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Digital Financial Literacy and Financial Inclusion: Visualizing Knowledge Networks through Bibliometric Analysis

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Keywords:

Digital financial literacy; financial inclusion; bibliometric analysis

Abstract

This study examines the intersection of digital financial literacy and financial inclusion by employing a bibliometric approach to map global research trends, key contributors, and thematic developments in the field. Data were retrieved from the Scopus database, covering publications from 2012 to 2025, and analyzed using Biblioshiny in the R environment. Results reveal a substantial increase in research activity after 2018, reflecting growing academic and policy attention to the role of digital literacy in advancing inclusive finance. India, the United States, and China emerge as the most active contributors, highlighting the global relevance of this issue across both developed and developing economies. Thematic mapping identifies financial literacy, digital financial services, education, empowerment, and fintech adoption as central topics driving the discourse. Network analyses further demonstrate strong international collaborations and an evolving research structure that connects digital technologies, financial behavior, and socio-economic development. Despite these advances, challenges remain in bridging the digital divide, particularly for marginalized groups with limited access to technological infrastructure and financial education. This study contributes by providing a comprehensive overview of the knowledge network on digital financial literacy and inclusion, offering insights for policymakers, educators, and researchers. Strengthening digital financial competencies, supported by inclusive policies and collaborative scholarship, is critical for ensuring equitable access to safe and sustainable financial services in the digital era.

1. Introduction

The rapid advancement of digital technology has fundamentally reshaped how individuals access and utilize financial services. Digitalization has accelerated the adoption of mobile banking, e-wallets, financial technology (fintech) platforms, and digital investment products, all of which provide new opportunities for expanding financial access, particularly to previously underserved populations. In many countries, this transformation has been hailed as a breakthrough in democratizing access to financial services and fostering greater inclusivity in the financial system. However, while digital financial innovations open new opportunities, they also pose challenges that are often overlooked, particularly the uneven distribution of access and skills required to navigate such services.

Several studies emphasize that the integration of big data analytics, artificial intelligence (AI), and algorithm-driven platforms in financial services requires users to possess not only basic financial literacy but also the ability to engage with digital tools in a secure and effective manner (Aman et al., 2024). Without adequate digital competencies, individuals risk mismanaging digital products, falling victim to fraud, or misinterpreting financial information. This reality highlights a paradox of digital transformation: while it enhances efficiency and accessibility, it simultaneously generates a widening digital divide that threatens to exacerbate financial inequality.

The concept of the “digital divide” has been extensively discussed in literature as the disparity in access to and utilization of technology across different segments of society. This divide is not only about infrastructure but also about knowledge, skills, and attitudes toward technology. In the financial domain, individuals with limited digital financial literacy face a heightened risk of personal data breaches, fraudulent schemes, and financial

exclusion. As financial services migrate toward digital platforms, the inability to engage safely and responsibly in these systems may deepen socio-economic disparities. Thus, digital literacy—particularly digital financial literacy—emerges as a crucial competency for individuals in the modern economy.

Financial literacy has traditionally been defined as the set of knowledge and skills that enables individuals to make informed and effective decisions with their financial resources (Iriobe et al., 2017). In contrast, digital financial literacy extends this concept by incorporating competencies related to the safe, responsible, and informed use of digital financial services. It encompasses knowledge of digital technologies, awareness of personal data security, and the ability to evaluate financial options based on digitally available information. As Choung et al. (2023) point out, digital financial literacy significantly contributes to overall financial well-being, as the ability to navigate digital platforms has become indispensable for achieving financial stability in today's interconnected world.

Education plays a critical role in improving digital financial literacy. Scholars such as Baafi and Asiedu (2025) argue that education is not merely a pathway to individual development but also a mechanism for enhancing social and economic quality of life. In the context of digital finance, education fosters awareness, reduces vulnerability, and strengthens the capacity of individuals to use digital financial products effectively. However, despite growing educational initiatives, disparities persist. Rural communities, older populations, and individuals with lower levels of education often exhibit significantly lower levels of digital financial literacy compared to other groups. This uneven distribution underscores the urgency of targeted educational interventions and inclusive public policies that can bridge the gap and promote equitable financial access.

The importance of digital financial literacy is underscored by its close link to financial inclusion. Financial inclusion refers to the ability of individuals to access affordable, reliable, and needs-based formal financial services. Adequate digital financial literacy equips individuals with the knowledge and confidence to participate in the digital financial ecosystem, thereby improving their opportunities to benefit from modern financial services. However, evidence suggests that access alone does not guarantee responsible or beneficial use. For example, individuals with access to digital banking may still misuse credit or expose themselves to fraud if they lack the necessary literacy skills. Therefore, enhancing digital financial literacy is not only about expanding access but also about ensuring sustainable and responsible participation in the financial system.

