Mapping the Landscape of Digital Financial Services: A Bibliometric Analysis

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KEYWORDS	ABSTRACT
Digital Financial Services, Bibliometric, Graphic Analysis	***Purpose:*** This research aims to achieve several objectives within the field of Digital Financial Services. It identifies influential authors and journals, assesses their contributions, and reveals research areas, document types, leading affiliations, and countries contributing significantly. It also explores keyword and citation networks to understand evolving research trends. ***Design/Methodology:*** This comprehensive bibliometric analysis focuses on Scopus database papers from 2008 to 2023. Data from 1628 documents was collected and analyzed for various bibliometric indicators, including annual growth rate, document age, citations, references, authorship patterns, and document types. ***Findings:*** Zhang Y leads in digital financial services publications, suggesting their significant influence. "Sustainability (Switzerland)" and "Technological Forecasting and Social Change" demonstrate impactful research venues. The USA holds the highest citation count despite China's prolific output, implying differing citation practices. Network analysis enriches insights through diverse connections among research elements. ***Social Implications:*** Understanding digital financial services research dynamics informs policymakers, industry professionals, and financial institutions about the evolving landscape and emerging areas in digital finance with broader societal implications. ***Originality/Value:*** This study's originality lies in its comprehensive bibliometric analysis of digital financial services research. It offers a detailed overview of the field's development, key contributors, and emerging trends. The findings contribute to existing digital finance knowledge and provide a valuable resource for scholars and practitioners.

Paper type: Literature review

1.

2. INTRODUCTION:

Numerous scientific studies affirm that the bedrock of a nation's economic growth and enduring welfare lies in innovative development (Balzer et al., 2020; Kirikkaleli & Ozun, 2019). Innovation is recognized as a crucial factor in enhancing enterprise efficiency (Bilan et al., 2020; Chigrin & Pimonenko, 2014; Podhorska et al., 2020; Pukala et al., 2018; Zygmunt, 2019), contributing to economic security and facilitating sustainable economic development (Sineviciene et al., 2018). Postelnicu and Câlea (2019) emphasize the continuous transition to Industry 4.0, which has prompted contemporary scientific research to explore the transformative effects of Industry 4.0 on a variety of human aspects. Modern innovation fundamentally centers on the utilization of technology (Kohnová et al., 2019).

Over the past ten years, the emergence of digital finance, referred to as financial technology or fintech, has significantly transformed the global financial services landscape. The increasing Internet penetration in the Global South has positioned digital financial services as a crucial component of the global financial inclusion initiative (McKinsey Global Institute, 2016). This movement views improved access to financial services as a driver of socioeconomic development, recognized across regions from Africa to South America and Southeast Asia to India, as the inclusion of marginalized populations in the expanding digital financial ecosystem is considered a significant objective (The Economist, 2014). Digital financial services (DFS) have proliferated in developing countries alongside the expansion of the digital economy (Demirgüç-Kunt et al., 2018a). However, a substantial global population remains impoverished, facing health issues, financial constraints, and unforeseen circumstances. A significant portion of individuals near or below the poverty line lacks access to essential banking services, with only 16% of those earning less than $2 per day possessing formal bank accounts, a situation exacerbated for women and rural residents, according to the World Bank's Global Financial Inclusion database (Gates Foundation, 2017). In the last ten years, financial services for the disadvantaged have significantly evolved, with technology breakthroughs positioning digital financial services (DFS) as crucial to future financial transformations (Mattern & McKay, 2018).

The widespread usage of mobile and digital solutions in contemporary life is apparent (Baptista & Oliveira, 2016). The trend has become especially evident during the COVID-19 pandemic, as individuals increasingly favor digital solutions that minimize human interaction (Al-Qu-dah et al., 2022). Kaur et al. (2020) have observed that finance and payment services have undertaken a substantial transformation to a digital landscape, which has enabled a more efficient approach to the management of payments, the supervision of finances, and the execution of transactions, among other functions. These services offer users benefits and improve the operations of banks, financial institutions, and virtually all organizations that engage in digital payments (Chawla & Joshi, 2019). This study comprehensively examines digital financial services across three main areas: digital banking, digital management and payment services, and digital wallets. Digital banking refers to financial services delivered through mobile or digital channels, facilitating transactions, trading, history visualization, and occasionally providing advisory services and cross-selling products (Baptista & Oliveira, 2015).

Conversely, digital management and payment services are separate from a specific bank, as FinTechs typically offer them. These solutions empower users to invest money, receive investment proposals, set financial goals, make payments, and access visualizations of financial history and performance (Gerlach & Lutz, 2021). Finally, digital wallets are mobile applications functioning as a digital repository for payments and information such as credit cards, passport details, multiple payment accounts, passwords, etc. (George & Sunny, 2022).

1.1 Evolution of Financial Services in the Digital Age: The transition from the previous era to the new digital era has brought profound changes to the landscape of financial services. While digitization in finance started decades ago, specific segments, such as retail brokerage, adopted digital channels over 20 years ago (IFC). However, the complete transformation of the industry was hindered by the advantages enjoyed by traditional financial services providers, such as customer trust, regulatory barriers favouring incumbents, and supervisory approaches focusing on internalizing the value chain. The 2008 financial crisis eroded trust in traditional institutions, leading to regulatory responses imposing stricter capital requirements and compliance costs. Consequently, lending services became more challenging and expensive for banks, creating an opportunity for tech-driven non-banks to thrive with lower costs and greater efficiency (IFC). Furthermore, the digital revolution observed in other industries increased consumer trust and comfort with technology-based financial solutions. This shift also raised expectations for immediate access to personalized products and services. Innovative FinTech companies emerged to meet these demands by offering cost-effective and convenient money transfers, borrowing, and investing solutions. It is important to note that FinTech's impact extends beyond customer-facing applications, influencing every aspect of financial services production (IFC). The mobile phone has become the preferred tool for communication and digital financial activities. However, there is a gap in mobile wallet-based payment systems in the developing world, as highlighted by various studies (Buckley & Mas, 2016; Tarhini et al., 2016; Ashraf et al., 2017; Patil et al., 2017; Asongu & Nwachukwu,

2018; Sharma et al., 2018). For example, in India, despite 75% of the population owning mobile phones, 60% of the 1.2 billion population still needs to improve. Cash transactions are still preferred by approximately 67% of Indians, with only 10% using debit/credit cards, while informal channels like Hawalas are widely relied upon (Amarante Consulting Group, 2014). This transition highlights the evolving landscape of digital financial services and the challenges and opportunities it presents in this new era.

3. Literature review:

A diverse range of digital financial services exists, differing in their functionalities, the organizations driving them, and the available features, among other aspects. Three primary services stand out: digital banking, digital management and payment services, and digital wallets. Digital banking, the most prevalent of these services, is typically affiliated with banking organizations and facilitates electronic or online banking activities (Al-Dmour et al., 2019). Operating around the clock, these services provide the flexibility to perform tasks anytime and anywhere, eliminating the need for queues and reducing operational costs (Inder et al., 2022). Digital banking encompasses a variety of functions, including transaction execution, trading, history visualization, and occasionally granting access to advisory services and cross-selling products (Baptista & Oliveira, 2015). The augmentation of these services by implementing emerging technologies, such as adaptive business intelligence, holds promise (Arjun et al., 2021). However, the acceptance of such technology hinges on various factors, particularly security and convenience.

In contrast, despite performing activities akin to digital banking, digital management and payment services are typically provided by FinTechs (Mainardes et al., 2023) or e-commerce entities like Amazon (Jena, 2022). These services empower users to invest, receive investment proposals, set financial goals, make payments, and access visualizations of financial history and performance (Gerlach & Lutz, 2021). With substantial data, advanced models employing deep learning or reinforcement learning are being developed to enhance decision-making (Singh et al., 2022).

The newest entrant among digital financial services is digital wallets. Defined as mobile applications replacing physical wallets, these wallets allow users to conduct payments without involving financial intermediaries (Tran et al., 2021) and store information such as credit cards, passport details, multiple payment accounts, passwords, etc. (George & Sunny, 2022). Digital wallets are not solely focused on financial transactions; research explores their potential in various domains, including health information storage using blockchain technology (Maher et al., 2023; Mittal et al., 2021).

Digital payments are pivotal in significantly improving clients' well-being directly and by fostering a more extensive ecosystem. In the Kenyan context, introducing M-PESA has empowered households to fortify their informal risk-sharing networks. This enhancement enables them to respond more effectively to unforeseen shocks by borrowing or receiving gifts from friends and relatives. Notably, households not utilizing M-PESA experienced a 7 per cent reduction in consumption in response to income shocks. In contrast, users' consumption remained unresponsive to such shocks. The critical mechanism driving this improvement was the facilitation of domestic remittances. M-PESA users were more likely to receive remittances during challenging times, receiving a higher volume from a more diverse range of sources. Risk-sharing improvements translated into increased savings, higher consumption levels, and shifts in occupational patterns for households using the service (Jack and Suri, 2014, 2015; Suri et al., 2012).

In the Indian context, implementing biometrically authenticated cards for workers engaged in a public works program involving 19 million people resulted in a notable reduction in corruption (Muralidharan et al., forthcoming). This move also intensified competition in the labour market, with wages in the private sector experiencing a more significant increase than those in the public sector. This suggests an overall economic benefit for the population (Muralidharan et al., forthcoming; Imbert & Papp, 2015; Zimmerman, 2015). Digital systems are being utilized to disburse cash transfers, impacting the cost-effectiveness of distribution and

nutrition outcomes (Aker et al., 2014). Additionally, digital systems are used for salary disbursement (Callen et al., 2015). Applying digital systems for government-to-person transfers has implications for public expenditure management systems. For instance, Banerjee et al. (2016) demonstrate that utilizing digital financial services in India to transfer funds in a public works program led to a notable 38 per cent reduction in program fund expenditure and a 25 per cent decline in corruption. Household transfers remained unaffected, indicating significant efficiency gains for households and the public exchequer.

Overall, the maturity of digital financial services is evident, yet significant opportunities persist due to ongoing digital advancements, including advanced methodologies and blockchain. It is crucial to delve into the existing literature and understand the depth of investigations in this field.

2.1 Research Objectives: The research objectives are given below.
   I.   To identify influential authors and journals in digital financial services and assess the significance and relevance of their published work.
   II.   The purpose of this study is to determine the prevalent research areas and document types associated with digital financial services publications, providing insights into the broader research landscape.
   III.   To identify leading publication affiliations and countries contributing significantly to this field and investigate keyword and citation networks to understand research trends comprehensively.

A set of research questions has been formulated to provide answers to achieve these objectives. Table 1 presents these questions and their significance.

