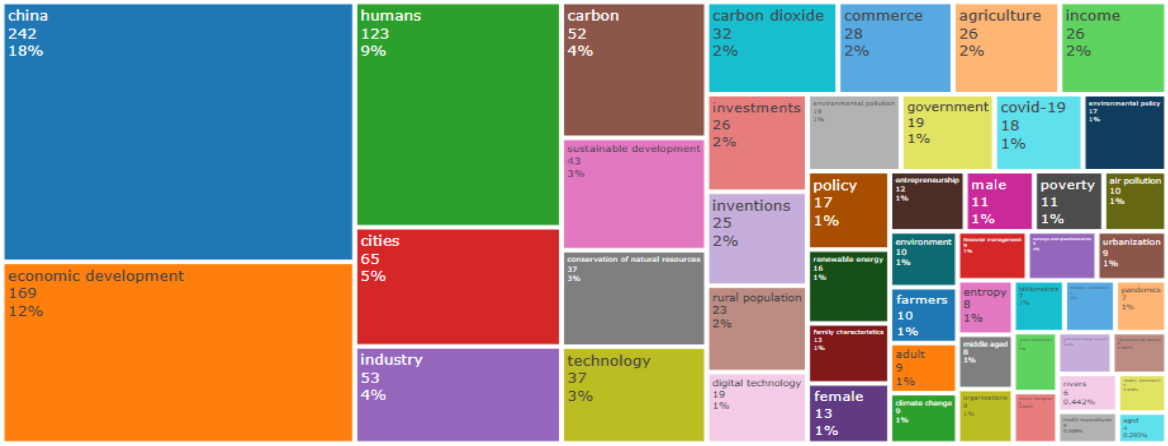


Figure.13: TreeMap

Conceptual Structure

Co-occurrence Network: The co-occurrence network analysis reveals key thematic clusters and influential nodes within the research domain. "Humans" emerges as the most central node (Cluster 1) with the highest betweenness centrality (228.8), closeness (0.018), and PageRank (0.093), indicating its pivotal role in connecting diverse research topics. Other significant nodes like "income", "rural population", and "COVID-19" show moderate betweenness (1.9–3.1), suggesting they bridge sub-themes but with less influence than "humans."

The cluster predominantly focuses on socioeconomic and public health themes, as seen in nodes like "poverty", "farmers", and "urban population", which have lower centrality metrics but contribute to the network's structure. Notably, "COVID-19" and "pandemics" highlight the network's responsiveness to global health crises, though their lower betweenness values imply more specialized connections.

Overall, the network underscores "humans" as the dominant interdisciplinary hub, linking health, demographics, and development research, while other nodes form tighter sub-clusters around

socioeconomic and rural-urban dynamics. The low betweenness of terms like "bibliometrics" and "pandemics" reflects their niche roles in the broader network.