Research shows significant disparities in digital financial literacy across demographic groups. Vulnerable populations—including rural residents, elderly individuals, and those with limited educational attainment—remain at a disadvantage. Furthermore, the imbalance between the availability of technology and the readiness of individuals to use it effectively amplifies these challenges. Buenestado-Fernández et al. (2023) highlight that digital competence is especially critical for younger generations, who must navigate increasingly complex financial environments to capitalize on opportunities. Addressing these disparities requires a multifaceted strategy involving not only education but also policy frameworks that ensure inclusivity and protection for all users.

Digital financial literacy thus serves as both a determinant of prudent financial behavior and a catalyst for inclusive growth. In the context of rapid digital transformation in the financial sector, improving digital financial literacy is becoming increasingly urgent. Strengthening digital literacy is not only vital for protecting consumers but also for achieving broader development goals related to financial inclusion and equitable economic participation. At the same time, the acceleration of digital transformation calls for continuous monitoring and evaluation of how academic research addresses these issues.

Despite the growing importance of digital financial literacy, existing literature reveals fragmentation in terms of themes, geographical coverage, and methodological approaches. While studies have explored the role of financial literacy, fintech adoption, and inclusion policies, there is still limited understanding of how research in this field has evolved, which countries and institutions are leading contributions, and what thematic areas remain underexplored. To address these questions, bibliometric research provides a systematic and rigorous approach to analyzing the knowledge base of a field.

Bibliometric analysis has become increasingly relevant for mapping the development of scientific knowledge across disciplines. It enables researchers to examine research dynamics, identify leading authors and institutions, explore international collaborations, and determine trending topics in the field (Binoy et al., 2021). Tools such as *Bibliometrix* and *Biblioshiny* facilitate these analyses by offering quantitative insights into the evolution of research networks, thematic clusters, and publication impact (Aria & Cuccurullo, 2017). In the context of digital financial literacy and financial inclusion, bibliometric analysis is especially valuable for synthesizing fragmented findings, identifying influential contributions, and highlighting gaps in knowledge.

Accordingly, this study applies a bibliometric approach to systematically map research on digital financial literacy and financial inclusion. Specifically, it aims to (1) analyze publication trends and growth patterns, (2) identify key authors, institutions, and countries contributing to the field, (3) explore thematic clusters and research hotspots, and (4) highlight gaps that warrant further investigation. By doing so, this research provides both a theoretical contribution—through the organization and mapping of knowledge—and a practical contribution—by offering insights that can inform policymakers, educators, and practitioners in designing strategies for strengthening digital financial literacy and advancing financial inclusion.

This study is therefore timely and relevant, given the pressing need to ensure that digital transformation benefits all segments of society. By examining the scientific landscape of digital financial literacy and financial inclusion, the research not only sheds light on how the field has developed but also provides a foundation for future scholarship and evidence-based policymaking. Strengthening digital financial literacy is not simply a matter of individual skill development; it is a societal priority that underpins sustainable financial systems and inclusive economic growth in the digital era.

2. Literature Review

2.1 Digital Financial Literacy

Financial literacy is widely recognized as a critical factor driving individual engagement with financial markets and services (Lusardi & Mitchell, 2014). Advances in digital technology have impacted financial literacy by facilitating easier access to financial information and services through digital means. This concept is referred to as Digital Financial Literacy, which encompasses an individual's knowledge, skills, confidence, and competence in using digital financial services and instruments safely while making informed financial decisions (Alliance for Financial Inclusion, 2021). Financial literacy has been widely recognized as a crucial element in shaping individual awareness, understanding, skills, attitudes, and behaviors necessary to maximize access to financial services (Kass-Hanna et al., 2022). These competencies are key to accessing and using financial products and services responsibly. Given the increasing complexity of financial services in the digital era, strengthening literacy is crucial to enabling people to make smarter financial decisions.

The concept of digital financial literacy has emerged as a crucial skill for enhancing individual participation in the digital age. Technology has also penetrated the education sector, facilitating open-access learning,

distance learning, and digital education platforms (Imjai et al., 2025). Digital financial literacy can be assessed through several indicators, including proficiency in using digital technology, online communication, information retrieval and analysis, access to online resources, and adherence to digital security standards. These aspects play a crucial role in fostering community skill development amidst ongoing digitalization (Chetty et al., 2018). Digital financial literacy contributes significantly to long-term economic and business growth (Fauzi et al., 2020). Awareness of the importance of digital literacy prepares people to navigate the increasingly complex modern world, where technology serves as a central element of economic and social life.