Table I. Research questions with their significance

S.No.	Research Questions	Significance
1	What is the annual trend in publications about digital financial services?	Analyzing the yearly volume of publications on digital financial services can provide insights into future trends in this field.
2	Which author and journal have significantly contributed to digital financial service research?	Identifying the authors and journals that have contributed the most to research on digital financial services can assist researchers in finding specific studies, methodologies, and resources for conducting high-quality research in this area.
3	Which research area and document type have published the most work on digital financial services?	Examining the areas and document types that have published the most research on digital financial services can help identify the research efforts in different domains and document formats. This information can 4guide researchers in identifying future research directions.
4	What is the most prominent publication affiliation for papers on digital financial services?	Determining the leading publication affiliations for digital financial services papers can assist researchers in selecting appropriate conferences, universities, and journals to publish their research work. It may also impact the future citation rates of their papers.
5	Which countries are at the forefront of publishing papers on digital financial services?	Understanding which countries are prioritizing research on digital financial services provides researchers and practitioners with insights into the geographical focus of this field. This knowledge can offer opportunities for contributing research work in those countries for future publications.
6	What are the keyword and citation networks related to digital financial services?	Analyzing the keyword and citation networks associated with digital financial services can provide future researchers with an efficient search method, enabling them to explore relevant literature more easily.

Source: Author Compilations

4. **Research Methodology:**

Building on previous bibliometric studies (Bhaskar et al., 2022; Bhaskar & Bansal, 2022; Donthu et al., 2021; Goodell, 2020; Khan et al., 2021; Mukherjee et al., 2022; Pattnaik, Hassan, et al., 2020), our research incorporates bibliometric analysis, a methodology initially rooted in information and library science but now widely applied across diverse domains (Donthu et al., 2021). Bibliometric analysis is a method that investigates the formal properties of knowledge domains by quantitatively analyzing information (Cancino et al., 2017) and (Mora et al., 2017).

Figure 1: Research Methodology Flowchart
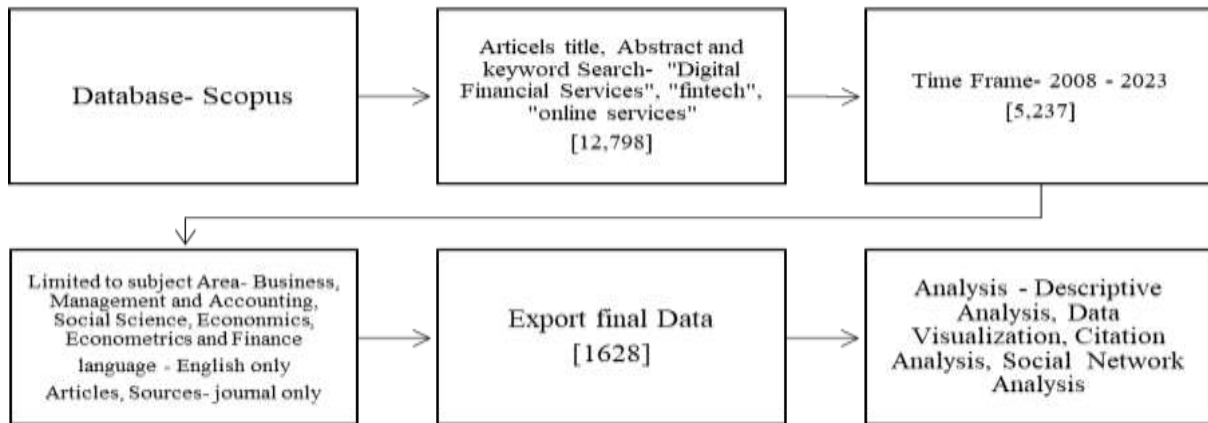
Source: Author Compilations

3.1 Selection of database: This study uses the Scopus database. Scopus stands out as a frequently recommended scientific database for conducting bibliometric reviews, as suggested by numerous scholars (Donthu et al., 2021; Lal et al. et al., 2022; Lal et al. et al., 2022; Mukherjee et al., 2022; Norris & Oppenheim, 2007). Its comparative strength, especially in business and economics, sets it apart from the Web of Science (Levine-Clark & Gil, 2009; Levine-Clark & Gil, 2008). Notably, Scopus's comprehensive coverage extends to a vast selection of peer-reviewed journals not encompassed by the Web of Science, often with commendable citation records (Vieira & Gomes, 2009).

3.2 Preparing data for analysis:

Selecting the period from 2008 to 2023 for a digital financial services trends analysis offers a comprehensive and insightful perspective, considering two major global financial crises during this span: the 2008 financial crisis and the economic challenges posed by the COVID-19 pandemic in 2020. The global economy experienced a significant downturn in 2008 due to the financial crisis, while more recent crises emerged amidst the COVID-19 pandemic. This research aims to explore the role of electronic currencies within the economy, focusing on their relevance in the face of contemporary global financial upheavals and the impact of cutting-edge electronic financial technologies (Dafri & Al-Qaruty, 2023).

Top Form Performance assessment evaluates the contributions of various research elements within a specific domain (Cobo et al., 2011).

3.3 Selection of bibliometric tool: The research employs a bibliometric method for comprehensive scientific mapping. The term "bibliometrics" was first introduced by Pritchard (1969) as the "application of mathematical and statistical methods to books and other means of communication" (p. 349). the Bibliometrix R package is employed, a tool developed in the R language by Ariaa and Cuccurullo (2017). This package facilitates comprehensive bibliometric research, including data analysis and visualization. It is an age-old research approach of statistical and mathematical analysis of scientific literature practised in library and information science to enhance the efficiency and effectiveness of libraries (Tella & Olabuiye, 2014).

Descriptive and network bibliographic data are included in our bibliometric analysis (Pandey et al., 2023). Conducting this study necessitated the acquisition of bibliographic data, which we obtained from Scopus, acknowledged as the most comprehensive and multidisciplinary database (Bar-Ilan, 2010; Bartol et al., 2014; Donthu et al., 2020; Goel et al., 2022; Norris & Oppenheim, 2007). A critical component of our methodology

has been the use of VOS viewer software for the analysis of bibliographic data, which is subsequently visualized using Gephi software (Bastian et al., 2009; Bhaskar et al., 2022; Donthu et al., 2020; Pandey et al., 2023; Rialti et al., 2019; Van Eck, N. J., Waltman, 2017., & Van Eck & Waltman, 2010).

5. Results And Discussion:

This study examined the explicit characteristics of literature, encompassing affiliation, authorship, citations, and keywords. Furthermore, we conducted keyword co-occurrence and cluster analysis. These strategies allowed us to reveal implicit information contained within the literature.

3.1.Basic Information: This evaluative process, characterized by its descriptive nature, constitutes a fundamental aspect of bibliometric investigations (Donthu et al., 2020). Table II provides some basic information about the data.

Table II, Basic Information

| Description	Results
Timespan	2008:2023
Sources (Journals, Books, etc.)	666
Documents	1628
Annual Growth Rate %	38.93
Document Average Age	2.2
Average citations per doc	17.38
References	81153
DOCUMENT CONTENTS	
Keywords Plus (ID)	2981
Author's Keywords (DE)	4080
AUTHORS	
Authors	3663
Authors of single-authored docs	282
AUTHORS COLLABORATION	
Single-authored docs	319
Co-Authors per Doc	2.77
International co-authorships %	27.58
DOCUMENT TYPES	
article	1628

Source: Biblioshiny

This includes a remarkable 38.93% annual growth rate, indicating increased research output. The average document age of 2.2 years suggests a dynamic research landscape. An impressive average of 17.38 citations per document highlights publication relevance and impact. Collaboration among authors, with 27.58% being international, signifies a global perspective within the research community.

4.1 Descriptive Analysis: This section 4.1 provides a descriptive analysis of the 1628 articles found in Scopus. A number of factors are covered in the analysis, such as trends in journal publication and citations, annual publication and citation trends, author collaboration, the identification of the most influential documents, and the most productive and significant nations, organizations, authors, and affiliations. By highlighting significant contributors, trends, and influential works in the subject, this comprehensive approach offers insightful information on the scholarly landscape within the scope of the examined articles (Lal et al., 2022).

4.1.1. Trends in Annual Publications and Citations: Scientific articles, marked by timestamps, enable bibliometric analysis that monitors the changing relationships between topics over successive time intervals.

This method facilitates the examination of technological evolution (Merigó et al., 2018; Morris et al., 2002). The annual scientific output in digital financial services, as illustrated in Fig. 2, has demonstrated significant growth and development over the years. In 2008, three articles focused on this subject, indicating the early phases of research in this field. A consistent increase has been observed in subsequent years, with ten articles published in both 2009 and 2010 indicating a rising interest. The field began to acquire momentum in 2011, with the publication of 14 articles. This trend continued in 2012, with 12 articles published. The number of articles dropped slightly in 2013 to five, but quickly rose again, hitting ten in 2014. The pivotal moment occurred in 2015 with the publication of 16 articles, indicating a notable increase in research output. This growth was sustained in the years that followed, with 19 articles in 2016, 30 in 2017, and a significant increase to 79 articles in 2018. In 2019, there was a significant increase, with 93 articles focused on digital financial services. A remarkable surge in research, which resulted in 223 articles, was notably transformative in 2020. This momentum continued into 2021, resulting in an increase to 264 articles. The trend hit its peak in 2022 and 2023, when 424 and 416 articles were published, respectively. This shows how quickly the field has grown and how important it is to scholars.

Figure 2, Annual Scientific Production
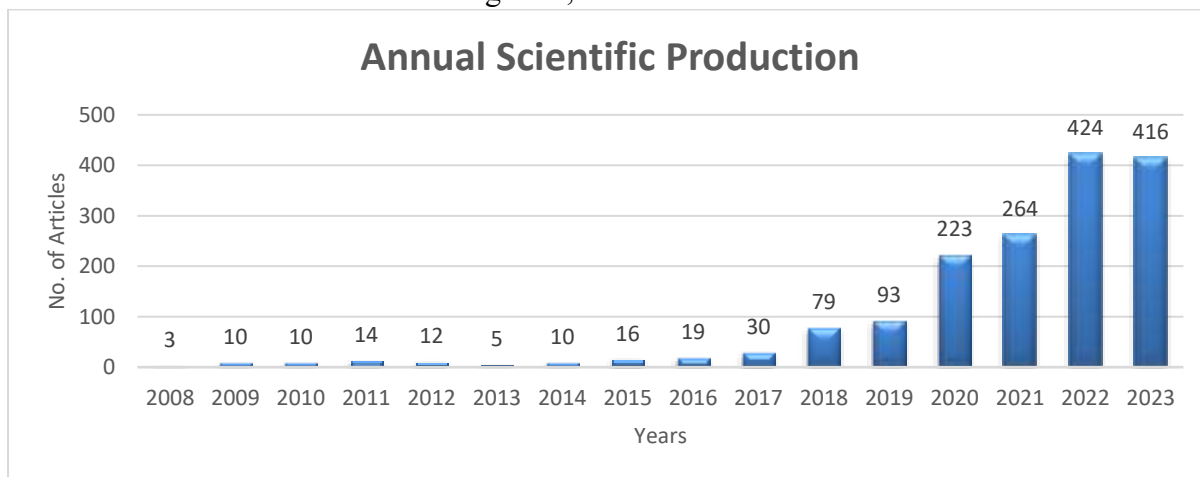
Source: Biblioshiny and Ms-Excel

Figure 3 displays the annual citation trends in digital financial services research, revealing a compelling narrative of recognition and impact. In 2008, articles received an average of 11.33 citations, indicating moderate recognition. The following year, 2009, saw a substantial increase to 45.9 citations per article, signalling growing interest. This continued in 2010 with 18.5 citations, reflecting sustained recognition. 2011, as the field matured, the average remained substantial at 16.21. However, 2012 marked a turning point with 52.67 citations per article, signifying a significant scholarly contribution. Citations remained robust in subsequent years, with averages of 24.6 in 2013, 43.9 in 2014, and 14.94 in 2015, highlighting ongoing relevance. Notably, 2016 stood out with 128.05 citations per article, underlining the field's growing influence. This peak continued in 2017 (59.77) and 2018 (65.95). Despite a substantial increase in articles in 2019 and 2020 (93 and 223), average citations remained respectable at 27.78 and 25.18. However, 2021 marked a decline with 17.48 citations per article, intensifying in 2022 (7.5) and reaching its lowest point in 2023 (1.27).

