METAVERSE THE NEXT RENAISSANCE OF FINANCIAL INCLUSION: SCIENTIFIC MAPPING AND FUTURE RESEARCH DIRECTIONS

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ABSTRACT

"Fintech" or "financial technology" a new age covering the area of financial services industry. Revolutions in technology has opened new paradigm and one such paradigm is *"Metaverse"*. The term "metaverse" was given by *Neal Stephenson* in his work Snow Crash during 1992. It has the potential to provide a unique and immersive experience unlike anything else on the Internet. Hence, in the present study we have tried to map the existing literature on new avatar of financial services i.e., *fintech*. The present study is bibliometric for which the documents are extracted from Scopus database. After exclusion of the incomplete information, we have analysed 432 set of documents. Basic performance analysis and science mapping have been attempted to explore the key areas and themes in this domain. Author impact reveals the most influential authors working in the area of fintech. The findings reveals that there has been exponential increase in studies in the area of fintech after 2016 and it has been maximum during the COVID-19 pandemic times. Blockchain, innovation, financial services, Fintech and banking are the key areas in which researchers have focussed their work. Studies suggested various key research areas where more can be done to explore more of fintech.

1. Introduction

Information technology progressions posit a powerful bearing on day-to-day life leading to transformation and augmenting humanoid touch, communiqué besides societal relationships. From the perception of end-operators, three significant technological invention cycles have been documented. These waves were successively revolved around advancement of special computers, the Cyberspace, and wireless devices (Mystakidis, 2021). The fourth wave of technological invention is presently being propelled by multidimensional, immersive technologies like *simulated 3-D environment* and *augmented reality (AR)*. The "Metaverse", a novel revolution that

this wave is likely to produce for pervasive computing, which has the ability to revolutionize electronic commerce, teaching, and theatre. The metaverse is a computer industry notion for the next incarnation of the internet. It is a unique, distributed, holistic, enduring, three - dimensional virtual arena where users can engage with computer-generated items and avatars in ways, they are unable to do in the real world (Tucci, 2022). This has the potential to provide a unique and immersive experience unlike anything else on the internet. Metaverse can be used to create virtual worlds that mirror reality or to create entirely new and imaginary worlds. A shared, immersive virtual environment known as a "metaverse" allows its users, who are represented by avatars, to engage in a variety of activities (Vidal-Tomás, 2022). Author Neal Stephenson first utilized the term "metaverse" in his book Snow Crash published in 1992 (Sparkes, 2022), that work on the systems which support an internet based on virtual reality has been ongoing for decades.

For the overall and inclusive development of any economy, it is imperative to include each and every section of society under the umbrella of financial system (Singh & Tandon, 2012). Majority of households lack access to finance mainly due to low level of financial literacy (Tandon & Singh, 2021). Moreover, number of commercial bank branches also pay significant role in explaining level of financial inclusion (Tripathi, Tandon & Yadav, 2019). Surprisingly, increased access to finance also contributes towards lower environmental quality (Singh, Tandon & Jasuja, 2022). Hence, interest has shifted towards the digitally transformed financial services. Although there are countless chances for the financial services sector in the present, the renaissance's value creation may serve as the best comparison. Due to the transformative potential and experiences that the Metaverse provides to customers and businesses worldwide, interest in it has recently increased (Cho, Dieck & Jung, 2023). The metaverse, which is a 3D depiction of the internet, is the next step in the growth of the internet, according to Fidelity Investments (Biller, 2022). The Renaissance, one of the most significant eras in heritage for science, math, and art, did something similar. The use of linear perspective to show three-dimensional depth in art was refined by masters like Michelangelo and Alberti. The

metaverse of today places us on the same path, and fintech may very well be the means to get there. Since its inception, the fintech space has been dominated by categories such as wealth management and payment innovation. Innovative companies have replaced the metaphorical mattock approach to developing new product and service delivery channels in financial services with technologies that streamline infrastructure and, increasingly, to boost human intellect. These cutting-edge fintech systems make it possible to combine and analyse client data considerably more effectively and robustly while also utilising connectivity. This means that financial services have been capable to approach more clients in more efficient and targeted ways than ever before. IoT, robots, data communicators and storage, data processor and presenters, and Metaverse are some probable technologies that will power future Fintech applications and breakthroughs where metaverse is the major data processor boosting financial services in the next era (Bhat, AlQahtani & Nekovee, 2023). Now-a-days customers want multi-way online involvement for banking-related activities in the wake of COVID-19's global convulsion. Consequently, Metaverse appears to be the best option. However, Metaverse's use cases go far beyond banking and will eventually be used to many aspects of life. Furthermore, leading financial institutions such as HSBC and JP Morgan have also started their virtual branches in the Metaverse to provide consumers with the finest user experience (such as cash withdrawal, deposit, stores, etc.). The usage of the Metaverse in financial transactions will improve user experience, reduce operating costs, and other factors and hence (Bhat, AlQahtani & Nekovee, 2023) proposed the metaverse model for application in banking and financial services industry (figure 1). With this backdrop, the present study intends to review the extensive literature on metaverse which is one of the enabler of fintech.

To be sure, there is much more to be done here; however, an important result of these efforts has been a future financial services industry with broader access, lower marginal costs, and greater transparency (Agarwal & Zhang 2020). As documented by Singh et al. (2020) and Qiu et al. (2015) fintech is having a substantial effect on the financial services sector (Singh et al. 2020), and other industries.

Remittances, custodial and adherence, institutional and retail investing, real estate, insurance, and various industries of financial services have prospered from cutting-edge fintech solutions over the past ten years, no doubt hastened by the global health crisis. The majority of fintech literature have emerged after 2015 (refer figure 2). Consequently, various books, journals, and conference papers have lately scrutinized the available FinTech literature (Gomber et al., 2017). However, previous literature review study has not covered future research directions and offer gap in this domain. Against this backdrop, this study attempts to conduct more in-depth bibliometric analysis covering each and every aspect and hence answered below research queries:

1. Which are primary fintech research areas?
2. Which have been dominant institutions, countries, sources, authors and documents in fintech research?
3. Which are the most influential and trending articles and topics?
4. What are the key research themes in fintech literature?
5. What are the various research gaps in fintech literature?

Additionally, the present research work is planned as under- *section two* discussed the methodology, *section three* presents the results followed by *section four* discussion and *section five* future research directions.

2. Data and approach
Both quantitative and qualitative techniques are used to conduct the literature review (Gupta et al., 2020 and Dubey, Gunasekaran & Papadopoulos, 2017). A quantitative technique used in many areas to evaluate the literature currently published is called bibliometric analysis (Aria and Cuccurullo, 2017). Ramos et al. (2020) argued that literature review study employs a quantitative viewpoint to track a specific area of research and processes the findings scientifically through a standardised review procedure. Similar argument has been given by (Singh and Dhir, 2019). The bibliometric review of study offers systematic scientific mapping, establishes trends over the period, pinpoint's most researched areas, and uncovers the organisations, authors, and

nations that have made major contributions to the field of study (Saha et al., 2020). Scholars can use a variety of software tools for bibliometric review of studies such as library Biblioshiny in R studio (Aria and Cuccurullo, 2017), Bibexcel (Persson et al., 2009), VosViewer (Van Eck and Waltman, 2010) and SciMat. The VosViewer offers simple visualisation of citation networks (Fabregat-Aibar et al., 2019). In contrast to the majority of free software (such as CiteSpace and Vosviewer), bibliometrix package of R emphasises the accuracy and statistical completeness of the results in addition to the data presentation (Derviş, 2019).