The role of technology in transforming literacy is evident in the rise of digital platforms. Social technologies have created innovative communication channels (Akpan et al., 2021). Three key indicators represent digital knowledge in digital financial literacy studies: understanding financial technology (fintech), using automated financial technologies such as machine learning, and awareness of cybersecurity risks (Lim et al., 2019). Such literacy not only empowers individuals in financial decision-making but also strengthens communities' digital resilience in the face of evolving technological risks.

Digital transformation in the financial sector has significantly impacted the accessibility and efficiency of financial management. Technological innovations provide opportunities for individuals to manage their finances effectively (Lo Prete, 2022). Financial literacy and digital literacy are complementary competencies in the digital financial ecosystem. Both have been shown to contribute to an increased propensity for individuals to engage in online entrepreneurship. However, digital literacy often has an indirect impact by improving technological adaptability and data-driven decision-making capabilities. Financial management skills are positively correlated with the adoption of digital financial services, as demonstrated by entrepreneurs who integrate digital tools to access financing, conduct transactions, and manage their business finances more efficiently. This integration supports their inclusion in the formal financial system. Individuals with adequate financial literacy are more likely to engage in strategic debt management, reflecting a clear link between financial literacy and future-oriented financial behavior.

2.2 Financial Inclusion

Financial inclusion refers to the availability and affordability of formal financial services for individuals and businesses. These services include essential products such as savings, credit, insurance, and efficient and affordable payment systems. A multifaceted concept, financial inclusion involves empowering individuals and businesses—especially those traditionally excluded from the financial system—to access, utilize, and benefit from financial services. The primary goal of financial inclusion is to facilitate equitable access to formal financial services, including bank accounts, credit, insurance, and payment systems at reasonable costs (Ravikumar, 2020). As defined by institutions such as the World Bank, financial inclusion empowers low-income communities to access financial instruments that support effective financial management (Sharma, 2024).

Financial inclusion plays a crucial role in driving economic development, particularly through its contribution to reducing income inequality and poverty. Financial services provide essential tools for savings, investment, and consumption, enabling individuals to engage in productive economic activities. This access has been shown to significantly improve the standard of living and economic prospects of many marginalized groups (Omar & Inaba, 2020). In this context, access to financial services serves not only as a means to manage financial resources but also as a pathway to achieving broader socio-economic goals, including gender equality and increasing economic resilience to external shocks (Demir

et al., 2020). The primary goal of financial inclusion is to facilitate equitable access to formal financial services such as bank accounts, credit, insurance, and affordable payment systems (Ravikumar, 2020). Ensuring equitable and affordable financial access is a crucial step in promoting inclusive and sustainable development.

Financial inclusion is an effort to empower low-income communities by providing easy access to financial services and instruments that help them manage their finances more efficiently and sustainably (Sharma, 2024). Financial services offer essential tools for saving, investing, and consuming, enabling individuals to participate in productive economic activities. This has been shown to significantly improve the standard of living and economic prospects of many marginalized groups (Park & Mercado, 2015). Financial inclusion refers to the provision of accessible, affordable, and high-quality financial services to all segments of society, especially those who have been historically underserved or marginalized. Implementing financial inclusion is crucial for driving economic growth while reducing social and economic inequality globally.

2.3 Bibliometric Analysis

Bibliometric analysis is a crucial methodological approach that enables researchers to systematically evaluate scientific literature using quantitative techniques. This method provides a tool for exploration by allowing users to import and analyze data from various databases, including Web of Science and Scopus. Recent studies have demonstrated the effectiveness of bibliometric analysis in identifying research trends, prolific authors, and the evolution of research topics over time. Furthermore, bibliometric analysis serves as a predictive tool for forecasting future research directions. This analysis is considered an effective method for assessing the development, impact, and trends in a research field over time (Binoy et al., 2021). The advancement of bibliometric analysis has been supported by tools such as Biblioshiny, which operates within the R programming environment.

The use of biblioshiny in scientometric reviews facilitates the identification of potential gaps in the literature, highlighting the importance of systematic mapping for identifying research needs (D.A.T. et al., 2020). Biblioshiny simplifies the bibliometric analysis process by offering an interactive dashboard that allows for comprehensive exploration of bibliographic data. Its features include descriptive statistics, trend analysis, and network visualizations such as co-authorship networks and co-citation networks. Numerous studies using this tool have demonstrated its ability to visually represent data, aiding researchers in interpreting and drawing meaningful conclusions from large datasets. Bibliometric analysis using Biblioshiny produces informative visualizations that demonstrate the tool's effectiveness in research, particularly in education (Olaleye & Olaleye, 2022). Furthermore, R's visualization capabilities have revolutionized the way bibliometric analysis is conducted.