Figure 3, Annual Citation Per Year
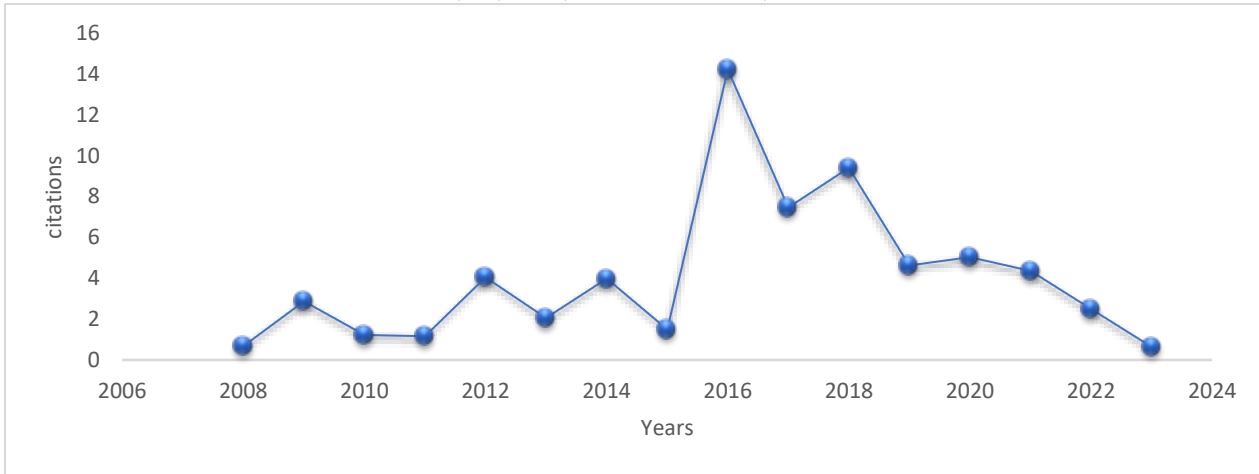
Source: Biblioshiny and Ms-Excel

Threefold plot: A threefold plot illustrating the interconnectedness among authors (left), Keyword (middle), and Country (right) of original articles on systemic lupus erythematosus from 2008 to 2023. Figure 4 displays a three-field plot, represented as a Sankey diagram, illustrating connections from authors to keywords to countries (Koo.M., 202).

Figure 4, Threefold plot
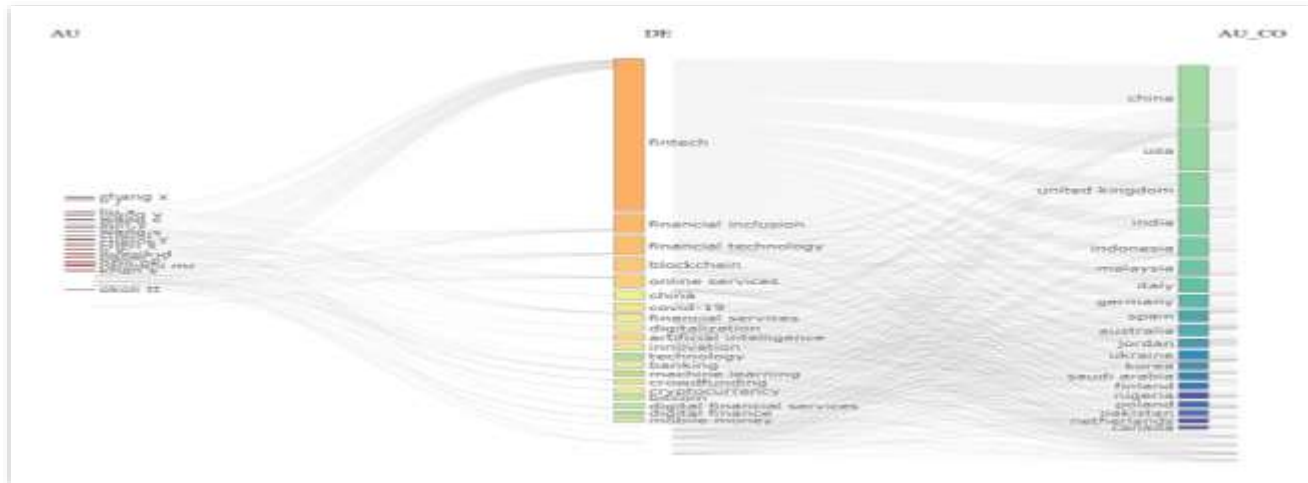
Source: Biblioshiny

4.1.2. Sources Publication and Impact: The scholarly production in digital financial services has evolved significantly, as seen in Figure 5, Sources Production Over Time. 2008, none of the selected journals published articles on this subject. However, the subsequent years witnessed a gradual increase in contributions, with "Financial Innovation" and "Electronic Commerce Research and Applications" starting to make their mark by 2015. This trend accelerated in 2016 and reached a turning point in 2017 and 2018 when "Financial Innovation" and "Electronic Commerce Research and Applications" significantly increased their article publications. Furthermore, "Sustainability (Switzerland)" and "Technological Forecasting and Social Change" entered the field in 2018. In the following years, all selected sources saw substantial growth in contributions. A notable increase marked 2019, and 2020 and 2021 witnessed a surge in research output across the board.

Figure 5, Sources Production Over Time
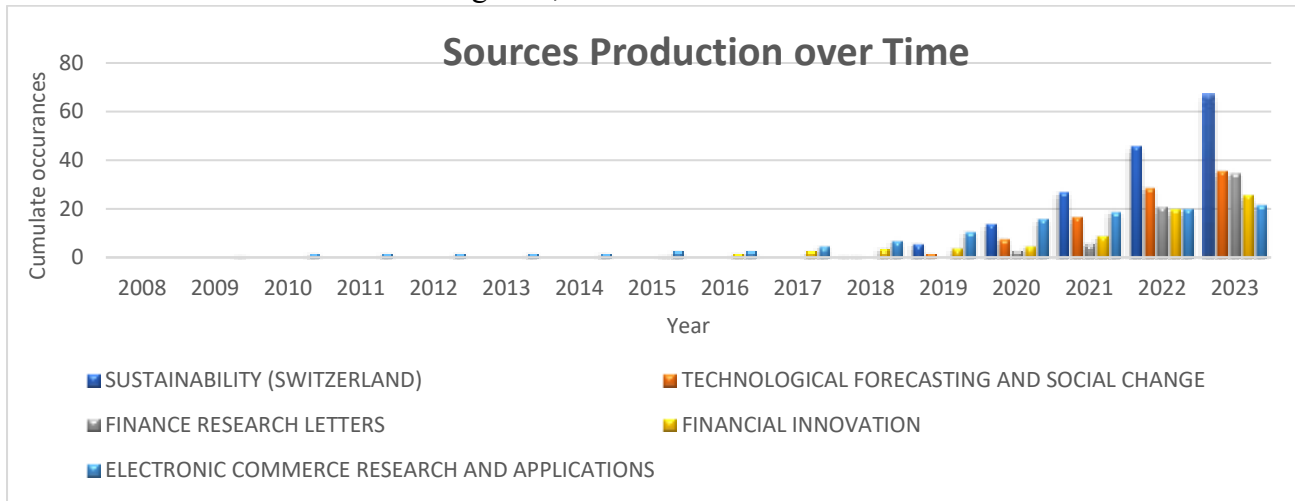
Source: Biblioshiny and Ms-Excel

Table III highlights impactful journals in the scholarly discourse on digital financial services. "Sustainability" leads with 67 articles emphasizing sustainability in finance. "Technological Forecasting and Social Change" follows with 36 articles, focusing on tech and societal shifts. "Finance Research Letters" and "Financial Innovation" contribute 35 and 26 articles exploring financial research and innovation. "Electronic Commerce Research and Applications" adds 22 articles, while "Journal of Risk and Financial Management" covers risk with 19 articles. "International Journal of Bank Marketing," "Electronic Commerce Research," and "International Review of Financial Analysis" play significant roles, offering 15, 14, and 13 articles, respectively. Lastly, "Journal of Open Innovation: Technology, Market, and Complexity" provides a multidisciplinary perspective with 13 articles highlighting the evolving financial landscape.