2.1 *Selection of period*
The data for the present study are reviewed over almost 37 years spanning from 1985-2022. The first article on fintech is reported to be in 1985 and year 2022 is terminating period as data was retrieved in December 2022.

2.2 *Selection of database*
The information was gathered from Elsevier's Scopus database. It comprises the top-ranked and most cited journals from around the world and has twenty percent more database than Web of Science (indexed in business, management, and accounting) (Gusenbauer, 2019; Zhang et al, 2019). In-depth mapping capabilities for minor study domains are another strength of Scopus (Zupic and ate, 2015).

2.3 *Selection of keywords for search of articles and Initial Search Criteria*
The search was conducted using the keyword "Fintech" or "Financial technology". The language chose was English and only those articles were selected which were finally published in journal. The detail search string is given in annexure. A total of 470 documents were extracted after applying filters. Further, documents are checked for any duplicate items and final count of documents are 452.

3. Results
3.1 *Sample characteristics*
Data features are shown in Table 1 with 452 publications published between 1985 and 2022 and 297 sources that produced 414 articles and 38 reviews. There are 12.27 citations on average for each document. The number of references (21,936) and keywords (1,159) used in these 993-authored publications

demonstrates the power of the scholarly collaboration in the field of fintech.

3.2 Annual scientific production
Below figure 2 depicts the publication trend in the area of "fintech". It is clearly visible that

Table 1: Data characteristics on Fintech

Timespan	1985: 2022
Sources	297
Documents	452
Yearly growth rate (in %)	13.84
Document Average life	2.67
Average citations per document	12.27
References	21936
Document Details	
Keywords	111
Author's Keywords	1159
Authors	
Authors	993
Authors of single-authored docs	135
Collaborating author(s)	
Documents with sole author	140
Joint author per Document	2.37
Global co-authorships (in %)	20.35
Document Categories	
Article	414
Review	38

Source: author(s) calculations

Primary keywords "Fintech" *OR* "Financial technology"
460 articles were extracted in the TITLE, ABSTRACT and KEYWORDS

⬇

Title-ABS (*"fintech" OR "financial technology"*)
Document type: article, review, book chapters
Source type: Journal

⬇

Deletion criteria
Total 5 articles that were duplicates and 6 articles with no author information were removed.
452 documents were identified for final analysis after deletion
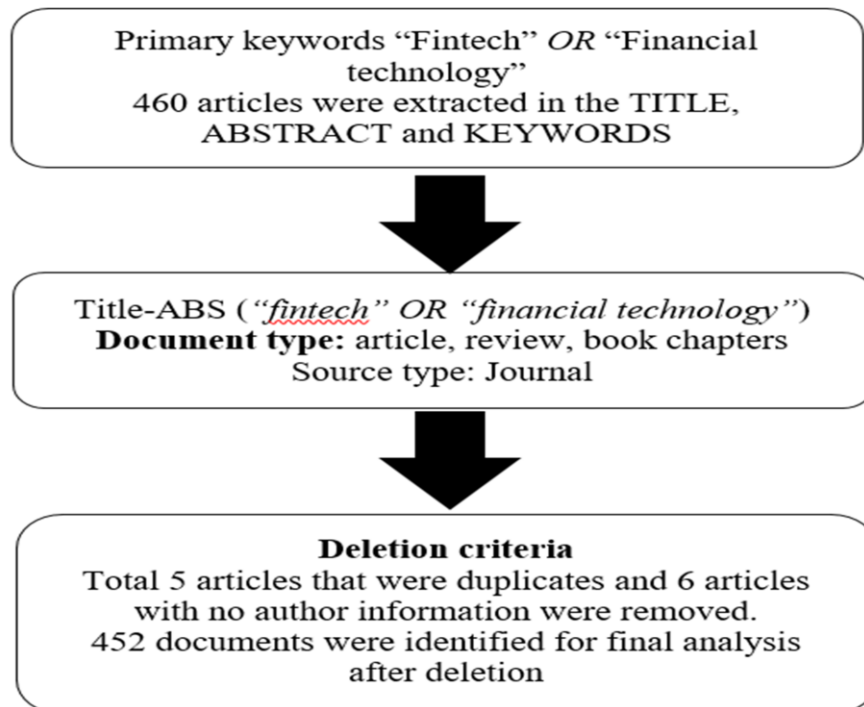
Figure 1: Flowchart of workflow

Source: author(s) compilation

there has been minimal research on fintech from year 1985-2015. The first article covering the aspect of fintech was published by Chandavarkar (1985) in which he discussed the contribution of fintech in developing the financial assistance. But the year 2016 is the trigger year, post which there have been exponential increase in research in this domain. This is because there are already over 12,000 start-ups in the world, and in 2015, the Fintech industry received major global investment totalling USD 19 billion (KPMG, 2016).

3.3 Influential aspect: Affiliation and Sources

The table 2 below depicts the top 10 publication outlet publishing in the zone of financial technology. "*Financial innovation*" journal is the topmost influential journal which has published 9 articles in the domain of fintech. It is followed by *banking law journal* with 7 articles to be published and *h*-index 5, *Cutter business technology* journal and finance research letters both published 7 articles. Amongst the top 10 influential journals *Finance research letters*, *European journal of finance*, *international journal of bank marketing* is the top

Brawijaya University and *Universitas Padjadjaran.*

Table 2: Top 10 publication outlet

| Sources	Articles	h-index
Financial Innovation	9	25
Banking Law Journal	7	5
Cutter Business Technology Journal	7	4
Finance Research Letters	7	62
Journal of Risk and Financial Management	7	4
Journal of Payments Strategy and Systems	6	4
European Company and Financial Law Review	5	5
European Journal of Finance	5	39
International Journal of Bank Marketing	5	87
Law And Financial Markets Review	5	7

Source: author(s) calculations
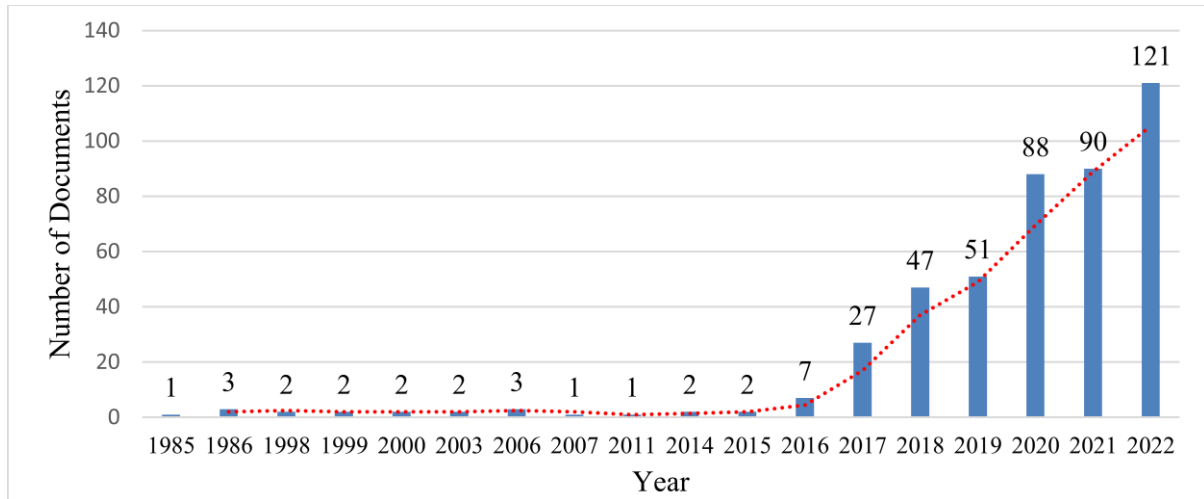
Figure 2: Annual Scientific Production

Source: author(s) calculations

rank ranked journal in the area of finance and financial services. The data clearly indicates that there has been wide research done in this domain in variety of spectrum of journals.