Bibliometric software can produce user-friendly visual representations for citation analysis, co-authorship networks, and keyword trends. This integration allows researchers to apply multiple methodologies, enriching their analytical perspectives. The role of Biblioshiny, as highlighted by Rahman et al. (2024), underscores how R facilitates interactive analysis without requiring advanced programming skills, making it more accessible to a wider academic audience. The application of bibliometric methods, especially with the support of software such as Bibliometrix and Biblioshiny, enables researchers to gain comprehensive insights that inform future research directions and support evidence-based decision-making, both at the academic and policy levels.

3. Research Methods

This study adopts a bibliometric analysis to systematically evaluate and map the scientific development of research on *digital*

financial literacy and *financial inclusion*. Bibliometric methods are quantitative approaches that assess and visualize scientific contributions through the analysis of publication metadata (Donthu et al., 2021). This approach is particularly useful for identifying key research trends, influential authors, collaborative networks, and the conceptual evolution of a field. By employing a bibliometric framework, the study not only measures the volume and quality of research but also provides insights into knowledge structures and emerging themes within the discipline (Agbo et al., 2021).

3.1 Data Source

The dataset for this study was retrieved from the Scopus database**,** chosen for its comprehensive coverage and indexing quality in the fields of management, finance, and social sciences. The search strategy employed a Boolean combination of keywords:

- "Digital Financial Literacy" OR "Digital Literacy" OR "Financial Education"
- AND "Financial Inclusion."

To ensure relevance and comparability, the search was restricted to English-language journal articles published between 2012 and 2025**.** This time frame was selected to capture both the emergence and the evolution of digital financial literacy discourse in relation to financial inclusion.

3.2 Data Extraction and Cleaning

The search results were exported in BibTeX and CSV formats, ensuring compatibility with bibliometric analysis software. Duplicate records and non-research documents (e.g., editorials, notes, conference abstracts) were removed to maintain the integrity of the dataset. Metadata extracted included authorship, institutional affiliations, keywords, journal sources, citations, and publication years.

3.3 Analytical Tools and Techniques

The bibliometric analysis was conducted using **Biblioshiny**, a web-based interface for the *bibliometrix* R-package. Biblioshiny was selected for its ability to combine R's statistical robustness with an interactive visualization interface, facilitating both quantitative and graphical mapping of bibliometric networks.

The analysis comprised:

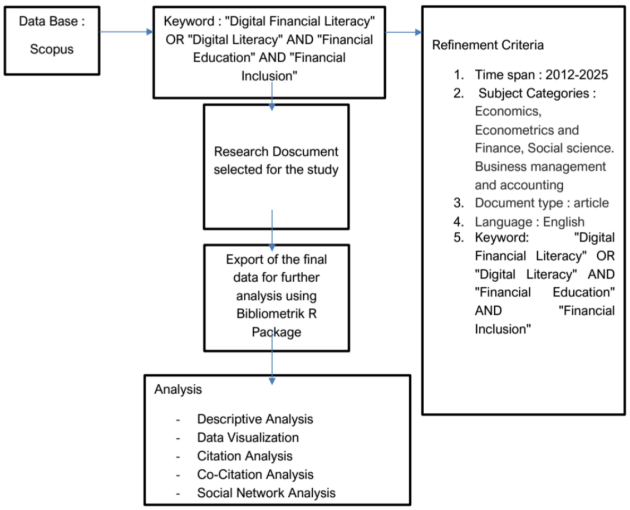
1. **Performance analysis**: to examine publication trends, citation patterns, and leading journals.
2. **Science mapping**: to identify co-authorship networks, institutional collaborations, and country-level contributions.
3. **Thematic analysis**: to detect keyword co-occurrence patterns and thematic evolution of digital financial literacy and financial inclusion research.

3.4 Reliability and Validity

Following bibliometric standards, this study ensured methodological rigor through:

1. **Transparent search strategy**: detailed reporting of databases, keywords, and inclusion criteria.
2. **Reproducibility**: providing standardized data formats (BibTeX, CSV) and software tools (R, Biblioshiny) that can be replicated in future studies.
3. **Cross-validation**: triangulating results across multiple indicators (e.g., citations, co-occurrence networks, thematic clusters) to strengthen validity.

Overall, the methodological framework integrates **quantitative rigor** with **visual exploration**, enabling a robust mapping of the intellectual landscape of digital financial literacy and financial inclusion research.



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4. Results and Discussion

Bibliometric analysis approaches consist of two main methods: descriptive analysis and scientific mapping. Descriptive analysis focuses on the use of statistical techniques to evaluate bibliometric information based on data components such as publication sources, journals, authors, and documents (Yadav & Banerji, 2023). This approach helps understand the general characteristics and distribution patterns in the literature.