Table III Sources Impact

Rank	Sources	Articles	h_index	g_index
1	SUSTAINABILITY (SWITZERLAND)	67	16	27
2	TECHNOLOGICAL FORECASTING AND SOCIAL CHANGE	36	18	36
3	FINANCE RESEARCH LETTERS	35	12	23
4	FINANCIAL INNOVATION	26	9	23
5	ELECTRONIC COMMERCE RESEARCH AND APPLICATIONS	22	15	22
6	JOURNAL OF RISK AND FINANCIAL MANAGEMENT	19	5	8
7	INTERNATIONAL JOURNAL OF BANK MARKETING	15	5	8
8	ELECTRONIC COMMERCE RESEARCH	14	2	2
9	INTERNATIONAL REVIEW OF FINANCIAL ANALYSIS	13	5	8
10	JOURNAL OF OPEN INNOVATION: TECHNOLOGY, MARKET, AND COMPLEXITY	13	9	13
11	EUROPEAN BUSINESS LAW REVIEW	12	4	5
12	JOURNAL OF BUSINESS RESEARCH	12	5	10
13	EUROPEAN BUSINESS ORGANIZATION LAW REVIEW	11	8	11
14	INTERNATIONAL JOURNAL OF SCIENTIFIC AND TECHNOLOGY RESEARCH	11	4	6
15	JOURNAL OF CULTURAL ECONOMY	11	4	7

| 16 | JOURNAL OF ECONOMICS AND BUSINESS | 11 | 6 | 11 |
17	RESEARCH IN INTERNATIONAL BUSINESS AND FINANCE	11	7	11
18	ELECTRONIC MARKETS	10	5	10
19	IEEE TRANSACTIONS ON ENGINEERING MANAGEMENT	10		
20	JOURNAL OF MANAGEMENT INFORMATION SYSTEMS	10	7	10

Source: Biblioshiny

In academic publishing, several journals stand out in the field of digital financial services. "Sustainability (Switzerland)" leads with 67 articles, an h-index of 16, and a g-index of 27, showcasing its comprehensive impact. "Technological Forecasting and Social Change" follows with 36 articles, an h-index of 18, and a g-index of 36, emphasizing its role in forecasting tech-related societal shifts. "Finance Research Letters" and "Financial Innovation" offer niche expertise, with 35 and 26 articles, h-indices of 12 and 9, and g-indices of 23, respectively. "Electronic Commerce Research and Applications" has 22 articles, an h-index of 15, and a g-index of 22, focusing on e-commerce aspects. "Journal of Risk and Financial Management" and "International Journal of Bank Marketing" contribute insights with 19 and 15 articles, h-indices of 5 and g-indices of 8, addressing risk and bank marketing in digital finance. "Electronic Commerce Research" and "International Review of Financial Analysis" enrich the discourse with 14 and 13 articles, h-indices of 2 and 5, and g-indices of 2 and 8. Lastly, "Journal of Open Innovation: Technology, Market, and Complexity" offers a multidisciplinary perspective with 13 articles, an h-index of 9, and a g-index of 13.

"Sustainability (Switzerland)" demonstrates its prominence in the field with 67 articles, highlighting its substantial contribution. With an h-index of 16 and a g-index of 27, this journal showcases a comprehensive impact, reflecting the quantity and quality of its publications.

4.1.3. Most Influential Documents: The influence of publications is measured in terms of the total citations received by the concerned article (Bar-Ilan, 2010; Tsay, 2009). Figure 6 shows that most globally cited documents represent diverse research areas and have significantly impacted their respective fields. These influential papers include works by Hamari, Gomber, Lee, Jahn, Ozili, Buchak, Gabor, Roca, and Thakor. Topping the list is Hamari's paper published in the Journal of the Association for Information Science and Technology in 2016, with an impressive total of 1,875 citations. Other notable contributions include Gomber's work in the Journal of Management Information Systems in 2018 (556 citations), Lee's article in Business Horizons in the same year (540 citations), and Jahn's research in the Journal of Service Management in 2012 (478 citations). These documents have been vital in advancing knowledge within their respective domains and are influential references for researchers worldwide.

Table Figure 6, Most Global Cited Document
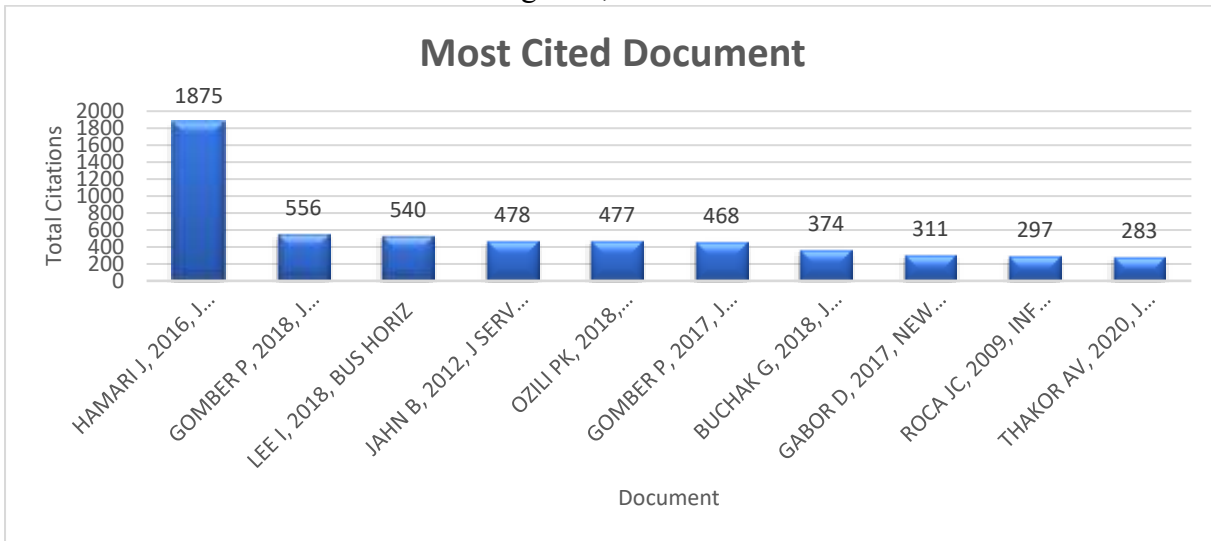
Source: Biblioshiny and Ms-Excel

Figure 7, Most Local Cited Document
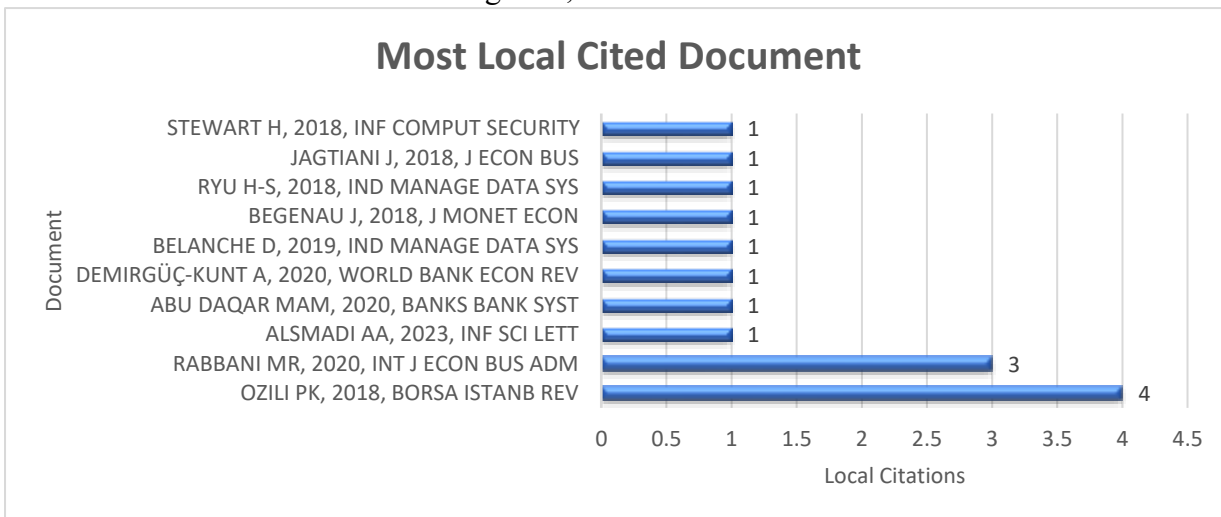
Source: Biblioshiny and Ms-Excel

Figure 7 provides information regarding the documents that have been cited the most frequently in the local community. It highlights the years in which these documents were published and highlights research contributions that have garnered significant attention in specific regional or local settings. The significance of Ozili's study, which was published in the Borsa Istanbul Review in 2018, was demonstrated by the fact that it received four local citations by the Turkish financial research community. Additional noteworthy works include the research conducted by Rabbani and published in the International Journal of Economics and Business Administration (2020, with three citations) as well as the essay written by AlsmaDi and published in Information Science Letters (2023, with one citation). Furthermore, a number of publications published in the year 2020, including those written by Abu Daqar, Demirguc-Kunt, and Belanche, each received one local citation, which is a reflection of their influence in their respective areas of research. The fact that the articles that Begenau, Ryu, Jagtiani, and Stewart published in 2018 were referenced once in their respective study groups is further evidence of the significance of these works to the conversations and investigations that take place in the region.

4.1.4 Most productive and Influential author: The subject of study on digital financial services has seen the emergence of a large number of notable authors, each of whom has made significant contributions to the ongoing conversation in the academic community (Figure 8). The most prominent individual on this list is Y.

Zhang, who has compiled a comprehensive portfolio consisting of fourteen publications that investigate many facets of this ever-evolving topic. The fact that Y. Wang and X. Zhang have written 11 papers displays their dedication to developing knowledge in the field of digital finance. They are considered to be in close pursuit. The next authors are Chen X, Liu J, and Y. Liu, and each of them has contributed ten or nine works, which demonstrates the substantial impact that they have had on the field. A comparable distinction is held by D. Wójcik, who has contributed considerably to discussions on digital financial services through the publication of nine original articles. MR. Rabbani and C. Wang have each contributed eight publications to this domain, each of which has provided substantial insights into their individual areas of expertise within this field. A wide corpus of research on digital financial services is enhanced by the seven papers that H. Baber contributes to the list, which ends the list. Because of the substantial publications that these authors have produced, the academic environment has been enhanced, and their grasp of digital finance has grown. They have made significant contributions that have shaped the evolution of financial technology.