Furthermore, figure 3 presents the most influential affiliations in the area of fintech. It is clearly understood that *Southwestern University of Finance* is the top institution publishing in this domain followed by

3.4 Citation analysis

Citation analysis counts the citations made to a specific document over a specific time frame. A highly cited article is thought to be more influential and successful than publications with fewer citations (Goyal & Kumar, 2021). It is among the most effective ways to gauge the impact of a research piece (Tsay, 2009). There are two broad categories of citation analysis: global citations and local citations. How
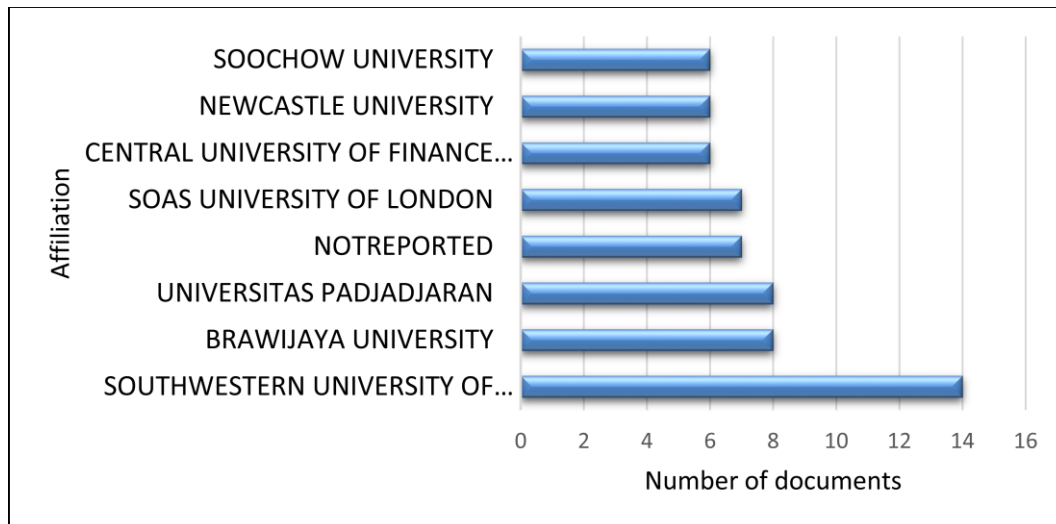
Figure 3: Top 10 most influential affiliations in the area of fintech

Source: author(s) calculations

frequently this document has been referenced in other research pieces found in different databases is shown by Global Citations (Tandon et al., 2022). The top cited study is done by Gomber (2017) titled "*Digital Finance and Fintech: current research and future research directions*" attracted 351 citations. In this study authors examined the state of research on these fresh and cutting-edge business operations in digital finance today. Second most highly cited stud globally is by Berger (2003) titled "*The Economic Effects of Technological Progress: Evidence from the Banking Industry*" attracted 266 citations. In this study, author investigated the technological advancement in the banking industry. All the globally cited documents presented in table 3 have garnered more than 100 citations.

Table 3: Top ten globally cited documents

Article title	Source	Author(s)	Citations
Digital finance and finTech: current research and future research directions	Journal of Business Economics	Gomber P. (2017)	351
The Economic Effects of Technological Progress: Evidence from the Banking Industry	Journal of Money credit and Banking	Berger A. N (2003)	266
Taming the Beast: A Scientific Definition of Fintech	Journal of Innovation Management	Schueffel P. (2016)	165
How Valuable is FinTech Innovation?	The Review of Financial Studies	Chen, Wu & Yang (2019)	145
The Role of Technology in Mortgage Lending	The Review of Financial Studies	Fuster et al. (2019)	139
A Systematic review of Blockchain	Financial Innovation	Chu, Chen & Kou (2019)	135
Socio-Technical Agency in Financial Markets: The Case of the Stock Ticker	Social Studies of Science	Preda (2016)	133
"Informing" technologies and the World Bank	Accounting, Organizations and Society	Neu et al. (2016)	122
How Blockchain can impact financial services – The overview, challenges and recommendations from expert interviewees	Technological Forecasting and Social Change	Chang et al. (2020)	119

Source: author(s) calculations

Further, table 3 presents the top 10 locally cited documents. The top cited article is written by Lee & Shin (2018) titled "*Fintech: Ecosystem, business models, investment decisions, and challenges*" which attracted 116 citations. The fintech industry's ecology is described by the authors of this report and provides a historical perspective on the field and discussing different fintech business strategies and funding categories.

The most important contributors to the field of study are the prolific authors, and this research sheds light on the authors' overall body of work grounded on the quantity of papers, co-authorship, and citations they have obtained (Naeem et al., 2022). This analysis is based on how many articles a certain author has written overall. Figure 5 illustrates that Zhang Y is the productive author with 14

Table 4: Top ten locally cited documents

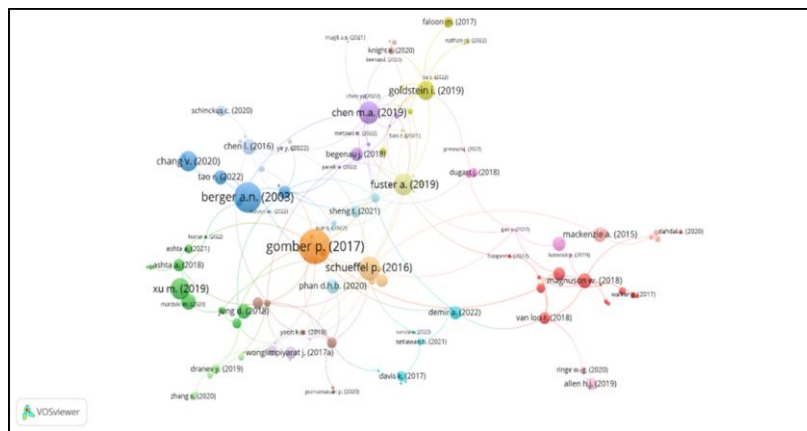| Article title	Source	Author	Citations
Fintech: ecosystem, business models, investment decisions, and challenges	Business Horizons	Lee and Shin (2018)	116
On the Fintech Revolution: Interpreting the Forces of Innovation, Disruption, and Transformation in Financial Services	Journal of Management Information System	Gomber et al. (2018)	107
Fintech	Business & Information System Engineering	Puschmann (2017)	102
Digital Finance and fintech: current research and future research directions	Journal of Business Economics	Gomber, Koch & Siering (2017)	88
Fintech, regulatory arbitrage, and the rise of shadow banks	Journal of Financial Economics	Buchak et al. (2018)	73
The emergence of the global fintech market: economic and technological determinants	Small Business Economics	Haddad & Hornuf (2018)	67
How Valuable is fintech Innovation?	The review of financial studies	Chen, Wu & Yang (2019)	47
A survey on FinTech	Journal of Network and Computer Applications	Gai, Qiu & Sun (2018)	46
The Role of Technology in Mortgage Lending	The Review of financial studies	Fuster et al. (2019)	46
Do fintech lenders penetrate areas that are underserved by traditional banks?	Journal of economics and business	Jagtiani & Lemieux (2018)	45

Source: author(s) calculations

Figure 4: Most cited authors

Source: author(s) calculations

articles followed by Liu Y (10 articles) and Chen X (9 articles).