Figure 14

Co-occurrence Network

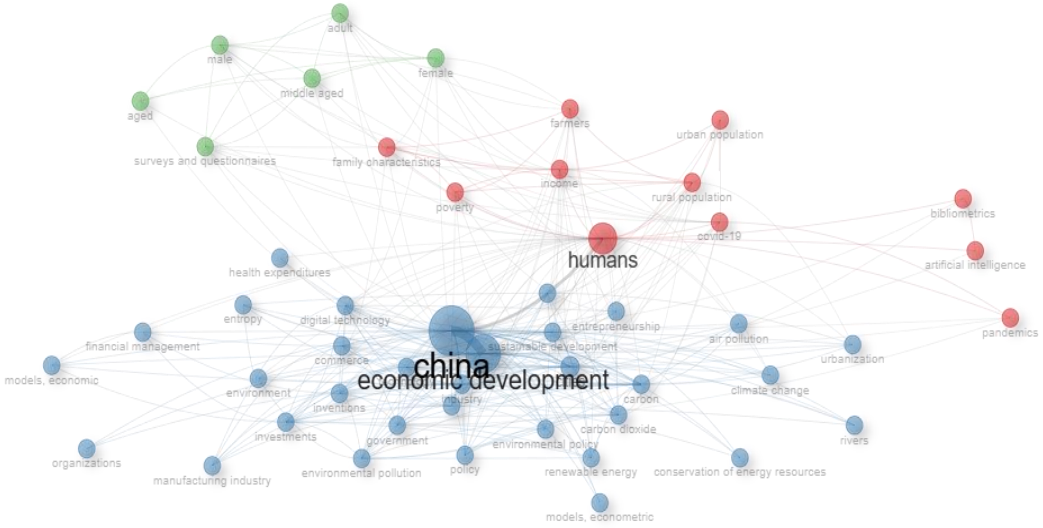
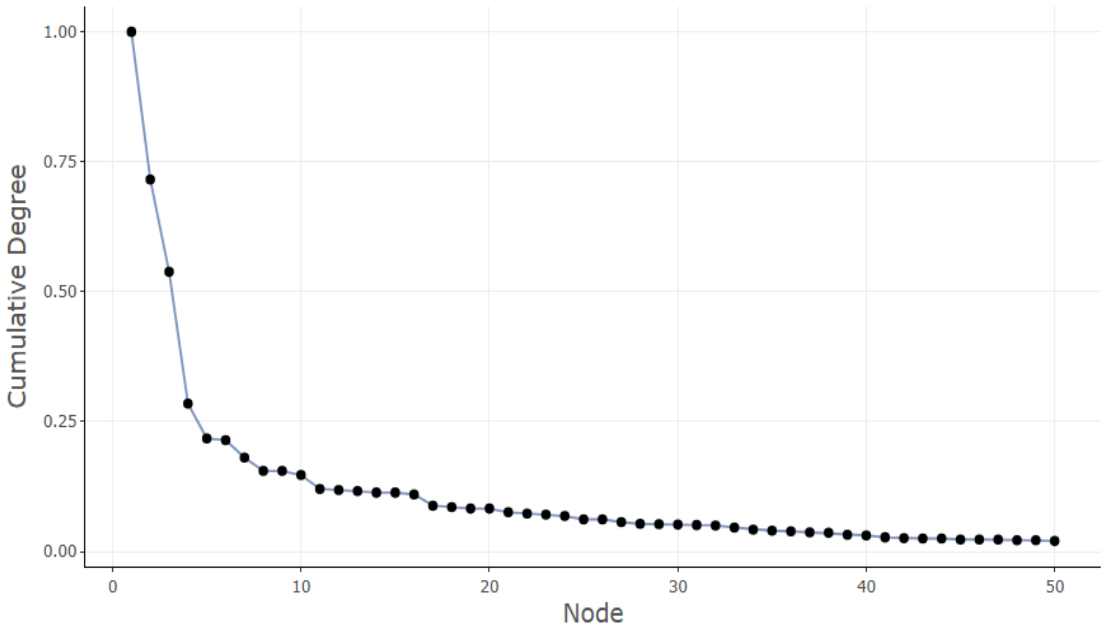


Table 15

Co-occurrence Network



Thematic Map

Table 16
Thematic Map

Occurrences	Words	Cluster	Cluster_Label	btw_centrality	clos_centrality	pagerank_centrality
4	india	1	india	371.273	0.002	0.004
3	qualitative research	1	india	31.143	0.001	0.003
2	focus groups	1	india	15.782	0.001	0.003
2	interviews as topic	1	india	16.094	0.001	0.002
2	nigeria	1	india	33.211	0.002	0.002
13	female	2	female	642.71	0.002	0.013
11	male	2	female	316.745	0.002	0.012
9	adult	2	female	230.817	0.002	0.01
9	surveys and questionnaires	2	female	359.023	0.002	0.009
8	middle aged	2	female	590.708	0.002	0.009

The thematic map visualization organizes research keywords into distinct clusters based on co-occurrence patterns, revealing key thematic focuses within the dataset. Cluster 1 (India) groups terms like *"qualitative research," "focus groups,"* and *"interviews as topic,"* highlighting a strong emphasis on social science methodologies and regional studies centered on India and Nigeria. The high betweenness centrality of *"India"* (371.27) indicates its role as a bridging node connecting these methodological and geographical themes.