Figure 8, Most Relevant Authors

Source: Biblioshiny and Ms-Excel

Figure 9, Author's Production over the Time
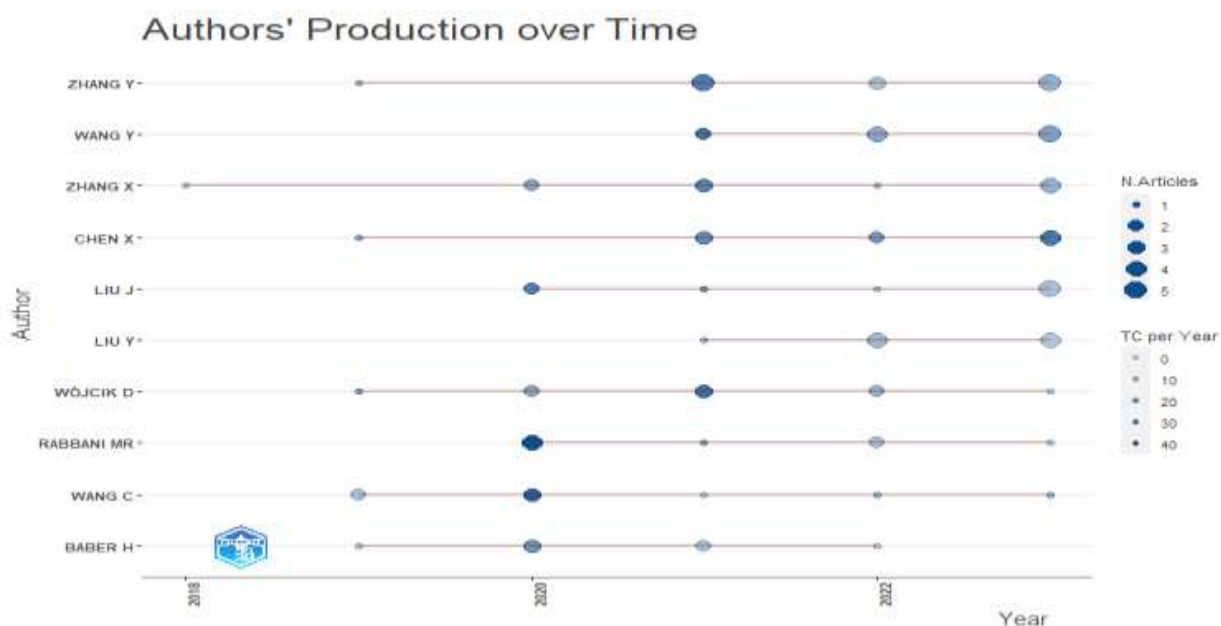
Source: Biblioshiny

Numerous authors have significantly contributed to digital financial services research, as depicted in Figure 9. Among them, Zhang Y stands out for their diverse publications in 2023, covering topics from green energy transition to COVID-19's impact on small enterprises. Zhang X also made substantial 2023 contributions, focusing on fintech development and financial inclusion in China. Wang Y's research in the same year spanned macroprudential policies and cross-border M&As. Chen X highlighted fintech's role in smart cities and gender imbalances. Liu Y and Liu J's research covered carbon emission reduction and financial distress prediction. Wójcik D explored India's fintech ecosystems and global production networks. Wang C and Rabbani MR examined financing constraints and machine learning-based P2P lending in Islamic fintech. Their findings were published in esteemed journals, fostering the ongoing discourse in this field.

Table IV Authors' Impact

S.No.	Author	Articles	Articles Fractionalized	h_index	g_index	m_index
1	ZHANG Y	14	3.475	6	10	1.2
2	ZHANG X	11	3.033333	5	11	0.833333
3	CHEN X	10	4.166667	5	10	1
4	WÓJCIK D	9	4.616667	7	9	1.4
5	WANG C	8	2.483333	7	8	1.4
6	RABBANI MR	8	4.166667	5	8	1.25
7	BABER H	7	6.5	5	7	1
8	WANG S	6	1.916667	5	6	1.25
9	BUCKLEY RP	5	1.333333	5	5	0.625
10	RUPEIKA-APOGA R	5	1.65	5	5	1.666667
11	TAN B	5	1.283333	5	5	0.714286
12	BANNA H	5	1.666667	4	5	1.333333
13	CHEN Y	5	1.708333	4	5	1
14	CHENG X	5	1.533333	4	5	0.666667
15	GRASSI L	5	2.083333	4	5	2
16	HUANG RH	5	2.5	4	5	0.666667
17	ARNER DW	4	1.083333	4	4	0.8
18	BERNARDS N	4	3.5	4	4	0.8
19	GOZMAN D	4	1.333333	4	4	0.666667
20	JAGTIANI J	4	1.666667	4	4	0.666667

Source: Biblioshiny

The provided data, Table IV, comprises a list of authors in the field of digital financial services, along with relevant metrics quantifying their research productivity and impact. These metrics include the number of articles authored by each researcher, the fractionalized count of their articles (indicating collaboration), their h-index (a measure of research impact), g-index (a variation of the h-index considering highly cited papers), and m-index (reflecting multi-authored publications). Notable authors in the list include Zhang Y, Zhang X, Chen X, Wójcik D, Wang C, Rabbani MR, Baber H, and others. Zhang Y has the highest number of articles, while researchers like Wójcik D and Wang C have impressive fractionalized article counts, indicating substantial collaboration. These metrics collectively offer insights into the research contributions and collaboration patterns among these authors in digital financial services.

Table V, Authors productivity

No. Articles	No. Authors
1	3155
2	363

| 3	66
4	32
5	26
6	6
7	6
8	2
9	3
10	1
11	2
14	1

Source: Biblioshiny

Table V represents author productivity in terms of the number of articles published by different numbers of authors. For instance, there are 3155 articles authored by a single author, 363 articles authored by two authors, 66 articles authored by three authors, and so on. The data indicates a common trend in academic publishing where single-authored articles are the most prevalent, followed by articles with two or three authors. As the number of authors increases, the frequency of articles decreases significantly, suggesting that collaborative efforts involving more authors are less common in comparison. This information provides insights into the distribution of authorship patterns in academic literature, highlighting the prevalence of solo-authored work and the decreasing frequency of multi-authored articles as the number of authors increases.

Zhang Y has the highest number of publications in digital financial services, indicating their significant contribution to the literature in this area. Researchers interested in studying digital financial services should consider reading Zhang's articles as they likely contain valuable insights, findings, and perspectives that could inform and enhance their research endeavours. By examining Zhang's work, researchers can better understand the current state of knowledge, emerging trends, and potential research gaps in digital financial services.

4.1.5. Most productive and influential country and organization: Figure 10 and Table VI provide insights into the scientific production of various regions and countries and the most frequently cited countries in academic research. China has the highest scientific production, totalling 763 articles, followed by the United States with 445 articles. The United Kingdom and India also demonstrate vital research contributions, with 288 and 249 articles, respectively. Regarding citations, the United States and China lead the way, with the USA accumulating 3,665 citations, closely followed by China with 3,525 citations. The United Kingdom and Germany also substantially impact the global academic landscape, with 2,511 and 1,569 citations, respectively. Notably, Indonesia, Malaysia, Italy, and Spain are emerging as significant contributors to scientific research, each with over 100 articles in their respective regions. This data highlights the global distribution of scientific output and the interconnectedness of countries in the academic realm, reflecting the collaborative and diverse nature of contemporary research.

Figure 10, Most Cited Country
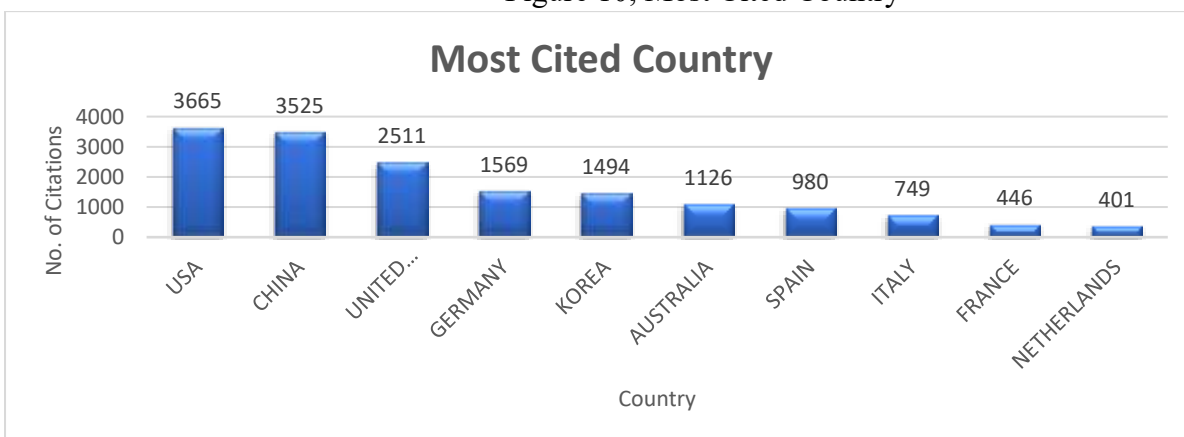
Source: Biblioshiny and Ms-Excel

Table VI Countries Production and Citation

The country's scientific production		Most cited countries	
Region	Freq	Country	TC
CHINA	763	USA	3665
USA	445	CHINA	3525
UK	288	UNITED KINGDOM	2511
INDIA	249	GERMANY	1569
INDONESIA	216	KOREA	1494
MALAYSIA	155	AUSTRALIA	1126
ITALY	145	SPAIN	980
GERMANY	127	ITALY	749
AUSTRALIA	116	FRANCE	446
SPAIN	100	NETHERLANDS	401

Source: Biblioshiny

Table VII showcases the scientific productivity of several countries during distinct periods spanning from 2008 to 2023. In the first five-year period from 2008 to 2012, the United States led the way with 83 research articles, followed by China with 36. India and the United Kingdom also made notable contributions, with 16 and 11 articles, respectively. During the subsequent period from 2013 to 2017, China significantly increased its research output, producing 78 articles, while the United States remained strong with 239 articles. India and the United Kingdom continued their research, with 32 and 46 articles, respectively. The most recent period, from 2018 to 2023, they witnessed a remarkable surge in China's scientific production, with 1,716 articles showcasing its increasing prominence in global research. India, Indonesia, the United Kingdom, and the USA continued their research with 552, 592, 846, and 1,416 articles. This data underscores the evolving landscape of scientific research, with China emerging as a dominant force in recent years while other countries consistently contribute to the global body of knowledge.
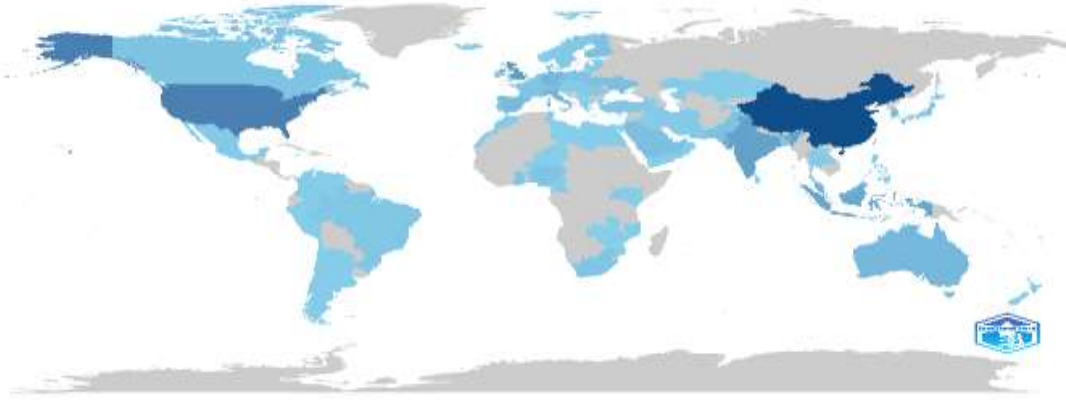
Table VII, Country production over time

country/years	2008-2012	2013-2017	2018-2023
China	36	78	1716
India	16	32	552
Indonesia	0	0	592
united kingdom	11	46	846
USA	83	239	1416

Source: Biblioshiny

Figure 11, Country Scientific Production

Source: Biblioshiny

Figure 13 presents a breakdown of academic articles published by country, along with their respective values for "SCP" (Share of Contributions) and "MCP" (Multiple Contributions Proportion). SCP represents the percentage of articles a country contributes to the total pool of articles. At the same time, MCP reflects the ratio of multiple contributions by a country to the total number of articles. China has the highest number of articles, contributing significantly to the overall pool, yet with a relatively lower MCP ratio than the USA and the United Kingdom. This indicates that while China produces many articles, they are less likely to be multiple contributions. Conversely, countries like the USA and the United Kingdom have lower article counts but higher MCP ratios, suggesting a higher likelihood of multiple contributions per article. Other countries exhibit varying degrees of contribution and MCP ratios, providing insights into their research output and collaborative practices in academic publishing.