In contrast, scientific mapping uses visualization techniques such as network analysis, three-plane plots, and thematic maps to map and explore the structure of knowledge within a specific research field (Yadav & Banerji, 2023). This mapping provides insight into the interconnections between concepts, authors, and keywords, helping to identify research trends, core themes, and interdisciplinary relationships. Ultimately, scientific mapping plays a crucial role in supporting literature reviews and assisting researchers in furthering their studies by offering a deeper understanding of the research topic.

Descriptive Analysis

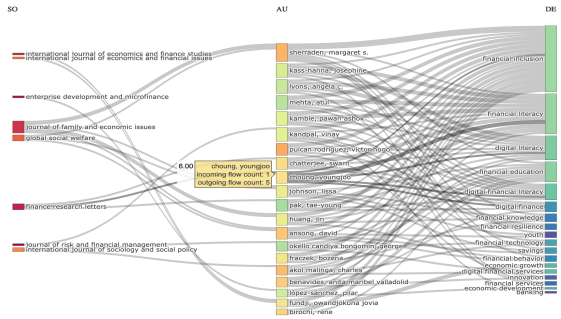
This section provides an overview of the various dimensions examined during the analysis process. Descriptive analysis captures key bibliometric indicators, including the number of publications per year, most prolific authors, leading journals, most cited documents, and contributing countries or institutions. These metrics help illustrate the growth and distribution of research over time, highlighting patterns of productivity, collaboration, and scholarly impact in the field of digital financial literacy and financial inclusion. Through this analysis, a general profile of the literature is constructed, offering fundamental insights into the evolution and characteristics of the research landscape.

1) Data Set

Source: Author's primary data

The dataset shown in the figure provides a bibliometric analysis of publications spanning from 2012 to 2025. During this period, 172 documents were published in 128 journals. The number of publications shows a growing trend, with an annual growth rate of 24.63%, indicating that this topic is becoming increasingly popular and in demand by researchers. The number of authors involved shows a total of 485 authors, with 25 of them writing individually. The involvement of authors from various countries is quite high at 27.33%, indicating that there is collaborative involvement from various countries on this topic, and each document is written by 2.97 authors, indicating a tendency for collaboration in writing articles. Based on the content contained, there are 533 keywords from the authors, reflecting the diversity of topics discussed in the research. The average age of the documents is 2.68 years, indicating that most of the research is relatively new. The number of citations per document averages 13.23 times, reflecting the level of influence among academics. Based on the presentation above, it can be seen that this research field is experiencing rapid development and is supported by global collaboration and producing impactful scientific work.

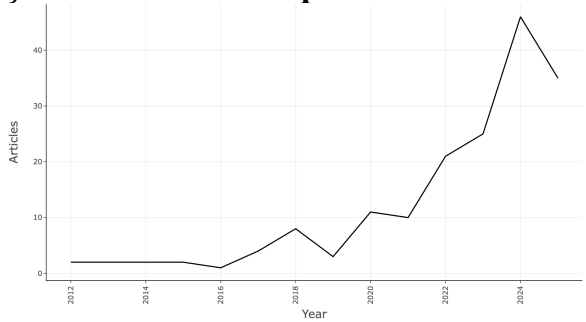
2) Three-Field Plot



Source: Author's primary data

The image above displays a Three-Field Plot, a visualization that illustrates the relationship between publication sources, authors, and keywords frequently used in research. The elements in the data above are connected by lines that show the flow of relationships between components, thus understanding contributions to a journal. The left column (SO) displays several journals or primary publication sources where related articles were published, such as the International Journal of Business and Social Science and Strategic Development and Performance. The middle column (AU) displays the most active contributing authors, such as Lusardi A., Mitchell OS., and several others with strong links to the journals where they publish their scientific work. Meanwhile, the right column (DE) displays the most frequently appearing keywords, such as Financial Literacy, Retirement Planning, Saving Behavior, and Digital Finance. The results of this Three-Field Plot illustrate that research related to digital financial literacy, retirement planning, and saving behavior has a strong relationship between publication sources, primary authors, and relevant keyword focus.

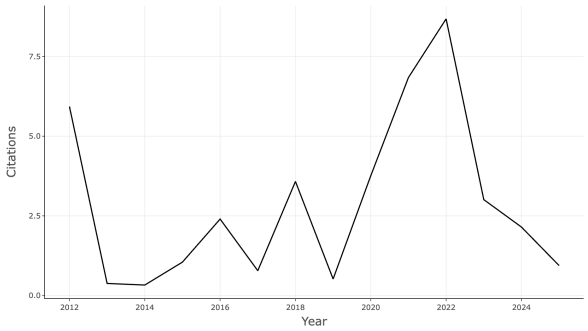
3) Annual scientific production



Source: Author's primary data

The data above provides a graphical overview of the development trends of scientific publications and their impact from 2012 to 2025. The first graph shows the number of publications published each year. This data shows a low and stable value until 2017, and has increased since 2018, with an increase in 2018 and a sharp increase in 2020. The highest peak occurred in 2023, with over 40 articles published. This condition indicates that attention to this topic has increased in recent years.