Further, figure 6 analyses the active authors on the basis of publications produced, total citations and h_index. As per the data author

Kaufferman J has the maximum citations (751) followed by Ozili (351) and Arner (305) and Buckley (305). On the basis of h_index Giudici P has the highest h_index of 7 followed by Arner D W, Buckley R P, Li X, Zhang X and Zhang Y. They all have h_index of 5. This data
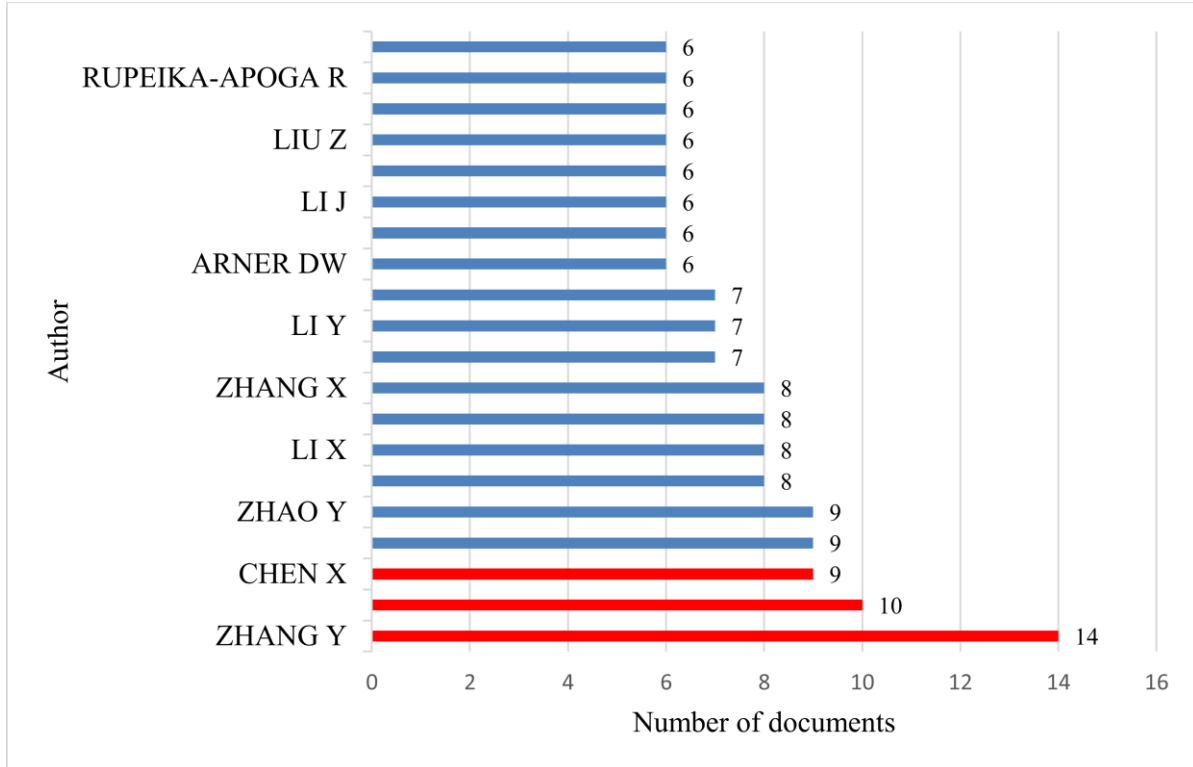

Figure 5: Most prolific authors
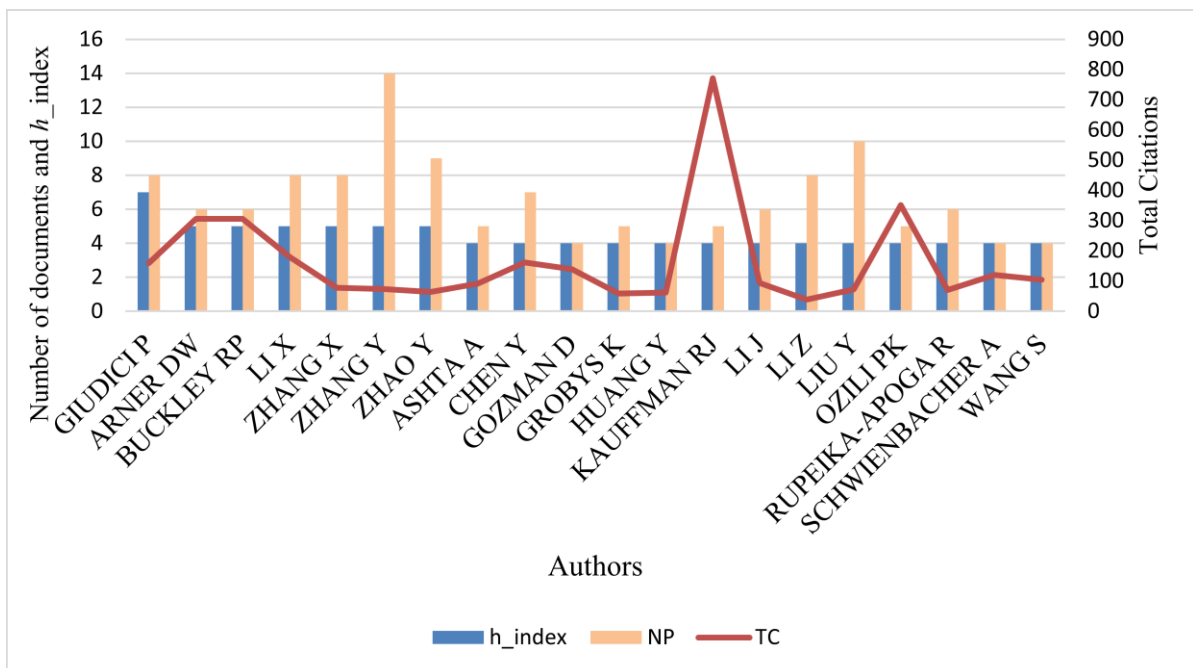
Source: author(s) calculations

Figure 6: Author impact

Source: author(s) calculations

clearly demonstrates that since 2015, this field has drawn a large number of additional experts who routinely research the various facets of fintech.

3.6 Bibliographic coupling

A comprehensive method to assess source similarity is bibliographic coupling (Naeem et al., 2022). A strategy for science mapping called bibliographic coupling works under the premise that two publications with comparable references also have similar content (Kessler, 1963). If two documents quote the same third document, they are considered to be bibliographically connected (Garfield, 2004). Figure 5 presents the bibliographic coupling on the basis of documents. Making bibliographic maps with VOSviewer is quite helpful for identifying commonalities between papers referencing the same work (Moral-Muñoz et al., 2020). The minimal number of documents and citations for a source to be displayed on the map remains 5, and 20, respectively. The figures 7 illustrates that it consists of 31 documents made up of seven clusters. Cluster 1 (Red) entails of 7 documents, Cluster 2 (green) comprises of 6 documents, cluster 3 (sky blue) five documents, cluster 4 (yellow) five documents, cluster 5(purple) three documents, cluster 6 (light blue) three documents and cluster 7 (orange) two documents.