Cluster 2 (Female) is dominated by demographic and health-related terms, with *"female"* (642.71 betweenness) and *"male"* (316.75) as central nodes, reflecting a focus on gender-based studies. Terms like *"adult," "surveys and questionnaires,"* and *"middle aged"* further specify this cluster's orientation toward population health research, likely in clinical or epidemiological contexts.

The map illustrates a clear division between region-specific social research (Cluster 1) and demographic/health studies (Cluster 2), with minimal overlap, suggesting these themes are developed independently in the literature. The high centrality metrics for *"female"* and *"India"* underscore their importance as connective hubs in their respective clusters, while terms like *"qualitative research"* and *"surveys and questionnaires"* define methodological approaches within each thematic domain. This structured visualization helps identify dominant research trends and their interrelationships.

Figure 16
Thematic Map

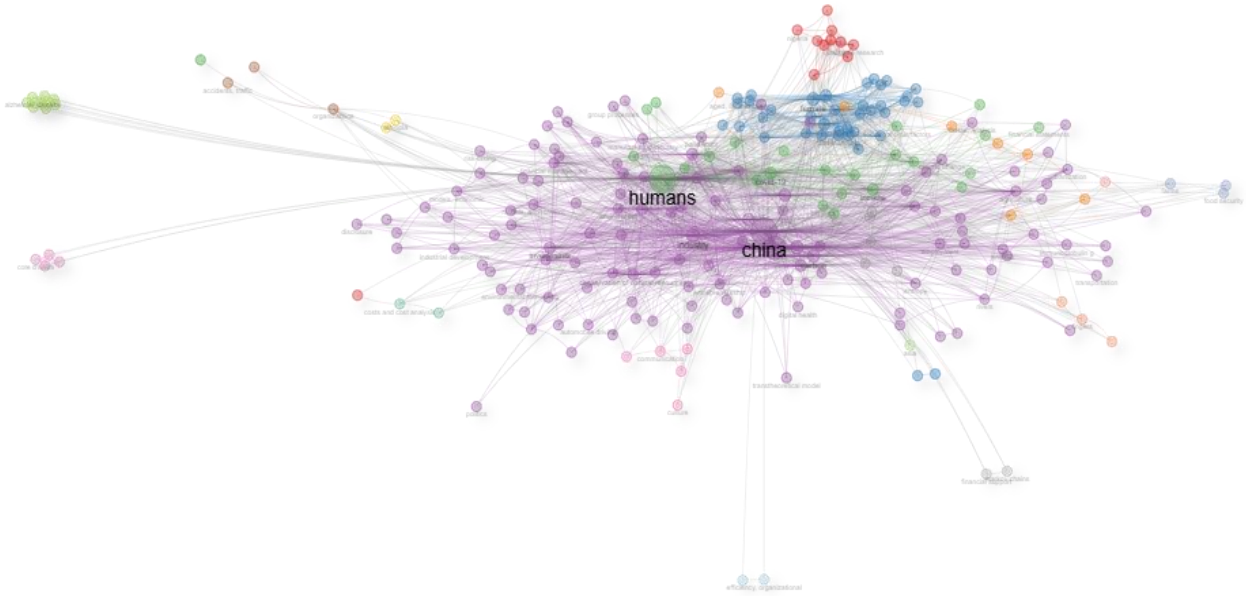
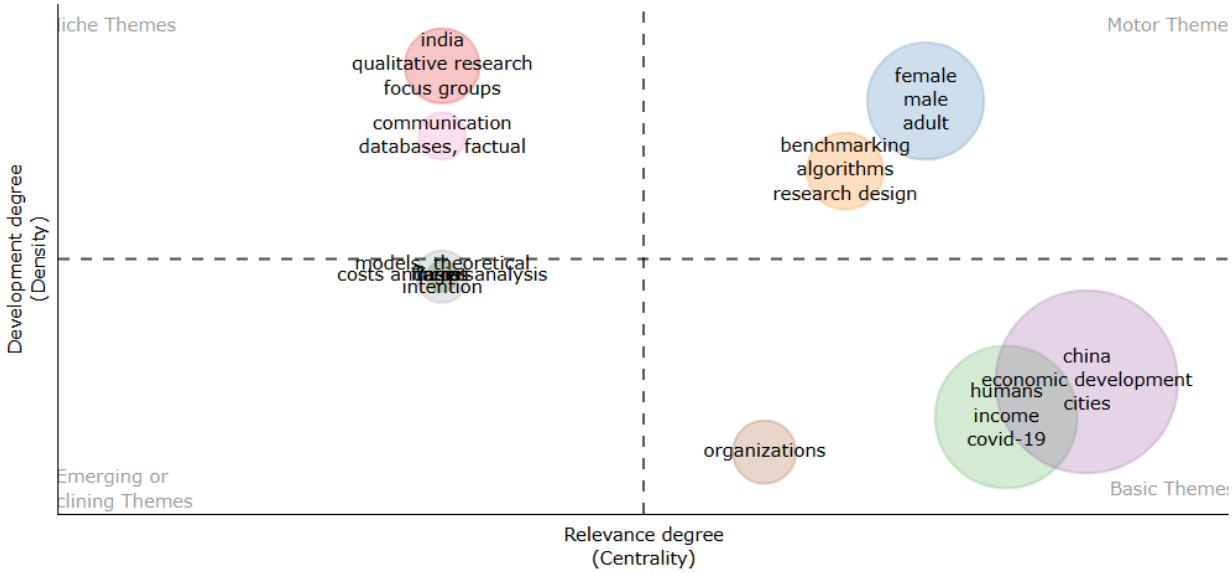