Figure 12, Corresponding Author's Countries
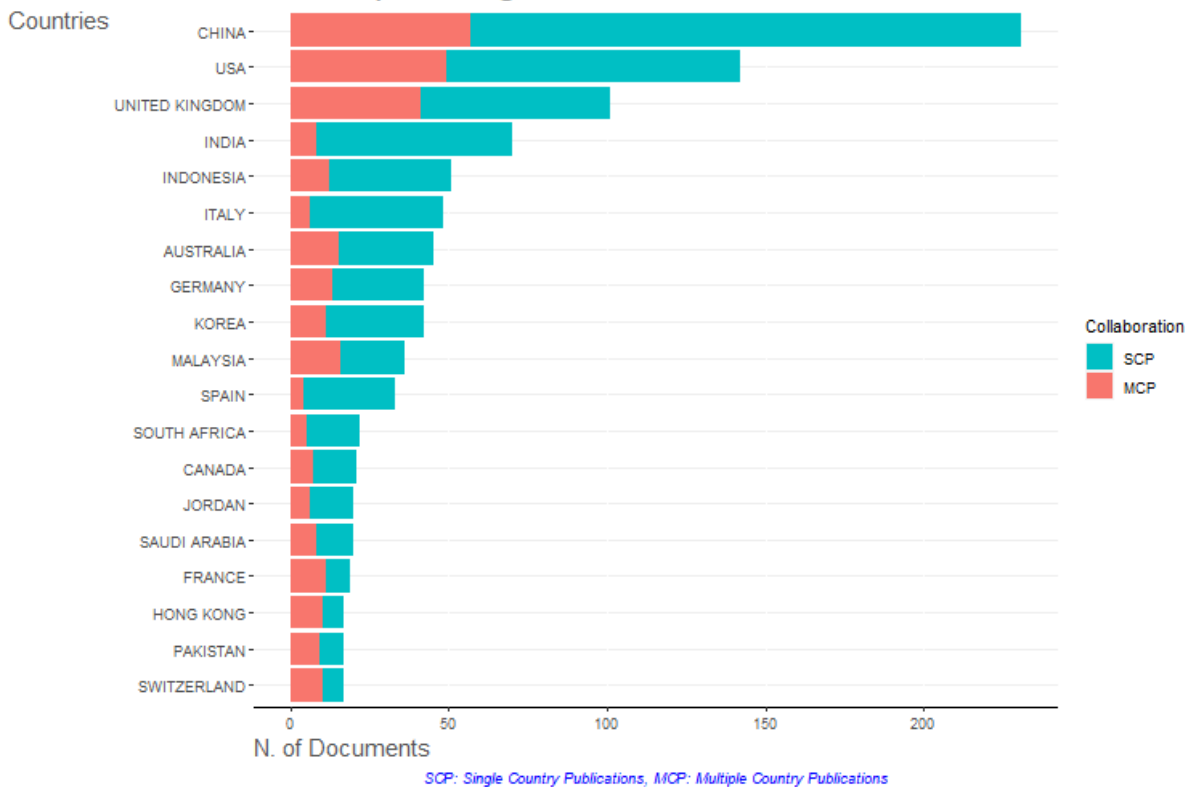
Source: Biblioshiny

Affiliations: Among the various affiliations mentioned in Figure 13, Renmin University of China is the most prolific research output in digital financial services. The 20 articles attributed to this institution demonstrate a significant and noteworthy contribution to the research landscape. The data also includes other reputable universities and institutions like Southwestern University of Finance and Economics, Symbiosis International (Deemed University), Tongji University, and several others, highlighting their active engagement in scholarly work within this domain. These affiliations collectively represent a diverse and impactful set of digital financial services research contributors.

Figure 13, Most Relevant Affiliation
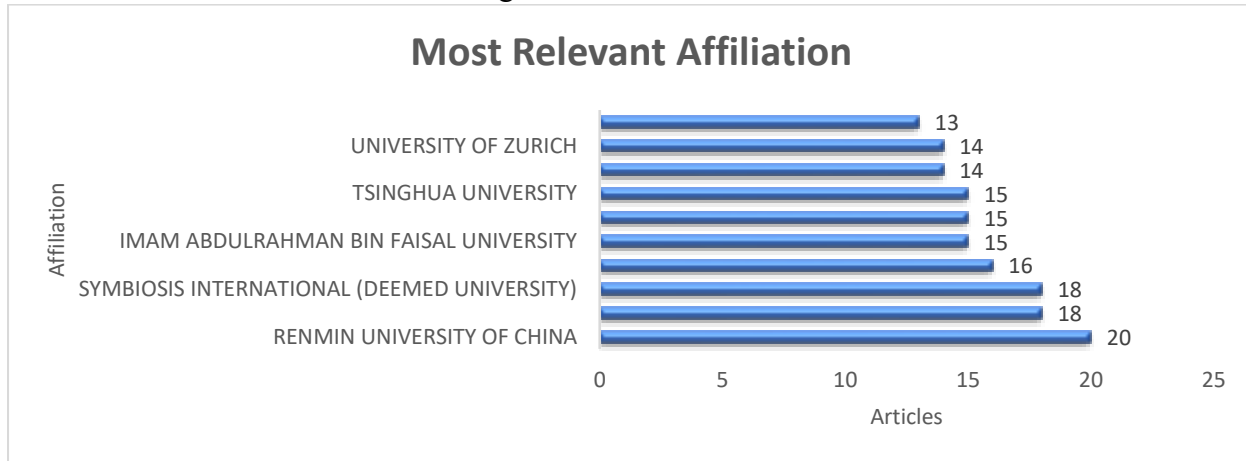
Source: Biblioshiny and Ms-Excel

Table VIII, Affiliations production over time

Affiliations	No. of Article
RENMIN UNIVERSITY OF CHINA	41
SHANDONG UNIVERSITY	31
SYMBIOSIS INTERNATIONAL (DEEMED UNIVERSITY)	41
TONGJI UNIVERSITY	58
IMAM ABDULRAHMAN BIN FAISAL UNIVERSITY	24
TSINGHUA UNIVERSITY	39
SOUTHWESTERN UNIVERSITY OF FINANCE AND ECONOMICS	34

Source: Biblioshiny

Table VIII, Upon scrutinizing affiliations' production over time, it becomes evident that certain institutions have exhibited differing output levels in scholarly articles. Tongji University stands out as a frontrunner, boasting 58 articles, closely trailed by the Renmin University of China and Symbiosis International (Deemed University), each tallying 41 articles. This variance in production rates often correlates with institutional resources, research funding, and academic infrastructure, which facilitate more extensive research endeavours. Following suit, Tsinghua University contributed 39 articles, while Shandong University and Southwestern University of Finance and Economics generated 31 and 34 articles, respectively. Imam Abdulrahman Bin Faisal University presents a lower output, with 24 articles. Such lower production rates may be attributed to resource constraints, limited research capacity, or institutional emphasis on other academic pursuits. Understanding these disparities sheds light on the diverse dynamics influencing scholarly output across institutions within the field.

Regarding citation impact, the United States (USA) is the most cited country with a total citation count (TC) of 3665, while China follows closely behind with a TC of 3525. Despite China being the most productive country with 763 articles, the USA's publications have garnered higher citation counts overall. This suggests

that while China produces a significant volume of research in the field, the research output from the USA tends to have a more significant impact regarding citations.

4.2. Network Analysis: Network analysis is an extensive method that broadens the scope of analysis by representing the connections between various entities. It encompasses techniques such as co-authorship analysis of countries, citation analysis of journals, author keyword co-occurrence analysis, co-citation analysis of journals, and bibliographic coupling of documents (Lal et al., 2022).

4.2.1.Country co-authorship analysis: With the help of co-authorship analysis, communication of new ideas and technologies is possible, thus developing new knowledge that helps society. We have analyzed the country scientific collaboration among different countries (Acedo et al., 2006; Fonseca et al., 2016; Koseoglu, 2016; Uddin et al., 2012). Figure 14 presents information on various countries and their corresponding attributes, such as geographical coordinates, cluster assignments, and weighted indicators related to publications and citations in the field of study. Each country is represented by a unique identifier and is accompanied by relevant metrics. For instance, Australia, with coordinates (-0.2372, -0.2172), belongs to Cluster 7 and has contributed to 33 articles, with a total link strength of 96 and an average publication year of 2020.2785. The weighted indicators provide insights into the country's research output, citations, and publication trends within the field. This dataset figure represents a valuable resource for analyzing and understanding the global landscape of scholarly activities and their distribution across different countries.

Figure 14 Countries Co-authorship
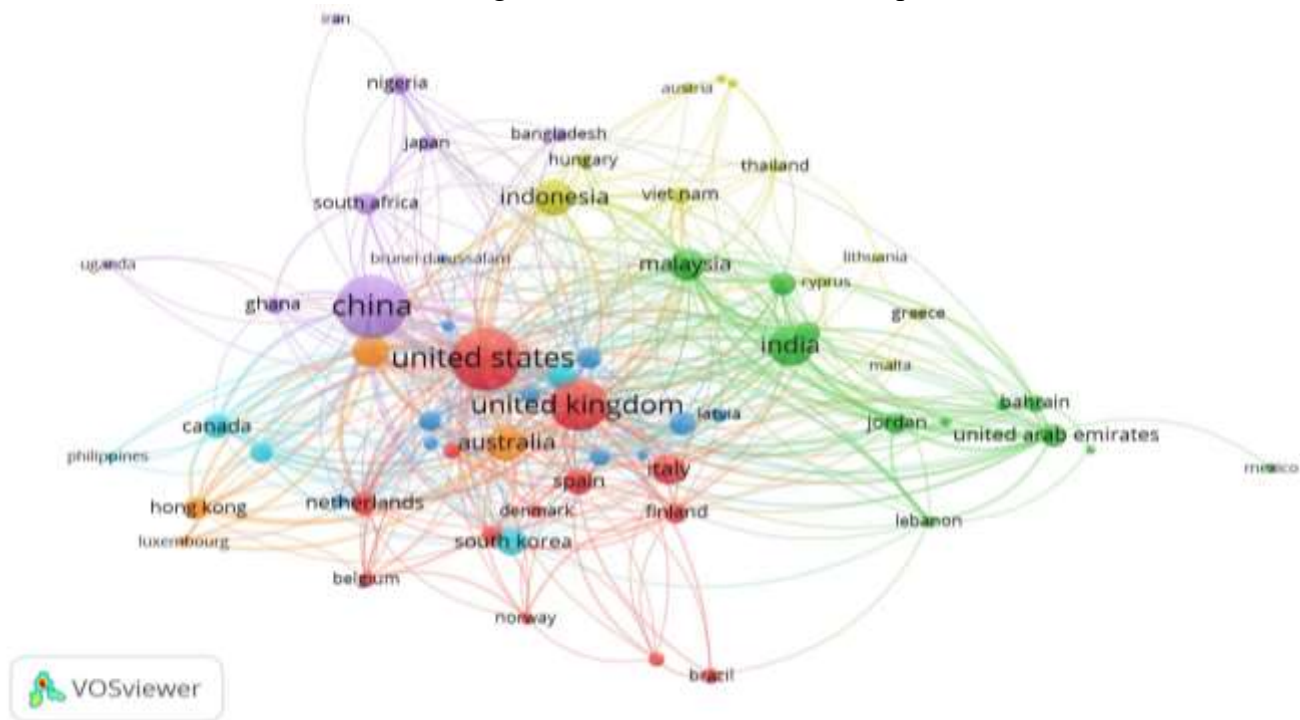
Source: VOS viewer

