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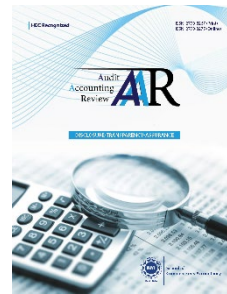
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Title: Future and Current Research Directions of FinTech: A Bibliometric Analysis

Author (s): Muhammad Asif¹, Farhan Sarwar¹, Rab Nawaz Lodhi²

Affiliation (s): ¹University of Education, Lahore, Pakistan.
² University of the Punjab, Lahore, Pakistan.

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Future and Current Research Directions of FinTech: A Bibliometric Analysis

Muhammad Asif^{1,*}, Farhan Sarwar¹, and Rab Nawaz Lodhi²

¹UE Business School, Division of Management and Administrative Sciences,
University of Education, Lahore, Pakistan.

²Hailey College of Commerce, University of the Punjab, Lahore, Pakistan.

Abstract

The current study aims to perform a bibliometric analysis of Fintech. For this purpose, 1,135 articles indexed on Scopus from 2002-2021 were reviewed that focused on Fintech and the banking sector. The study identified and searched "*Fintech*" OR "*FinTech*" OR "*Financial Technology*" OR "*financial technology*" keyword within the title indexed on Scopus. In the second step, MS Excel and VOS viewer were used to provide visualization network and descriptive analysis of co-citation, bibliographic coupling, citation, co-occurrence of keywords and co-authorship analysis. The study found that 2021 was the leading year with 389 articles, which accounted for 34.3% of total publications, in which China was identified as the most productive country having 142 publications, accounting for 12.5% of total the publications. The current study's findings can help the future researchers and practitioners in the banking sector to take informed decisions regarding Fintech research, which can equally contribute to the advancement of the present knowledge and understanding of Fintech in the banking industry.

Keywords: artificial intelligence, bibliometric analysis, co-occurrence, Fintech, financial inclusion, innovation

Introduction

Financial technology (Fintech) is a technological innovation that aims to revolutionize traditional financial methods by delivering financial services. This rapidly growing emerging industry has introduced numerous game-changing improvements, which are improving financial activities through automation (Agarwal & Zhang, 2020). Fintech has introduced new products and services as compared to previous industrial revolutions, such as mobile payment solutions, crowdfunding platforms, online portfolio management,

* Corresponding Author: asif5650@yahoo.com

and international money transfers, to compete with traditional banking and financial players (Anyfantaki, [2016](#)).

In the past four decades, innovation in the Fintech industry has brought changes in the telecom, information technology, insurance, asset management, and banking sectors. These changes have encouraged various innovations that have transformed organizational structure, production processes, customer services, and many other financial products. The current advancements in Fintech are serving society in a user-friendly environment, where Fintech encompasses a broad range of activities, including financial services and data security. Furthermore, it is crucial for scholars and professionals to identify the future directions and trends of Fintech (Nasir et al., [2021](#)).

The financial revolution in Europe during the late 1600s played a significant role in the industrial revolution, with stock companies, insurance companies, and banking sectors being key players (Arner et al., [2016](#)). Currently; there is a prevailing occurrence of extensive issues within the banking and finance sector, which has caused substantial risks by reducing the stability of the financial market. However, the digital changes and the rise of technological advancements are commendable, as they have linked financial services with technology. Following the financial crisis that occurred in 2008, digital advancements have increased the financial circle and technological innovations, especially in e-commerce and mobile technologies for the banking sector. Researchers have taken an interest in the problems faced by Fintech startups and have produced scientific research that accompanies various experiments and practices performed by these startups, recommending solutions for them (Benziane et al., [2022](#)).

These valuable findings should be reviewed carefully, using qualitative and quantitative approaches. Bibliometric analysis is an important tool for understanding the recent trends and future directions of research in Fintech. By analyzing and categorizing previous literature, bibliometric analysis can help to identify the most prominent journals, authors, countries, and years of research in the field of Fintech. This analysis can be useful for both scholars and professionals in the banking and finance industry, as it can help to identify research gaps, track the evolution of research over time, and highlight areas where further research is required. Furthermore, bibliometric analysis can help to identify emerging trends and areas of interest within the Fintech industry. As the field of Fintech continues to

rapidly evolve and expand, bibliometric analysis can help to identify emerging areas of research, such as block chain technology or digital currencies, and can provide insights into the development of new financial products and services.

Therefore, the current study highlights the functions of Fintech industry by analyzing the previous literature, precisely the published articles extracted from Scopus. The objectives of the current study are as follows:

- a. To utilize co-citation techniques in bibliometric analysis to detect the association between high-ranking articles in the field of Fintech.
- b. To identify emerging areas of research in the field of Fintech through bibliographic coupling.
- c. To analyze the impact of the most significant article or author in the field of Fintech through citation analysis, which can inform future research and development.
- d. To conduct a co-occurrence analysis of keywords to discover the main themes and topics used in the field of Fintech, which can inform future research and development.
- e. To utilize a co-authorship analysis to identify the social network of researchers in the field of Fintech, which can provide insights into the collaborative nature of research in this field.

An Overview of Fintech Literature

In recent years, Fintech research has gained significant attention due to its potential to revolutionize the financial industry. The advancements in the digital technology have enabled the creation of new and innovative financial products and services, which have challenge the traditional banking and financial institutions. As a result, there has been a surge of interest in studying Fintech and its impact on the financial markets and their consumers. This research has focused on a wide range of topics, including the impact of Fintech on traditional banking, the emergence of new Fintech-based banking services, and the regulatory and policy implications of these developments.