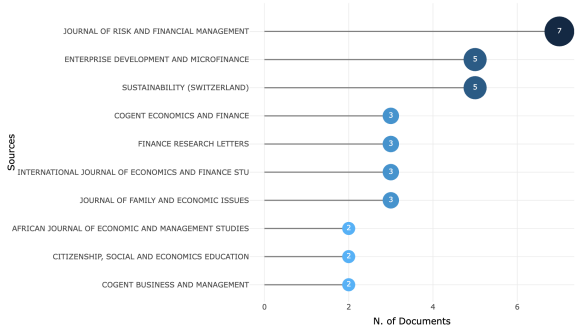
4) Average article citations per year



Source: Author's primary data

The data above shows the average number of citations per article per year. 2012 saw a high number of citations, but this number declined in subsequent years. The highest number of citations occurred in 2022, with a decline in the following years. This graph demonstrates that while the number of publications continues to increase, their scientific influence or impact is not always stable and requires time to develop along with wider academic acceptance.

5) Most Relevant Source

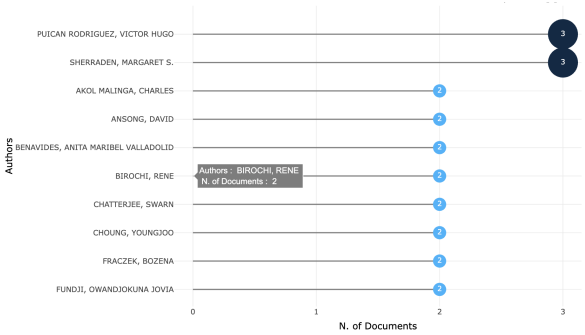


Source: Author's primary data

This figure shows the top ten journals that published the most documents related to the analyzed research topics. The journal with the largest number of publications is the Journal of Risk and Financial Management, with seven

documents. This is followed by Enterprise Development, Microfinance, and Sustainability (Switzerland), which published five documents each. Other journals contributing to the publications are Cogent Economics and Finance, Finance Research Letters, and the International Journal of Economics and Finance Studies, each contributing three documents. This figure illustrates that related research is predominantly focused on journals in the fields of financial risk management, microfinance, and sustainable development.

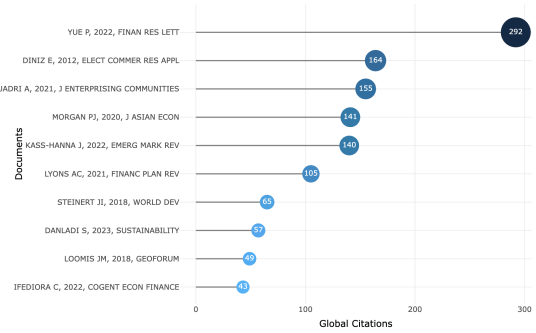
6) Most Relevant Author



Source: Author's primary data

Most Relevant Author refers to a list of authors who are the most productive or most frequently contributing to the field of digital financial literacy, financial planning, and financial behavior. These authors are identified based on the number of documents they have published during the period. Puican Rodriguez Victor Hugo, Sherraden Margaret S., and Akol Malinga Charles are the most relevant, having each produced three publications in this field. The high productivity of these authors demonstrates their active role in developing knowledge in the area of digital financial literacy, both through conceptual exploration, theoretical model testing, and providing practical solutions for strengthening individual financial capacity in the digital era. Identification of Most Relevant Authors is important to provide direction for new researchers in determining primary references and to understand who are the pioneers or authorities in this research field.

7) Most cited documents



Source: Author's primary data

Most-cited documents refers to a list of publications or articles that have received the most citations from other research in the fields of digital financial literacy, financial planning, and financial behavior. A high number of citations in these documents indicates that the work has had significant influence and serves as a primary reference in the development of knowledge in the related field. In the visualization shown, Yue's (2022) article published in Finance Research Letters is the most-cited document with a total of 292 citations. This is followed by Diniz's (2012) article with 164 citations and Abdouqaloumi's (2021) article with 155 citations. These documents generally contain significant contributions such as theory development, analytical models of financial behavior in the digital era, or empirical studies relevant to current financial trends. This list of most-cited documents is important because it helps researchers identify seminal works that require further study to understand the development of science, theoretical foundations, or established methodologies in the fields of digital financial literacy and finance in general.