4.2.2.Journal Citation Analysis: Citation analysis assesses the influence of research publications based on their citation count, reflecting intellectual linkages between documents (Tsay & Ming-Yueh, 2009). This method determines the impact of a publication by the number of citations it receives, allowing the identification of the most influential works in a research field (Appio et al., 2014). While various methods exist to measure publication importance, citations offer an objective measure of impact (Pieters & Baumgartner, 2002; Stremersch et al., 2007). By analyzing citations, one can gain insights into the intellectual dynamics of a field. Figure 22 represents various academic journals in economics, finance, and related disciplines, along with their characteristics such as clustering, coordinates in a graphical representation, and different weight metrics. Each journal is positioned within a cluster, indicating thematic similarities with other

journals in the same cluster. For instance, journals like "Applied Economics" and "Applied Economics Letters" are clustered together, suggesting similar thematic content. The weight metrics provide insights into the influence and connectivity of each journal within the network. Additionally, scores such as average publication year and citation metrics offer further context regarding the prominence and impact of each journal within its field.

Figure 15, Journal Citations Analysis
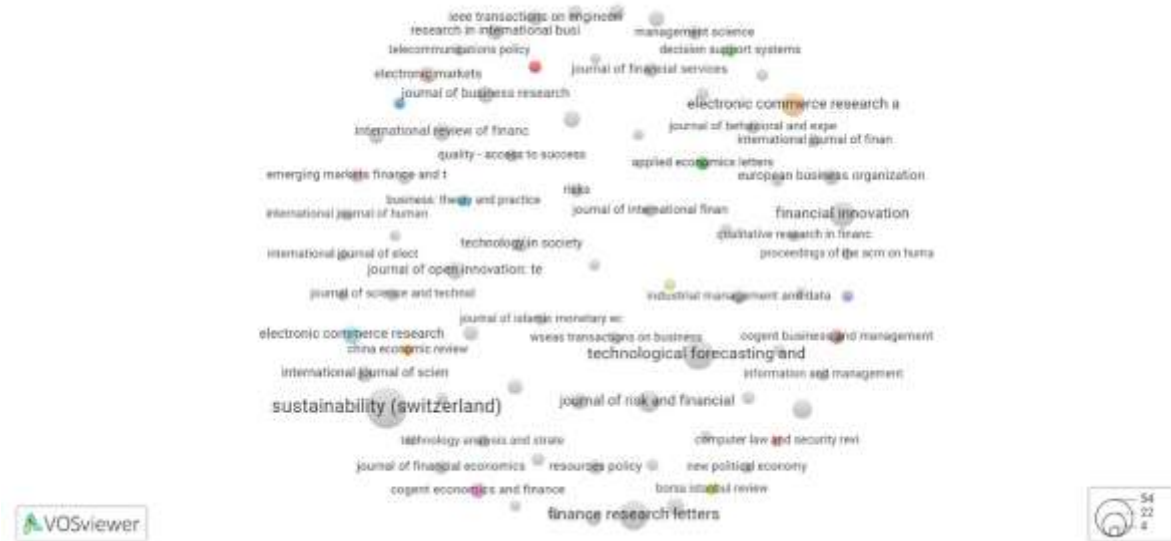
Source: Vosviewer

4.2.3.Author keyword co-occurrence analysis: In a network, nodes can be segregated into clusters based on the weight of edges connecting them. This concept, as described by Leydesdorff (2017), suggests that nodes within a cluster have stronger connections among themselves compared to nodes in different clusters. These clusters reflect thematic groupings within the network, where articles or keywords within the same cluster share common themes or topics.

Clustering facilitates a thematic network analysis, allowing researchers to identify coherent groups of nodes representing distinct topics or areas of interest (Xu et al., 2018). For instance, in Figure 16, nodes are clustered based on the weight of edges, and each keyword is assigned to a specific cluster. Keywords within the same cluster are likely thematically related, as indicated by the higher weight of edges connecting them compared to keywords in different clusters. For example, keywords like "academic libraries," "adoption," "AI," "artificial intelligence," "big data," "blockchain," "fintech," "digital transformation," and "financial inclusion" may belong to separate clusters, each representing a unique theme or topic within the broader domain of academic research. This clustering approach systematically explores and analyses complex networks, revealing underlying structures and relationships among nodes.

Figure 16. Keyword Occurrence
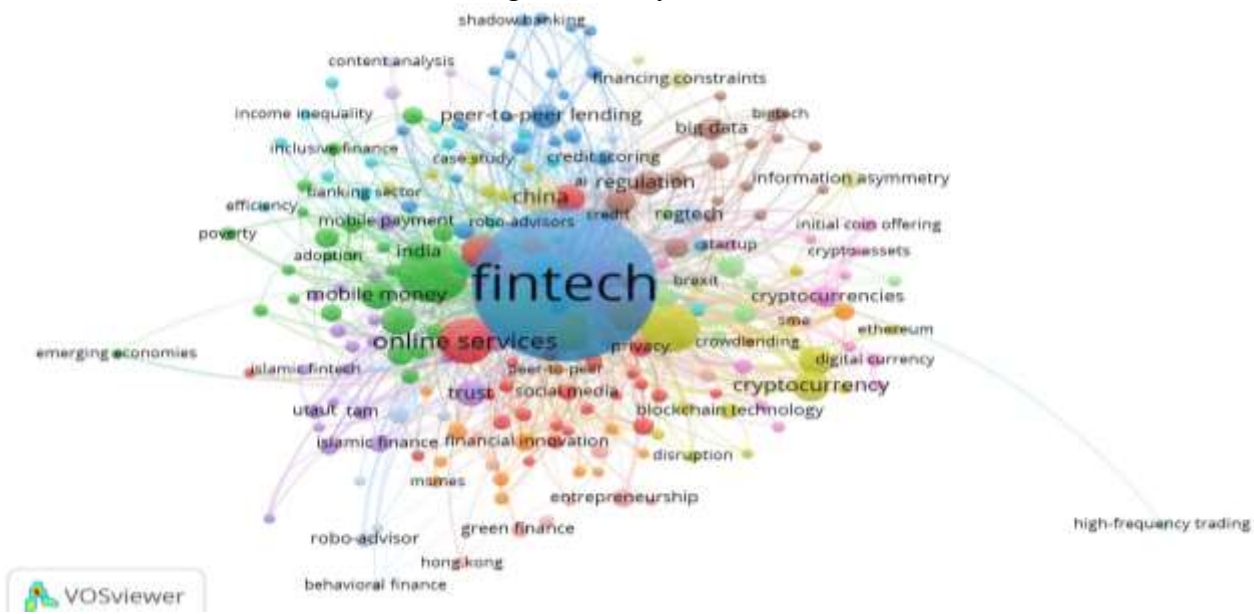
Source: VOS viewer

4.2.4.co-authorship analysis: This technique delves into scholar interactions within the research field. Co-authorship is a formal conduit for intellectual collaboration among scholars, a practice that has gained paramount importance (Acedo et al., 2006). Understanding how scholars interact among themselves, including exploring their affiliations and countries of origin, is pivotal. In today's landscape of progressively intricate methodologies and theories, scholarly collaborations have become commonplace, leading to improved research outcomes, including enhanced clarity and more profound insights (Tahamtan et al., 2016). These collaborations give rise to "invisible collages" in the form of scholarly networks, whose study contributes significantly to advancing research within the field (Crane, 1969).

Figure 17 Authors' Co-authorship

Source: VOS viewer

4.2.5.Author co-citation analysis: Co-citation analysis, a method in science mapping, reveals thematic similarities among publications by identifying frequently co-cited works (Hjørland, 2013). This technique unveils the intellectual structure of a research field (Rossetto et al., 2018), exposing underlying themes (Liu et al., 2015). In a co-citation network, connections form between publications when they appear together in reference lists. Business scholars benefit from this analysis by pinpointing influential publications and uncovering thematic clusters. Figure 21 illustrates a network of researchers mapped in multidimensional space

based on their citation counts and relationships. Researchers with high total link strength, such as Ali (weight<Total link strength>: 4804), indicate extensive collaborations, showcasing their central role in knowledge exchange. Moreover, scholars with high citation counts, exemplified by Ajzen (weight<Citations>: 7272), wield significant influence in the field, signifying the impact of their work. This analysis provides valuable insights into collaborative dynamics and intellectual contributions, shaping the research domain.