Figure 17
Thematic Map



Factorial Analysis

Table 17

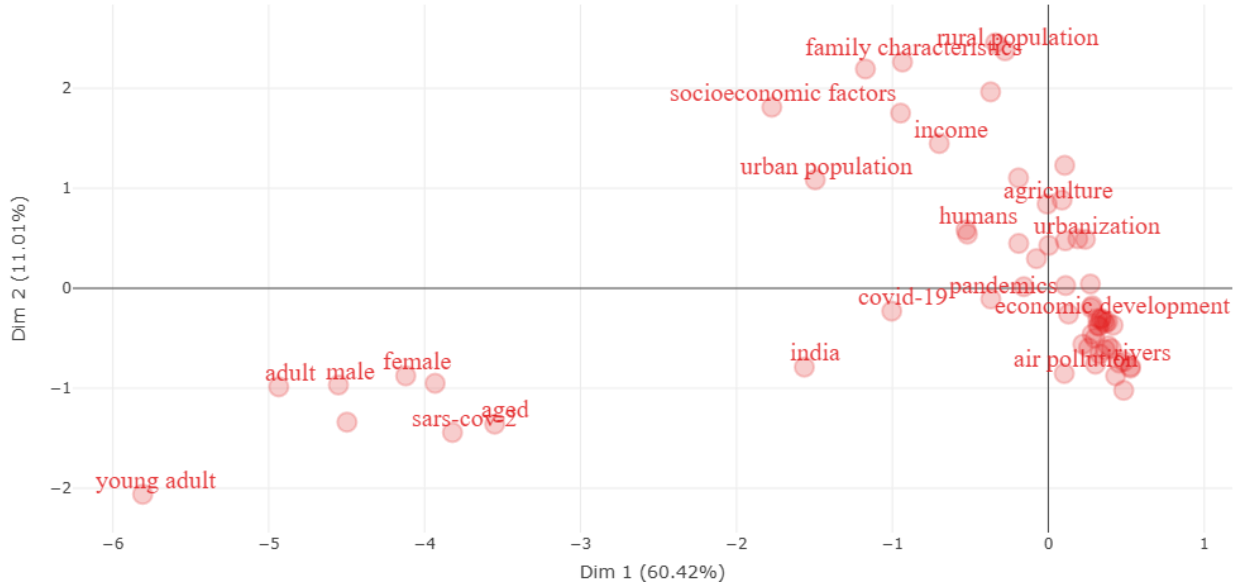
Factorial Analysis

Documents	dim1	dim2	contrib	TC	Cluster
lin b, 2022, journal of environmental management	0.12	0.12	0.00	384	1
hu j, 2023, journal of environmental management	0.16	0.16	0.00	209	1
ren x, 2023, journal of environmental management	0.10	0.10	0.00	209	1
liu x, 2023, journal of environmental management	0.13	0.13	0.00	180	1
liu j, 2022, environmental science and pollution research	0.15	0.15	0.00	165	1
su y, 2021, international journal of environmental research and public health	0.15	0.15	0.00	135	1
xu s, 2022, international journal of environmental research and public health	0.16	0.16	0.00	124	1
dou q, 2022, environmental science and pollution research	0.09	0.09	0.00	111	1
yao l, 2022, plos one	0.06	0.06	0.00	94	1
zhu z, 2022, international journal of environmental research and public health	0.15	0.15	0.00	84	1

The factorial analysis of the research documents reveals a clear clustering pattern, with most high-impact publications grouped closely together in Cluster 1, as indicated by their similar coordinates along dim1 and dim2 (ranging between 0.06-0.16). This tight clustering suggests these studies share strong thematic similarities, likely centered on environmental management and sustainability, given their prevalence in journals like *Journal of Environmental Management* and *Environmental Science and Pollution Research*. Despite their high citation counts (TC)—such as Lin B (2022) with 384 citations and Hu J (2023) with 209 citations—their near-zero contrib values indicate they do not significantly drive the variance in the factorial map, implying they represent a dominant, homogeneous research trend rather than outliers.