3.7 Keyword co-occurrence analysis

The frequency of the words reveals the development and central idea of a certain area of study (Kumar et al., 2021). The most popular research stream and its sub streams, as well as the most common words writers employ in their titles, keywords, or abstracts, can all be learned about through this analysis (Wu et al., 2021). The co-word analysis is a method that looks at the publication's real content (Donthu et al., 2021). By setting the minimum frequency at 10, the Biblioshiny application generates the words that are most frequently used. Finance, technological development, financial services, Innovation, blockchain are the most frequent keywords used in the studies as depicted in table 5 and figure 8. It shows that scholars are exploring these themes in the context of fintech.

Further, figure 9 shows the keyword co-occurrence map. The criterion for minimum occurrence is set as 4; out of 1,160 author's keywords, only 15 met the threshold criteria. The output map forms six clusters. Cluster 1(red) has seven keywords, cluster 2(green) four keywords, cluster 3(blue) four keywords, cluster 4(yellow) four keywords, cluster 5 (purple) three keywords and cluster 6 (sky blue) one keyword. There clusters are namely: artificial intelligence, big data, blockchain, financial innovation, digital lending and digital payment.
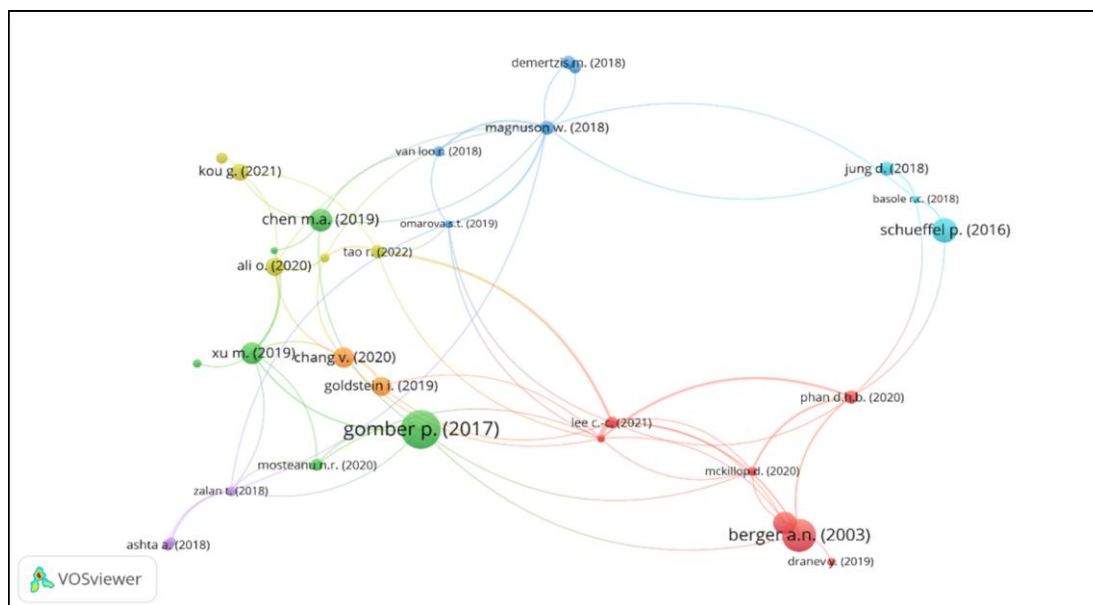

Figure 7: Bibliographic coupling

Source: author(s) calculations

Table 5: Top 10 frequently occurred keywords

Words	Occurrences
Finance	7
Technological Development	5
Financial Services	4
Financial Service	3
Innovation	3
Blockchain	2
Financial Market	2
Global Perspective	2

Source: author(s) calculations

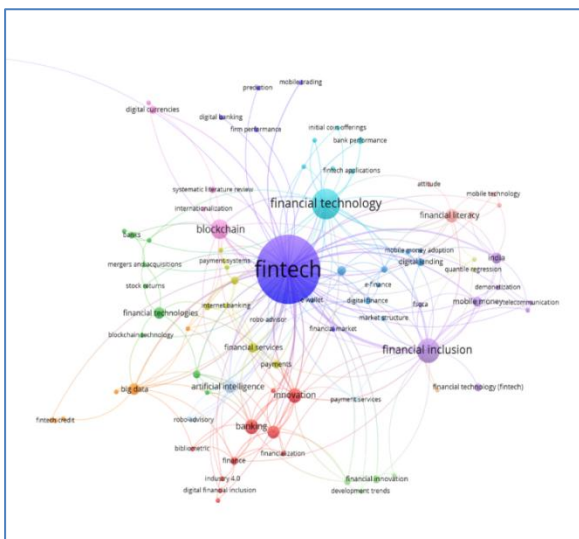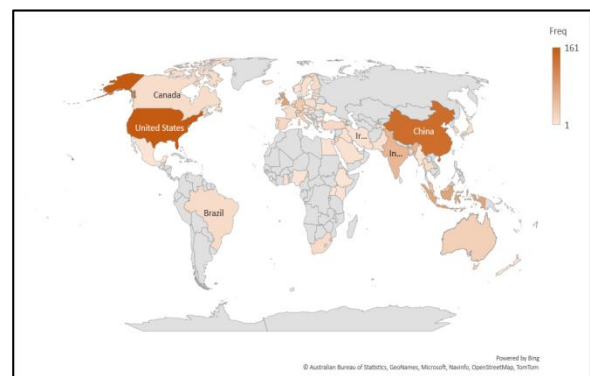Source: author(s) calculation

Figure 8: Word Cloud

Figure 9: Keyword co-occurrence map

3.3 Publishing activity

Fintech has been recognized by the academicians and policy makers all around

the globe and has been widely researched post 2016. Figure 10 presents the most active countries involved in the research in this area. In this table, it can be interpreted that USA is the highest publishing country followed by China, UK, Indonesia and India. With politicians, bankers, and legislators taking steps to support inclusive growth, India is recognised as the world leader in the study of economic growth through financial technology. Further figure 11 presents the country wise publication on the basis of citations. USA has maximum citation (513) followed by United Kingdom (478), Germany (466), China (345) and Canada (142).

Source: author's computation using Microsoft excel

Figure 10: Top countries publishing in the area of "Fintech"
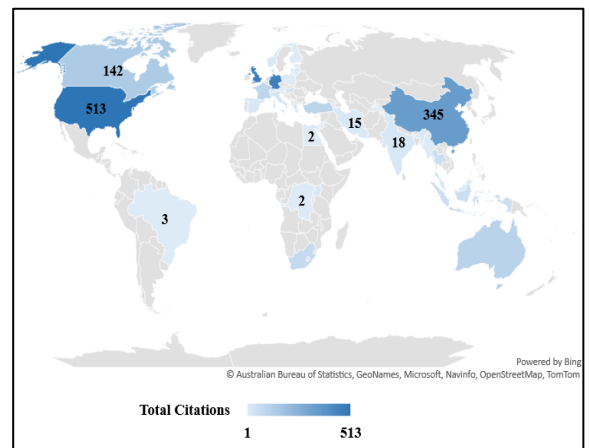