Figure 18, Author co-citation analysis
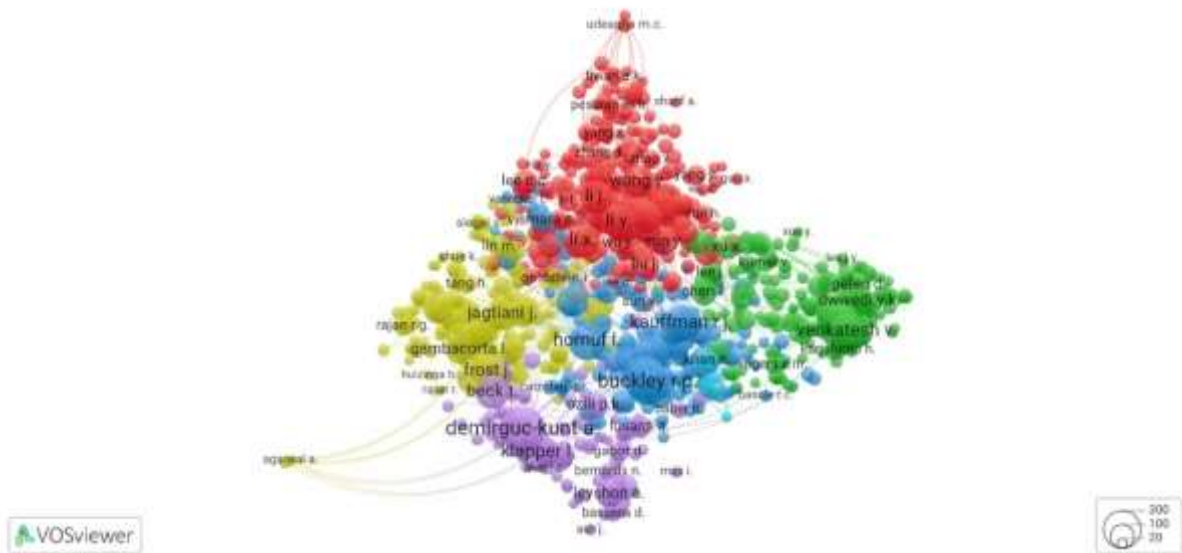
Source: VOSViewer

4.3. Thematic Map: The provided data presents the results of a community detection analysis using the Walktrap algorithm on a set of keywords related to the Digital Economy (DE) field. The analysis reveals three distinct clusters, each characterized by keywords representing specific thematic areas within DE.

Cluster 1: Online Services: This cluster includes keywords such as "online services," "e-government," "social media," and "service quality." These keywords are primarily associated with digital services and platforms. Notably, "online services" emerges as the central keyword within this cluster, with high betweenness centrality and PageRank centrality, indicating its significance in connecting other keywords within the cluster.

Cluster 2: Regulation: Keywords in this cluster, such as "regulation," "banks," "big data," and "financial markets," revolve around regulatory frameworks and institutions governing the digital economy. "Regulation" stands out as the central keyword, reflecting its pivotal role in shaping the regulatory landscape of DE. Other keywords like "big tech" and "robo-advisors" highlight emerging regulatory concerns related to technology giants and automated financial advisory services.

Cluster 3: Fintech: This cluster comprises keywords related to financial technology ("fintech"), including "financial technology," "blockchain," "artificial intelligence," and "crowdfunding." Fintech emerges as the dominant theme, with keywords like "blockchain" and "artificial intelligence" highlighting key technological innovations driving financial services. "Fintech" exhibits the highest betweenness and PageRank centrality, underscoring its pivotal role in connecting other keywords within the cluster.

Cluster 4: mobile banking: Cluster 4, centred around the keyword "COVID-19," encompasses keywords related to the impact of the COVID-19 pandemic on various aspects of the digital economy. The prominence of "COVID-19" as the central keyword within this cluster reflects the significant attention and research focus on understanding the pandemic's implications on digital transformation and behaviour. Keywords like "e-commerce" and "mobile banking" underscore the accelerated shift towards online platforms and digital financial services in response to lockdowns and social distancing measures. The presence of "gender" as a

keyword suggests an exploration of gender disparities in accessing and utilizing digital technologies during the pandemic.

This analysis helps identify and understand the thematic clusters within the fields of Digital financial services and Digital Economy, providing valuable insights for researchers and policymakers alike. It highlights the interconnectedness of different concepts and sheds light on emerging trends and regulatory challenges shaping the digital economy landscape.

Figure 19 Thematic Map
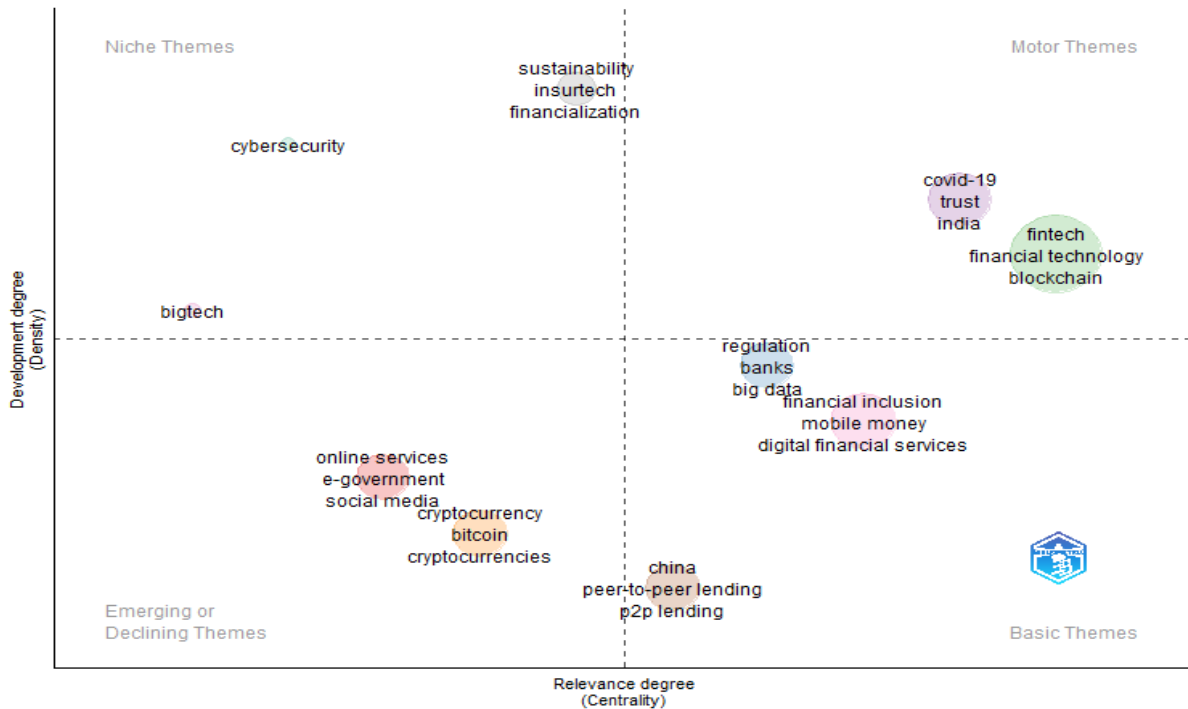
Source: Biblioshiny

Thematic patterns on a theme basis:

Identifying Emerging Areas: Researchers can focus on motor themes to explore emerging trends and capitalize on new research opportunities. These are fintech, blockchain fin, financial technology, etc.

Addressing Niche Topics: Niche themes highlight specialized areas where further investigation may be warranted, offering opportunities for in-depth exploration, such as big tech, cybersecurity, insurance, etc.

Reevaluating Declining Topics: Recognizing declining themes can help researchers assess the reasons behind diminishing interest and potentially reframe or revitalize these topics, such as cryptocurrency, bitcoin, and online services.

Strengthening Basic Understanding: Basic themes signify fundamental concepts that require continuous attention and refinement, indicating areas where foundational knowledge is essential for advancing research. Examples include financial inclusion, mobile money, and digital financial services.

By analyzing these thematic patterns, researchers can gain insights into the evolving landscape of Digital financial services and the digital economy, identify research gaps, and prioritize areas that require further exploration or explanation.

4.4.Factor Analysis: The provided data represents the results of a Multidimensional Scaling (MDS) analysis performed on a set of keywords related to the Digital Economy (DE) field. The analysis aimed to visualize the relationships between these keywords based on their semantic similarities. Each keyword is represented in a two-dimensional space (Dim.1 and Dim.2) and is grouped into clusters based on their proximity. The keywords are clustered based on their semantic similarities. Keywords within the same cluster are closer to each other in the two-dimensional space, indicating that they are more closely related in meaning. In this analysis, all

keywords belong to a single cluster (cluster 1), suggesting a high degree of interconnectedness among the concepts related to the Digital Economy. The positions of keywords in the two-dimensional space reflect their relationships with one another. Keywords closer together have more similar meanings or are frequently mentioned together in the literature. For example, "blockchain," "cryptocurrency," and "bitcoin" are clustered closely together, indicating their solid semantic association within the domain of digital finance and cryptocurrencies. Some keywords have more influence or centrality within the cluster based on their positions. For instance, "cryptocurrency" and "bitcoin" are positioned farthest from the origin, suggesting they are highly influential and central topics in digital finance and blockchain technology. The MDS analysis reveals semantic associations between keywords. For example, "fintech," "financial inclusion," "financial technology," "digital financial services," and "mobile money" are all clustered closely together, indicating their interconnectedness and relevance within the broader context of financial technology and digital finance.

Emerging Trends: Certain keywords may stand out as emerging trends or topics of interest. In this analysis, "COVID-19" appears close to other keywords like "blockchain" and "cryptocurrency," suggesting a growing interest in the impact of the COVID-19 pandemic on digital finance and related technologies.

This analysis provides valuable insights into the semantic relationships and thematic patterns within the Digital Economy field, helping researchers identify critical concepts, emerging trends, and areas of interest for further investigation.

Figure 20 Factor Analysis

Source: Biblioshiny

Conclusion:

In conclusion, the data presented in this study demonstrates the remarkable growth rate, extensive research output, and diverse topics and collaborations in digital financial services. This reflects the increasing recognition of digital financial services as a crucial area of study and innovation, with implications for the financial sector, technological progress, and global economic development. The findings and insights from this research contribute significantly to our understanding of digital financial services and set the stage for further progress and applications in this dynamic domain. Collectively, these authors have enriched the field of digital financial services through their varied and insightful research, deepening our understanding of this ever-evolving sphere. This study offers a thorough view of the evolving financial technology landscape. It identifies key trends, with 'Fintech' as a dominant theme, signalling its growing influence in reshaping finance. 'Blockchain' and 'Artificial Intelligence' also garner substantial attention, emphasizing their transformative

potential. 'Financial inclusion' and 'privacy' discussions underscore the necessity for regulatory alignment and security within the fintech ecosystem.

4.1. Future Scope: This study underscores the growing importance of digital financial services, paving the way for further exploration. As technology advances, future research can delve into integrating emerging tech like blockchain, IoT, and machine learning into these services, uncovering benefits, challenges, and risks for improved solutions.

4.2. Limitations: This comprehensive study has temporal limitations (2008-2023), potentially missing earlier or later relevant research. It focuses on Social Sciences, Business, and Economics, overlooking insights from other disciplines. Exclusively using English articles may omit global research. Additionally, incorporating techniques like correspondence analysis can yield more insights (Leung et al., 2015).

4.3 *Implications:* The bibliometric analysis of digital financial services assists in identifying the topics that have been extensively researched within the field. By conducting an analysis of the frequency of keywords, authors, journals, and citations, researchers can identify the most prevalent areas of research. This research also reveals deficiencies in the existing literature, enhancing comprehension of the field's intricacies. Furthermore, it provides insights into the research that has profoundly impacted the advancement of the subject. Overall, the extensive scope of this study in bibliometric analysis has the potential to advance research, inform practice, and influence policies in this critical field.

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