The consistent positioning of these documents along both dimensions highlights a cohesive research front, with no clear divergence into sub-themes. This could reflect a concentrated academic focus on environmental policy, pollution control, or sustainable development, as evidenced by the recurring journals and high citation metrics. The absence of documents in other clusters suggests limited thematic diversity among the most cited works, with the field being heavily dominated by environmental studies. The factorial map thus underscores a robust, unified research direction, where influential papers collectively reinforce core themes rather than branching into niche areas.

Figure 18
Factorial Analysis



Social Structure

Table 18
Collaboration Network

Node	Cluster	Betweenness	Closeness	PageRank
wang y	1	106.783	0.01	0.036
wang z	1	89.936	0.009	0.032
li l	1	3.142	0.007	0.012
chen x	1	40.199	0.009	0.02
chen z	1	27.736	0.009	0.022
ma y	1	7.781	0.008	0.014
wang r	1	3.097	0.007	0.014
xu y	1	31.513	0.009	0.02
chen c	1	16.545	0.008	0.018
fan y	1	5.964	0.007	0.012

The collaboration network analysis reveals a tightly connected research community, with Wang Y and Wang Z emerging as the most influential collaborators in Cluster 1, as evidenced by their high betweenness centrality (106.78 and 89.94, respectively) and PageRank scores (0.036 and 0.032). These metrics indicate that these researchers serve as critical bridges within the network, facilitating connections between different subgroups and playing a pivotal role in knowledge dissemination. Other key contributors, such as Chen X (betweenness: 40.20), Chen Z (27.74),

and Xu Y (31.51), also exhibit strong intermediary roles, suggesting they act as secondary hubs in the collaboration network.

The relatively high closeness centrality scores for these researchers (ranging from 0.007 to 0.01) further highlight their proximity to other nodes, enabling efficient communication and collaboration within the network. Meanwhile, researchers like Li L, Wang R, and Fan Y show lower betweenness and closeness values, indicating more peripheral roles or specialized collaborations. The predominance of Chinese surnames (e.g., Wang, Chen, Li) suggests a research network heavily centered on collaborations within Chinese institutions, which aligns with earlier findings on China's dominance in research output.