Source: author's computation using Microsoft excel

Figure 11: Countries with most cited documents

3.9 Country collaboration network

This section discusses the collaboration of different countries on the given theme. Figure 12 depicts that there has been maximum collaboration between China and USA (31)

followed by China and United Kingdom (24). It is also seen that USA is the most cooperative country as it has maximum collaboration with other countries.
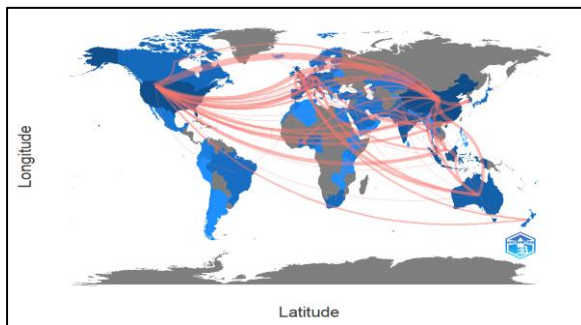
Source: author(s) calculations

Figure 12: Country collaboration map

3.4 Co-citation analysis

The number of times two articles are quoted together is known as co-citation (Small, 1973). Co-citation analysis is a science mapping technique that makes the assumption that publications that are frequently referenced together have comparable subject content (Hjørland, 2013). When two publications appear together in the reference list of another publication, they are linked in a co-citation network (Donthu et al., 2021). The analysis can be used to show how a study field is conceptualised (Rossetto, Bernardes, Borini & Gataz, 2018). Therefore, it is crucial to establish the research domain's intellectual framework using the key texts.

3.10 Cluster Analysis
Cluster-1: Fintech and big-data applications
After a thorough review of all articles in cluster 1 (table 5), it can be inferred that the cluster 1 can be named as "Fintech and big-data applications". The top cited article in the cluster is by Chen, Wu & Yang (2019) on "*How Valuable Is Fintech Innovation*?". The article offers extensive proof of the prevalence and importance of FinTech innovation. The findings indicated that the majority of FinTech breakthroughs provide significant value to inventors, with blockchain being especially useful. Further, Fuster (2019) attempted study
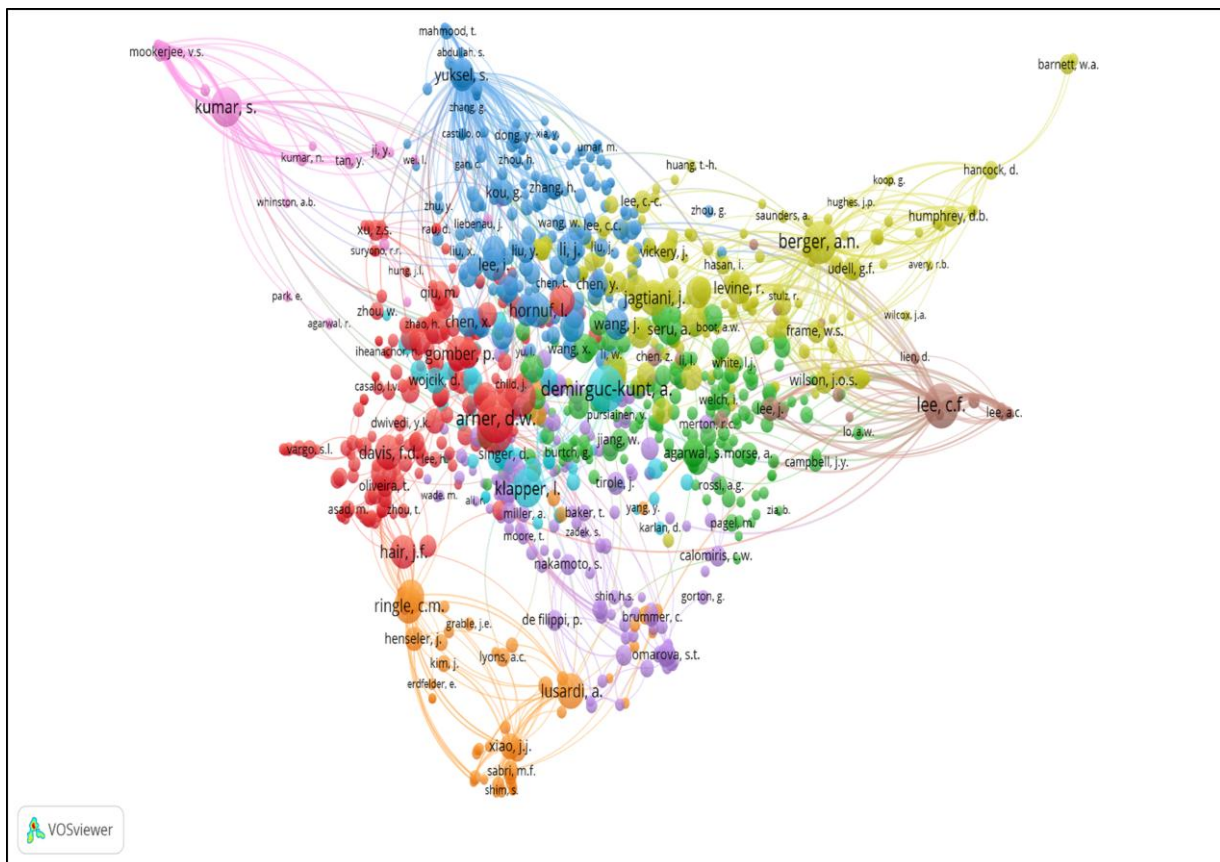
Source: author(s) calculation

Figure 13: Network diagram presenting co-citation analysis

on "*The Role of Technology in Mortgage Lending*". In this article, author demonstrated that FinTech lenders execute mortgage applications twenty percent more quickly than traditional lenders, adjusting for observable variables, leveraging loan-level information regarding financing options and issuances. Moreover, author don't discover any proof that FinTech lenders specifically target credit-challenged borrowers. This article garnered 139 citations. Another article written by Goldstein, Jiang & Karolyi (2019) on "*Fintech and beyond*" discusses the developments in the area of fintech. It can be seen here that majority of research focus on application of big-data application in the area of fintech which is the new frontier in the financial services industry.

explanation of fintech as a comprehensive, global issue. The article reveals the moral and political relevance of the emerging fintech era by positioning the assessment of changing fintech patterns within a broader institutional framework. The introduction of fintech, it contends, opens the door to a potentially significant change in the fundamental public-private system of checks, capabilities, and functions in the financial system. Another article by (Bu, 2022) on "*Effective Regulations of Fintech Innovations: The Case of China*". Author precisely characterises the current state of development and key traits of FinTech businesses and regulatory bodies. In order to illustrate the evolutionary game behaviour between FinTech enterprises and regulatory bodies and to study the influencing variables

Table 5: Top 10 articles in cluster 1- "Fintech and big-data applications"

Article title	Author(s)	Citations
How valuable is fintech innovation?	Chen, Wu and Yang (2019)	145
The role of technology in mortgage lending	Fuster A. (2019)	139
To fintech and beyond	Goldstein, Jiang & Karolyi (2019)	107
Bricks, mortar, And proptech: The economics of IT in brokerage, space utilization and commercial real estate finance	Saiz A. (2020)	10
Can fintech improve corporate investment efficiency? Evidence from China	IV P. (2022)	10
Robo-Advisors (RAS): The programmed self-service market for professional advice	Wexler M. Y. (2020)	5
Deciphering big data in consumer credit evaluation	Jiang et al. (2021)	5
Big Data Applications the Banking Sector: A Bibliometric Analysis Approach	Nobanee et al. (2021)	5
Givers Or Receivers? return and volatility spillovers between fintech and the traditional financial industry	Chen, Chiu and Chung (2022)	5
Fintech credit, bank regulations and bank performance: A cross-country analysis	Nguyen, Tran and Ho (2022)	5

Source: author(s) calculations

Cluster 2: "Regulatory framework for fintech"
The below table 6 presents the top 8 articles in cluster 2 "*Regulatory framework for fintech*". Van (2018) authored document titled "*Making Innovation More Competitive: The Case of Fintech*". This article makes the claim that the framework for existing competition legislation is preventing consumer financial innovation. Omarova (2019) in their article *titled "New Tech vs. New Deal: Fintech as A Systemic Phenomenon*". Such narratives are contested in this article, which also offers a different

of their strategic decisions, we secondly create a two-player evolutionary game model. By looking after the articles in cluster 2, it is clear that the studies focus more innovations in the area of fintech or how fintech can be further utilized as the innovative financial services platform.