8) Country's scientific production

Number	Country	Freq
1	India	73
2	Usa	46
3	China	34
4	Peru	33
5	Indonesia	23
6	Spain	22
7	Uk	13
8	Brazil	12
9	Malaysia	12
10	Uganda	12

Source: Author's primary data

The Country's Scientific Production data lists the ten countries with the highest number of scientific publications related to digital financial literacy, financial planning, and financial behavior. India ranks first with 73 publications, demonstrating the dominance and high level of attention Indian researchers have paid to this topic. This is followed by the United States (USA) with 46 publications and China with 34 publications, confirming the two countries' positions as global research centers in various fields, including digital finance. Peru ranks fourth with 33 publications, demonstrating the South American country's significant contribution to digital financial literacy studies. Indonesia ranks fifth with 23 publications, reflecting the increasing participation of Indonesian academics in studying digital financial issues relevant to national and global economic developments. Other countries such as Spain, the United Kingdom, Brazil, Malaysia, and Uganda also make the list, with contributions ranging from 12 to 22 publications. This indicates that research in this field is global in scope and is beginning to receive widespread attention from both developed and developing countries. Overall, this data reflects significant research interest and growth in digital finance across the globe, with significant potential for future international collaboration.

9) *Word cloud*

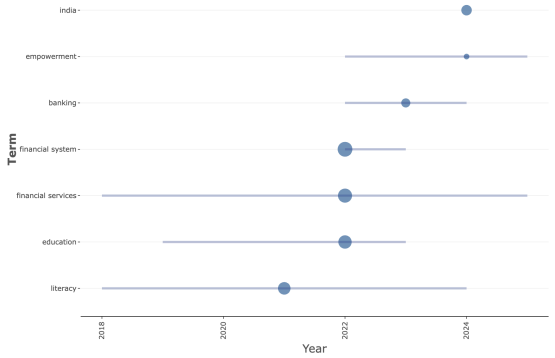
Source: Author's primary data

A word cloud is a visual representation of published scientific articles. In bibliometric research, word clouds are used to illustrate the frequency of keywords or terms frequently used by researchers in a field of study. The size of a word in a word cloud indicates how frequently it appears; the larger the word, the higher its frequency in the analyzed documents. In research on digital financial literacy, word clouds show that terms such as "financial services," "financial system," "education," "literacy," and "empowerment" are the focus of attention. This reflects the focus of research in this field on financial services, financial systems, financial literacy education, and community empowerment. Thus, word clouds are an effective tool for initial exploration in understanding the focus and direction of a body of research and help uncover the relationships between frequently occurring keywords.

10) *Conceptual structure*

Jaringan *co-occurrence* atau analisis co-
In other words, conceptual structure shows how themes, subjects, and trends interact. This is the only technique that uses the content of research articles. As a result, research subjects are ideas, frequently used terms, or themes that emerge across the network (Li et al., 2018).

Trend topics

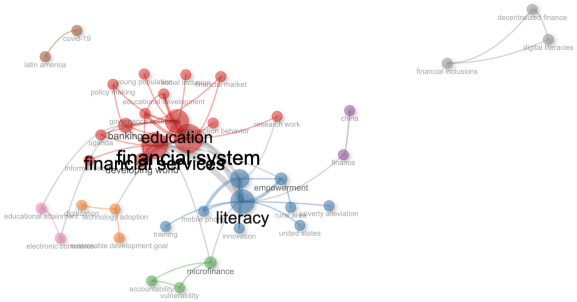


Source: Author's primary data

The figure above is the result of a temporal analysis of keywords in a bibliometric study that illustrates the development of key terms in scientific literature from 2018 to 2024. Each term is represented by a horizontal line indicating the time span of its appearance in publications, while the blue circle indicates the peak frequency of use of the term in a given year—the larger the circle, the more frequently the term appears. Based on this visualization, it can be seen that terms such as financial services, education, and literacy have been consistently discussed topics in recent years, indicating the importance of these themes in the finance and education literature. Meanwhile, the terms India and empowerment have begun to show increased relevance in the last two years (2023–

2024), which can be interpreted as an indication that the research focus is shifting or developing towards a more contextual and inclusive direction. This visualization is very useful for understanding the dynamics of topics in the research field, as well as assisting researchers in identifying trends and determining the direction of relevant studies going forward.