Overall, the network structure underscores a hierarchical collaboration pattern, where a few central figures (e.g., Wang Y, Wang Z) drive large-scale connectivity, while others contribute to smaller, specialized clusters. This reflects both the strength and potential limitations of the network, as it relies heavily on key individuals to sustain collaboration flows. The high betweenness of these central nodes also implies that their removal could fragment the network, emphasizing their critical role in maintaining research cohesion.

Figure 19

Collaboration Network

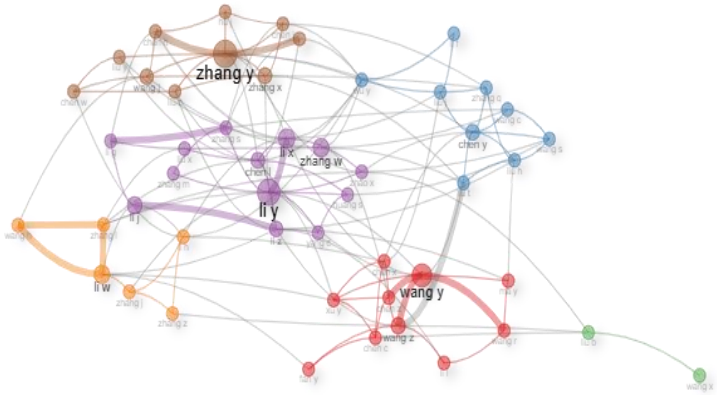
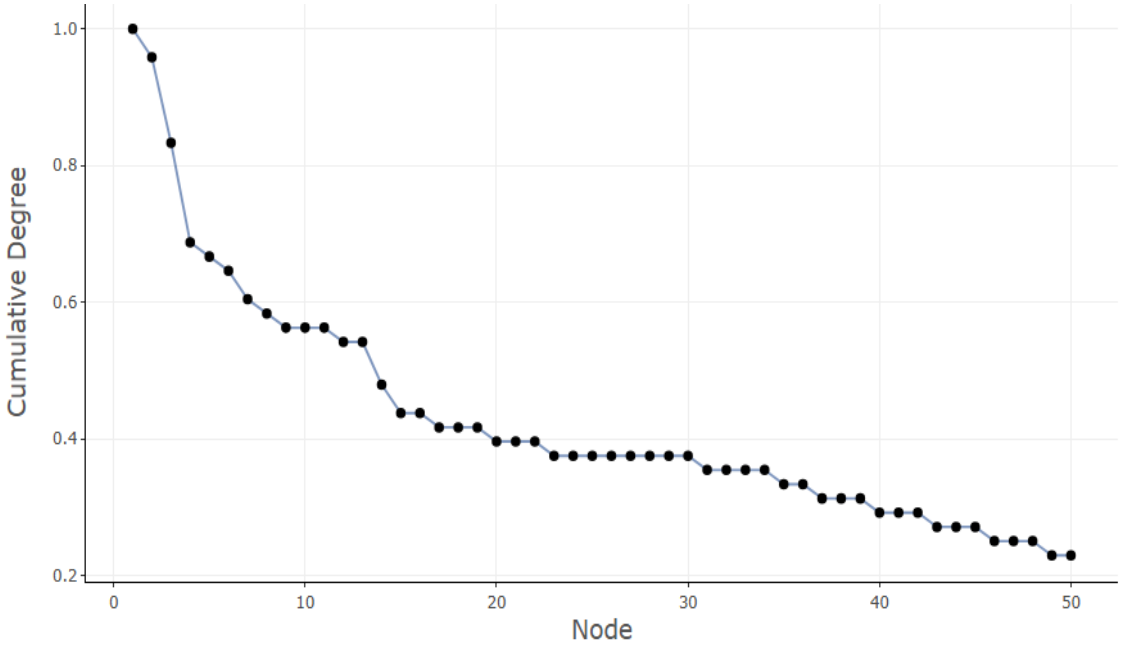


Figure 20

Collaboration Network



Discussion

The bibliometric analysis of emerging trends and challenges in e-finance reveals several critical insights into the research landscape. The exponential growth in publications, particularly from China, underscores its dominance in e-finance research, driven by strategic investments in digital financial technologies. The annual scientific production surged from 13 articles in 2021 to 1,075 in 2025, reflecting accelerated scholarly interest, though the slight decline in 2025 may indicate data incompleteness or a potential saturation point.