Cluster 3: "Fintech and Banking industry"
Table 7 presents the top 10 article in cluster 3 "*Fintech and Banking industry*". The top cited article in this cluster is by (Phan, 2020) titled

Table 6: Top 8 articles in cluster 2- "Regulatory framework for fintech"

Article title	Author(s)	Citations
Making innovation more competitive: The case of fintech	Van Loo R. (2018)	43
New tech vs. new deal: fintech as a systemic phenomenon	Omarova S.T. (2019)	26
Regulating fintech in the EU: the case for a guided sandbox	Ringe & Christopher (2020)	16
Effective regulations of fintech innovations: The case of China	Bu, Li & Hu (2022)	7
the new data of student debt	Odinet C.K. (2019)	6
Consensus-based multidimensional due diligence of fintech-enhanced green energy investment projects	Liu et al. (2021)	6
The racial landscape of fintech mortgage lending	Haupert T. (2022)	6
Cross-border regulation and fintech: are transnational cooperation agreements the right way to go?	Ivanova P. (2019)	4

Source: author(s) calculations

"Do Financial Technology Firms Influence Bank Performance?". Financial technology being now integral aspect in financial services industry need to be studied as to how it influences the bank performance especially post COVID-19. Authors formulated the theory that the expansion of fintech has a detrimental impression on bank performance. Further, they examined the Indonesian market, where FinTech has experienced significant growth and demonstrated that the expansion of Fintech firms posits detrimental effect on bank effectiveness using a sample of 41 banking organizations. Second most cited document is by (Wonglimpiyarat, 2017a) titled *"Fintech Banking Industry: A Systemic Approach"*. The author in their study tries to examine FinTech and the banking sector's dynamic changes as a result. The study specifically examines the systemic character of innovations based on FinTech. The primary motivation for conducting this study endeavour creation of a holistic initiative, that can serve as a flexible instrument to tracce the advancement and adoption of technology. The electronic payment system in Thailand, the most recent financial innovation from PromptPay FinTech, is also included in the study. Further, (Hung,

Table 7: Top 10 articles in cluster 3 "Fintech and Banking industry"

Article title	Author(s)	Citations
Do financial technology firms influence bank performance?	Phan, Narayan & Rahman (2020)	59
Fintech banking industry: a systemic approach	Wonglimpiyarat J. (2017a)	46
Entry of fintech firms and competition in the retail payments market	Jun & Yeo (2016)	34
Fintech in Taiwan: a case study of a bank's strategic planning for an investment in a fintech company	Hung & Luo (2016)	37
The impact of fintech M&A on stock returns	Dranev, Frolova & Ochirova (2019)	27
The rise and rise of financial technology: the good, the bad, and the verdict	Iman N. (2020)	16
Economic basis of digital banking services produced by fintech company in smart city	Popova Y. (2021)	12
Liability and antifraud investment in fintech retail payment services	Yoon & Jun (2019)	9
Effects of fintech on stock return: evidence from retail banks listed in Indonesia stock exchange	Asmarani & Wijaya (2020)	4
Technology acceptance model of financial technology in micro, small, and medium enterprises (MSME) in Indonesia	Purnamasari et al. (2020)	4

Source: author(s) calculations

2016) conducted study on *"Fintech in Taiwan: A Case Study of a Bank's Strategic Planning for An Investment in A Fintech Company"*. Above study employed a case based approach of top five leading banks in Taiwan. The primary information is collected using interviews with team members and the meeting minutes of the FinTech investment task group. The PARTS techniques in co-petition theory served as the basis for the interview questions, which were utilised as the theoretical framework. After detailed scrutiny of the studies in this cluster, majority of studies are focussing on application and influence of fintech revolution to banking industry.

Cluster 4: Fintech and Development
Below table 8 presents the articles that are formed as a cluster 4 *"Fintech and Development"*. majority of the studies in this cluster discusses how fintech leads to the overall development. Gomber (2017) conducted study on *"Digital finance and Fintech: current research and future research directions"*. This article examines the state of research on these fresh and cutting-edge business operations in digital finance today. Additionally, it provides a preview of possible future study trajectories. The online financing

triad, that encompasses trio elements namely, the corresponding business operations, the technologies and technological notions utilised, as well as the establishments concerned, is given as a conceptual framework for examining this area. This article is the most cited article as it articulates one of the crucial aspects of fintech development. Further, (Tao, 2022) conducted study on *"Can Fintech Development Pave the Way for a Transition Towards Low-Carbon Economy: A Global Perspective"*. Author in this study

Cluster 5- Innovation and fintech
Table 9 below displays the top articles in cluster 5. After doing the initial scrutiny of the articles it can be concluded that studies in cluster focusses on new advancements in the area of fintech. Hence, the cluster can be named as *"Innovation and fintech"*. The top cited article in this cluster is by (Xu, 2019) on *"A Systematic Review of Blockchain"*. This study examines the most recent scholarly studies on blockchain, particularly in the field of business management. It is one of the top cited articles as blockchain is the new advancement in the area of financial technology. Hence, this study acts a guiding inspiration for the other researchers. Another study by (Chen, 2017)

Table 8: Top 9 articles in cluster 4 "Fintech and Development"

Article Title	Author(s)	Citations
Digital finance and fintech: current research and future research directions	Gomber P. (2017)	351
Can fintech development pave the way for a transition towards low-carbon economy: a global perspective	Tao et al. (2022)	60
From fintech to finlife: the case of fintech development in China	Chen L. (2016)	70
VAR and market value of fintech companies: an analysis and evidence from global data	Najaf, Schinckus, & Yoong (2020)	19
Fintech in the time of covid−19: technological adoption during crises	Fu & Mishra (2022)	19
An exploratory study of the fintech (financial technology) education and retraining in UK	Sung et al. (2019)	14
Financial technology as a driver of poverty alleviation in China: evidence from an innovative regression approach	Ye, Chen & Li (2022)	8
Impact of fintech on bank risk-taking: evidence from China	Deng et al. (2021)	7
Fintech and IPO under-pricing: an explorative study	Salerno, Sampagnaro & Verdoliva (2022)	7
The long tail thesis: conceptualizing China's entrepreneurial practices in fintech and electric vehicles	Dai & Taube (2020)	6

Source: author(s) calculations

focussed on "*The Transition from Traditional Banking to Mobile Internet Finance: An Organizational Innovation Perspective - A Comparative Study of Citibank and ICBC*". The Industrial and Commercial Bank of China (ICBC) and Citibank are compared and analysed using a comparative case study approach in this paper. It examines the approaches taken by these two banks to address the effects of FinTech in terms of their organisations, HR systems, and product innovations. For ICBC and Citibank, this research suggests an "*electric vehicle mode*" and an "*aeroplane mode,*" respectively. It also discusses the challenges the Chinese banking sector is facing and suggests some workable improvements. Future financial organisations' primary competitive principle will be "technology power." The study conducted by (Chiu, 2017) titled "*A New Era in Fintech Payment Innovations? A Perspective from The Institutions and Regulation of Payment Systems*". This article examines the infrastructure and institutions that are currently in place for payments. Both higher magnitude and consumer remittances are considered necessary for competent clearance based on central bank support, and in the EU, UK, and US, it is recognised how important it is to regulate to provide shield to consumers who avail remittances services. Hence, the studies mostly focussed on fintech innovations and their implication on financial services industry.