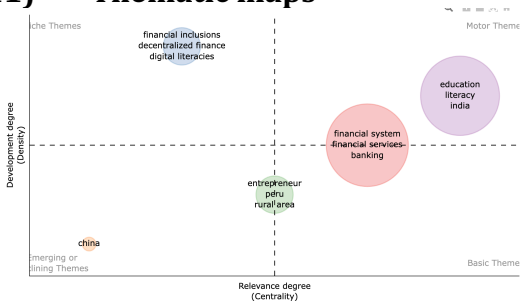
Co-occurrence network



Source: Author's primary data

The figure above shows a map of the keyword co-occurrence network, used in bibliometric analysis to identify thematic relationships between concepts that frequently appear together in scientific literature. Each node (dot) represents a single keyword, while the size of the node reflects its frequency of occurrence; larger nodes indicate the more frequently the word is used. Lines connecting nodes indicate the relationship or coexistence between keywords within a single document; the thicker the line, the stronger the relationship. Meanwhile, the colors of the clusters indicate groups of thematically related keywords. In this figure, keywords such as financial system, education, and literacy are central to the network due to their large size and numerous connections. These words are key themes in the literature analyzed. The red cluster dominates the themes of education and banking, while the blue and green clusters relate to empowerment, vulnerability, and microfinance. There are also separate keyword groups, such as sustainable finance and financial inclusion (gray cluster), that, while relevant, do not co-occur frequently with the main keywords. Overall, this visualization helps to show the intellectual structure of the research field, by identifying central themes, relationships between topics, and potential gaps or areas of exploration for further research.

11) Thematic maps



Source: Author's primary data

The image above is a thematic map depicting the position and development of various research themes based on a bibliometric analysis of keywords frequently appearing together in the scientific literature. This map uses two main axes: the horizontal axis indicates the degree of connection or relevance of the theme to other themes, while the vertical axis indicates the level of internal development or maturity of the theme. In the upper right quadrant, themes such as education, literacy, and India are indicated by large bubbles and central positions. These themes are conceptually strong and play a significant role in the literature, making them central to academic discussions. In the lower right quadrant, financial systems, financial services, and banking are highly relevant to research but still offer room for further conceptual development. Themes such as entrepreneurship, Peru, and rural areas are in the middle, near the boundary between the basic and emerging quadrants, indicating topics that are beginning to grow but have not yet become the focus of mainstream discussion. On the other hand, in the upper left quadrant, themes such as financial inclusion, decentralized finance, and digital literacies are developing intensively within a limited and specific scope. These themes demonstrate innovative potential but are not yet closely connected to other dominant themes. On the other hand, China is in the lower left quadrant, which suggests that this topic may be in its early stages of development or experiencing declining interest in recent literature.

5. Closing

5.1 Conclusion

This study employed bibliometric analysis to systematically examine the scientific landscape of digital financial literacy and financial inclusion from 2012 to 2025. The

findings indicate that research in this domain has experienced rapid growth, particularly after 2018, reflecting increased global attention to the role of digital competencies in advancing inclusive finance. India, the United States, and China emerged as leading contributors, underscoring the global relevance of this issue across both advanced and emerging economies.

Thematic and network analyses reveal that financial literacy, digital financial services, education, empowerment, and fintech adoption constitute the central themes driving academic discourse. Furthermore, the results highlight the significant role of education in fostering digital financial literacy and the importance of collaboration among countries and institutions in advancing knowledge in this field.

Despite this progress, challenges remain. The persistence of the digital divide—particularly among rural populations, the elderly, and those with limited education—continues to hinder equitable participation in digital finance. The uneven distribution of digital financial skills underscores the need for more inclusive policies, targeted educational programs, and stronger digital infrastructure to ensure that technological innovation translates into sustainable financial inclusion.

Overall, this research contributes to the literature by providing a comprehensive knowledge map of digital financial literacy and inclusion, highlighting key contributors, thematic clusters, and knowledge gaps that require further exploration.

5.2 Recommendations

Based on the findings, the following recommendations are proposed:

1. **For Policymakers**
   - Develop inclusive public policies that prioritize digital infrastructure expansion in underserved regions.
   - Integrate digital financial literacy into national education curricula and adult learning programs to reduce disparities.
   - Promote regulations that safeguard digital finance users against fraud, cyber risks, and misinformation.
2. **For Educators and Practitioners**
   - Design targeted educational interventions that address the needs of vulnerable groups such as rural communities, women, and the elderly.
   - Collaborate with fintech providers to develop user-friendly training modules that enhance both financial and digital competencies.
   - Emphasize the integration of financial education with digital skill-building to prepare individuals for safe and responsible participation in the digital economy.
3. **For Researchers**
   - Expand future studies to include comparative cross-country analyses that highlight cultural and contextual differences in digital financial literacy.
   - Explore the intersection of digital financial literacy with emerging themes such as artificial intelligence, blockchain, and sustainable finance.
   - Conduct longitudinal studies to examine the long-term impact of digital literacy initiatives on financial inclusion and socio-economic outcomes.

By addressing these recommendations, stakeholders can contribute to narrowing the digital divide, strengthening financial resilience, and promoting sustainable and equitable financial inclusion in the digital era.

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