- Geographic Disparities: China accounted for 71.8% of publications, with limited international collaboration (10.3% MCP). In contrast, smaller nations like Bangladesh (80% MCP) and Australia (66.7% MCP) exhibited stronger global partnerships, suggesting divergent research strategies—China prioritizes volume, while others focus on collaborative quality.
- Citation Impact: Spain led in per-article citations (62.00), despite fewer publications, highlighting high-impact research. China's lower average citations (13.10) reflect its high output volume, which may include less influential studies.
- Thematic Clusters:
    - -Environmental Management dominated highly cited works (e.g., Lin B, 2022; Ren X, 2023), emphasizing sustainability and policy.
    - -inancial Innovation (e.g., Kou G, 2021) and Health Demographics (e.g., "female," "adult") emerged as niche but impactful subfields.

- Collaboration Networks: Chinese researchers (e.g., Wang Y, Zhang Y) were central to collaboration networks, with high betweenness centrality, while others (e.g., Li L, Fan Y) played peripheral roles.

Challenges and Gaps:

- Regulatory and Cybersecurity Risks: Despite advancements in AI and blockchain, cybersecurity threats and fragmented regulations remain critical barriers.
- Digital Divide: Limited infrastructure and literacy in developing economies hinder financial inclusion, as seen in low contributions from Africa and South Asia.
- Interdisciplinary Gaps: Few studies integrate technology, policy, and social equity holistically, as noted in the thematic map's disjointed clusters (e.g., "India" vs. "female").

Conclusion and Implications

This study highlights the transformative potential of e-finance in advancing financial inclusion and risk management, while underscoring persistent challenges. China's research hegemony and the rising influence of Spain, Malaysia, and Australia demonstrate varied global priorities—quantity versus impact. The dominance of environmental themes in citations suggests a pressing focus on sustainable finance, whereas gaps in cross-border regulation and inclusive technology adoption demand further exploration.

Acknowledgment
The authors would like to thank stakeholders who took advantage of the chance to voluntarily participate in this study. The authors would also like to thank everyone and all sources that have contributed in various ways and improved the work.
Conflict of Interest
The Authors declare that there is no conflict of interest.
Funding
There was no external source of funding for the research.

References

Allen, F., Gu, X., & Jagtiani, J. (2021). Fintech, cryptocurrencies, and CBDC: Financial structural transformation in China. *Journal of International Money and Finance, 124*, 102625.DOI:10.1016/j.jimonfin.2021.102625

Arner, D. W., Barberis, J., & Buckley, R. P. (2015). The evolution of FinTech: A new post-crisis paradigm? *Georgetown Journal of International Law*, *47*(4), 1271–1319. DOI:10.2139/ssrn.2676553

Beck, T., Demirgüç-Kunt, A., & Pería, M. S. (2007). Reaching out: Access to and use of banking services across countries. *Journal of Financial Economics, 85*(1), 234-266. DOI:10.1016/j.jfineco.2006.07.002

Buchak, G., Matvos, G., Piskorski, T., & Seru, A. (2018). Fintech, regulatory arbitrage, and the rise of shadow banks. *Journal of Financial Economics, 130*(3), 453-483. DOI:10.1016/j.jfineco.2018.03.011