4. Discussion

Fintech is still in its infancy (Li & Xu, 2021). Digital lending, blockchain, financial regulation machine learning, big data, and innovation are the core study fields that combine with the thematic map and co-occurrence diagram of author keywords. We have conducted bibliometric analysis by extracting documents using the Scopus database for the time period 1985:2022. In total 452, documents were extracted and further analysed. The study's key discovery is that although the field of fintech is relatively young, it has enormous potential for growth. The observations along with the findings are discussed below.

First, there have been minimal number of studies in this domain but tend to surge post 2016 due to more and more fintech solutions came into field. The rise of publications over the past several years, particularly in 2020 (refer figure 2, is evidence of the growing interest in Fintech. This acceptance may be attributed to Fintech solutions' quick development and adoption, which was expedited by the COVID-19 epidemic.

Table 9: Top 8 articles in cluster 5 "Innovation and fintech"

Article title	Author(s)	Citations
A systematic review of blockchain	Xu, Chen & Kou (2019)	135
The transition from traditional banking to mobile internet finance: an organizational innovation perspective - a comparative study of Citibank and ICBC	Chen et al. (2017)	73
Fintech evolution: strategic value management issues in a fast-changing industry	Ashta & Biot-Paquerot (2018)	45
A New Era in Fintech Payment Innovations? A Perspective from The Institutions and Regulation of Payment Systems	Chiu (2017)	31
Artificial Intelligence and Fintech: An Overview of Opportunities and Risks for Banking, Investments, And Microfinance	Ashta & Herrmann (2021)	23
Strategic Implications of Fintech on South African Retail Banks	Coetzee (2018)	15
Fintech In India: An Analysis on Impact of Telecommunication on Financial Inclusion	Siddiqui & Siddiqui (2020)	9
The Influence of Halal Product Expectation, Social Environment, And FIQIH Knowledge on Intention to Use SHARIAH Financial Technology Products	Marzuki & Nurdin (2020)	4

Source: author(s) calculations

Publication of studies in top ranked journal such as *financial innovation* and *finance research letters* demonstrate the academic community's keen interest in this area but because this interest is still in its infancy, there have only been a few books produced on the subject, exclusively when contrasted to the greater sum of articles and conference papers that have been published. On the subject at hand, further books and book chapters may be released in the near future (Aysan & Nanaeva, 2022). Concerning the most cited sources (refer table 4), *Journal of financial economics* is most cited journal followed by *Review of financial studies*, *Journal of finance*, *Journal of business research* and *international journal of bank marketing*. Furthermore, *Southwestern University of Finance and Economics* is the most relevant affiliation producing 14 articles in this domain *Second*, analysis of utmost productive country on the basis of documents produced reveals that United States of America (161) is the most productive country followed by China (138), United Kingdom (79), Indonesia (75) and India (54). Moreover, on the basis of citations, USA (513) is the most cited country followed by UK (478), Germany (466), China (345) and Canada (142). With regard to collaborative study, USA and China has maximum collaborative study (31) followed by China and UK (24). *Third,* after conducting author analysis, it is discovered that *Kauffman RJ* is the most cited author with 771 citations followed by *Gomber P* (745), *Shin YJ* (418), *Lee I* (399) and *Parker C* (394). Interestingly, findings revealed that Arner DW, Buckley RP and Li X are the authors with the highest impact as measured by h_index. Fourth, keyword analysis revealed the most prominent keywords are *"blockchain"*, *"innovation"*, *"financial services"*, *"global perspective"* and *"technological development"*. The linkage between authors researching financial disruption and the development of blockchain technology may account for the relative prominence of the term "blockchain" (Aysan & Nanaeva, 2022). Furthermore, Biblioshiny mapped the term "digital lending" among the primary themes that require further research. Similar to this, a shift in trending themes towards "digital transformation" and "disruptive innovation" shows that academics have just recently become interested in the subject. The growing use of phrases like "blockchain technology" and "artificial intelligence" may be a sign that Fintech is

moving in that direction. The word "financial inclusion" is becoming more and more widespread, which may indicate that academics are interested in its potential social influence. The most prominent theme is briefly discussed below:

4.1 Blockchain
Big data, a crucial know-how and one amongst FinTech-related subjects, has a significant impact on changing the marketplace by presenting new code based techniques and serve as primary driver of digitalization and the digital economy (Gruin, 2020). Integration of technologies like big data and cloud computing, which has led to an unprecedented expansion in the volume of data, has aided the Internet of Things' quick development, realising the interconnectedness and interprocess communication of individuals, individuals and things, and things and things (Li & Xu, 2020). More and more financial institutions, including banks, P2P, insurance, and securities firms, are starting to develop their big data platforms in response to the growth of the social economy. A crucial role will be played by safeguarding data haven and increasing data utilisation effectiveness, getting better models or financial products by recognising and filtering out the disruptive components.

4.2 Innovation and fintech
There has been more focus on innovation and fintech. Articles such as *"The Transition from Traditional Banking to Mobile Internet Finance: An Organizational Innovation Perspective - A Comparative Study of Citibank and ICBC"*, "Making Innovation More Competitive: The Case of Fintech" and *"Effective Regulations of Fintech Innovations: The Case of China* "clearly signifies that researchers are more inclined towards exploring this area. The relevance of financial technologies and innovations in business is reflected in the growing importance of fintech and sustainability in 2021 (Ellilli, 2022). However, there is need to further explore such area with the concept of design thinking and creativity.

5. Future research agenda
The findings of the study discovered that since digital innovation expanded to include financial services ten years ago, fintech has grown quickly. Financial services have also been impacted by international trends in

economics and finance, which has led to a rise in articles worldwide. Additionally, this study provides a list of the top Fintech publications, authors, nations, organisations, and journals based on the Scopus database. Apart there are few gaps which have been identified after conducting this study. *First,* the fintech research is *concentrated in nature,* studies have been mostly prominent in developed countries. It provides the future research scope for the developing economies as well to explore such as enthralling area. *Second*, *social implication is missing,* meaning thereby there no such study which can clearly explain what the social implication of fintech revolution are. As research is all about the development and novelty for the society such a kind of study is desirable. *Third*, *more focus on technology*, the study in this area is more stressed towards technological aspect such as blockchain, artificial intelligence. Hence, fintech should be studied in correlation with other interdisciplinary areas as well. *Fourth*, there are many aspects in fintech domain which have been less explored such as digital lending, credit worthiness, consumer awareness about fintech applications. These areas are emerging themes which can be studied to gain the in-depth field insight of the financial services industry.

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