Chen, M. A., Wu, Q., & Yang, B. (2019). How valuable is FinTech innovation? *Review of Financial Studies, 32*(5), 2062-2106.DOI:10.1093/rfs/hhz018
Claessens, S., Frost, J., Turner, G., & Zhu, F. (2018). Fintech credit markets around the world: Size, drivers and policy issues. *BIS Quarterly Review, September 2018*, 29-49. DOI:10.2139/ssrn.3248019
Demirgüç-Kunt, A., Klapper, L., Singer, D., & Van Oudheusden, P. (2020). The Global Findex Database 2021: Financial inclusion, digital payments, and resilience. *World Bank*. DOI:10.1596/1813-9450-7255
Gabor, D., & Brooks, S. (2017). The digital revolution in financial inclusion: International development in the fintech era. *New Political Economy, 22*(4), 423-436. DOI:10.1080/13563467.2017.1259298
Goldstein, I., Jiang, W., & Karolyi, G. A. (2019). To FinTech and beyond. *Review of Financial Studies, 32*(5), 1647-1661.DOI:10.1093/rfs/hhz025
Gomber, P., Kauffman, R. J., Parker, C., & Weber, B. W. (2018). On the Fintech revolution: Interpreting the forces of innovation, disruption, and transformation in financial services. *Journal of Management Information Systems, 35*(1), 220-265. DOI:10.1080/07421222.2018.1440766
Gomber, P., Koch, J. A., & Siering, M. (2017). Digital Finance and FinTech: Current research and future research directions. *Journal of Business Economics*, 87(5), 537–580. DOI:10.1007/s11573-017-0852-x
Haddad, C., & Hornuf, L. (2019). The emergence of the global FinTech market: Economic and technological determinants. *Small Business Economics*, *53*(1), 81–105. DOI:10.1007/s11187-018-9991-x
Kou, G. (2021). Blockchain and financial innovation. *Financial Innovation*, *7(*1), 1–22. DOI:10.1186/s40854-021-00256-y
Kshetri, N. (2021). Blockchain and sustainable economic development. *IT Professional, 23*(3), 35-39.DOI:10.1109/MITP.2020.2987467
Lin, B. (2022). Sustainable finance and green energy transitions. *Journal of Environmental Management*, 305, 115833. DOI:10.1016/j.jenvman.2022.115833
Mbiti, I., & Weil, D. N. (2011). Mobile banking: The impact of M-Pesa in Kenya. *NBER Working Paper No. 17129*. DOI:10.3386/w17129
Ozili, P. K. (2018). Impact of digital finance on financial inclusion and stability. *Borsa Istanbul Review*, 18(4), 329–340. DOI:10.1016/j.bir.2017.12.003
Philippon, T. (2016). The fintech opportunity. *NBER Working Paper No. 22476*. DOI:10.3386/w22476
Rau, P. R. (2020). Law, trust, and the development of crowdfunding. *University of Cambridge Working Paper*. DOI:10.2139/ssrn.2989056
Suri, T., & Jack, W. (2016). The long-run poverty and gender impacts of mobile money. *Science, 354*(6317), 1288-1292. DOI:10.1126/science.aah5309
Tapscott, D., & Tapscott, A. (2017). How blockchain will change organizations. *MIT Sloan Management Review, 58*(2), 10-13.DOI:10.7551/mitpress/11645.003.0004

Zetzsche, D. A., Buckley, R. P., Arner, D. W., & Barberis, J. (2020). From FinTech to TechFin: The regulatory challenges of data-driven finance. *NYU Journal of Law & Business, 16*(1), 87-114.DOI:10.2139/ssrn.2959925

Author's Bio

Nirmal Lamsal is a Research Scholar at Tribhuvan University with research interests in e-finance, digital banking, financial inclusion, and technology-driven risk management. His academic work focuses on emerging financial technologies and their role in enhancing secure, accessible, and inclusive financial systems.

Note: The authors acknowledge the use of AI-assisted tools (such as Quillbot and ChatGPT) strictly for editing language, improving readability, and grammar checking. No AI tools were used for data analysis, interpretation, or the creation of original scientific content. The authors take full responsibility for the accuracy and integrity of the manuscript.