The influence of Fintech on the traditional banking sector has been a significant area of research, which has been considered for the current study. Previous studies have explored how the rise of Fintech has disrupted the

traditional banking sector by challenging the dominance of traditional banks and by creating new opportunities for smaller and more agile financial firms. These studies have also examined the potential risks associated with Fintech, such as cyber security and data privacy concerns, which have explored ways to mitigate these risks (Anyfantaki, [2016](#); Arner et al., [2016](#)).

Another area of interest has been the emergence of new Fintech-based banking services. These services include mobile payments, peer-to-peer lending, and digital currencies, which have the potential to offer faster, cheaper, and more accessible financial services to their consumers. Previous studies have also explored the growth of these services and the challenges, which they face, such as regulatory barriers and competition from traditional banks (Agarwal & Zhang, [2020](#); Nasir et al., [2021](#)).

Research has also focused on the regulatory and policy implications of the Fintech revolution. Studies have explored the ways in which policymakers and regulators can encourage innovation in the Fintech industry, while also ensuring that consumer protection and financial stability are maintained. These studies have also examined the role of international cooperation in regulating the global Fintech market (Benziane et al., [2022](#)).

Over the last ten years, literature on Fintech in the banking sector has focused on the disruptive potential of Fintech, the emergence of new Fintech-based banking services, and the regulatory and policy implications of these developments. As the Fintech industry continues to evolve and expand, it is likely that research in this area would continue to be a focus for scholars and practitioners alike.

To evaluate and find out the market trends of Fintech qualitative and quantitative approaches can be used. Several studies have been performed by using qualitative analysis, namely literature review, systematic literature review, and content analysis. On the other hand, quantitative analysis can also be used such as bibliometric, mapping, and social network techniques.

Banking sector has increased its innovative IT services and products and paper work has been replaced with Fintech (Butt & Khan, [2019](#)). Fintech is an innovative idea, which has improved the financial services operation by supplying financial services according to the business requirements. Moreover, the services such as payments, advisory services, compliance,

and crowd funding have a positive impact on retention of customers in Malaysia and UAE (Leong & Sung, [2018](#)).

Methodology

Bibliometric Analysis

Bibliometric analysis is a statistical analysis of published data, which presents a quantitative approach into academic literature (Benckendorff & Zehrer, [2013](#)). Bibliometric analysis categorizes the most productive and influential journals, authors, studies, countries, and universities (Tepe et al., [2021](#)). Bibliometric analysis gives visual representation of published literature such as words, journals, documents, and authors broadly used for industrial and academic purposes. Therefore, the current study implements a bibliometric analysis by analyzing co-citation, bibliographic coupling, citation, co-occurrence of keywords, and co-authorship analysis through VOS viewer software (Van Eck & Waltman, [2014](#)).

Co-Citation Analysis

Two documents are frequently quoted in conjunction when they are co-cited (Small, [1973](#)). Co-citation revealed that two sources, references, journals or authors are cited in one paper at the same time (Li & Xu, [2021](#)). Co-citation analysis investigated the association between research fields and examined the knowledge structure, evolution, and foundation (Benckendorff & Zehrer, [2013](#)).

Bibliographic Coupling Analysis

When two papers cite a third work, it is referred as bibliographic coupling (Mas-Tur et al., [2021](#)). A relationship between things is called "bibliographic coupling," and it is based on the number of references they share. Bibliographic coupling is an activity of two documents when they cite the third document (Ferreira, [2018](#)).

Citation Analysis

According to the premise citations, which occur when one publication cites another, show logical relationships between publications and citation analysis for scientific mapping (Donthu et al., [2021](#)). By scanning these linkages, the researcher can scrutinize the relationships among various documents, which are contributing to the development of specific research area (Ardito et al., [2019](#)). The efficiency of an influential research is

measured by the number of citations and citations per year (Ahmi et al., [2020](#)). Thus, the most significant publications can be categorized by using citation analysis.

Co-occurrence of Keywords Analysis

A method that is helpful in determining the relationship between items in the related data is co-occurrence of keywords or co-words analysis (de la Hoz-Correa et al., [2018](#)). It is a process of matching the keywords and regularity of words, which occur collectively (Johnson & Samakovlis, [2019](#)). Keywords co-occurrence is a procedure that is used to set up connections between the terms of articles (Demir & Zečević, [2022](#)). Co-occurrence of keywords analysis is based on the link of strength of the words, which come into sight in the same keywords list (Zhuang et al., [2019](#)).

Co-authorship Analysis

Co-authorship is the most prescribed demonstration of logical association in the research practices. In this demonstration two or more authors participate to produce a study (Casillas & Acedo, [2007](#)). Co-authorship analysis explores the relationships not at individual level but also at international and institutional levels (Kumar & Jan, [2013](#)), (Kumar, [2015](#)). Co-authorship analysis presents an image of cooperation patterns between individuals and institutions and in technical terms, co-authorship is a combination of two or more authors or organizations (Fonseca Bde et al., [2016](#)). The association of co-authorship means that minimum two authors are keen to work together (Chang & Huang, [2012](#)). The most fashionable form of co-authorship is collaborative network and collaborative publications, which have most significant impact in the field of research (Abdullah & Othman, [2022](#)).

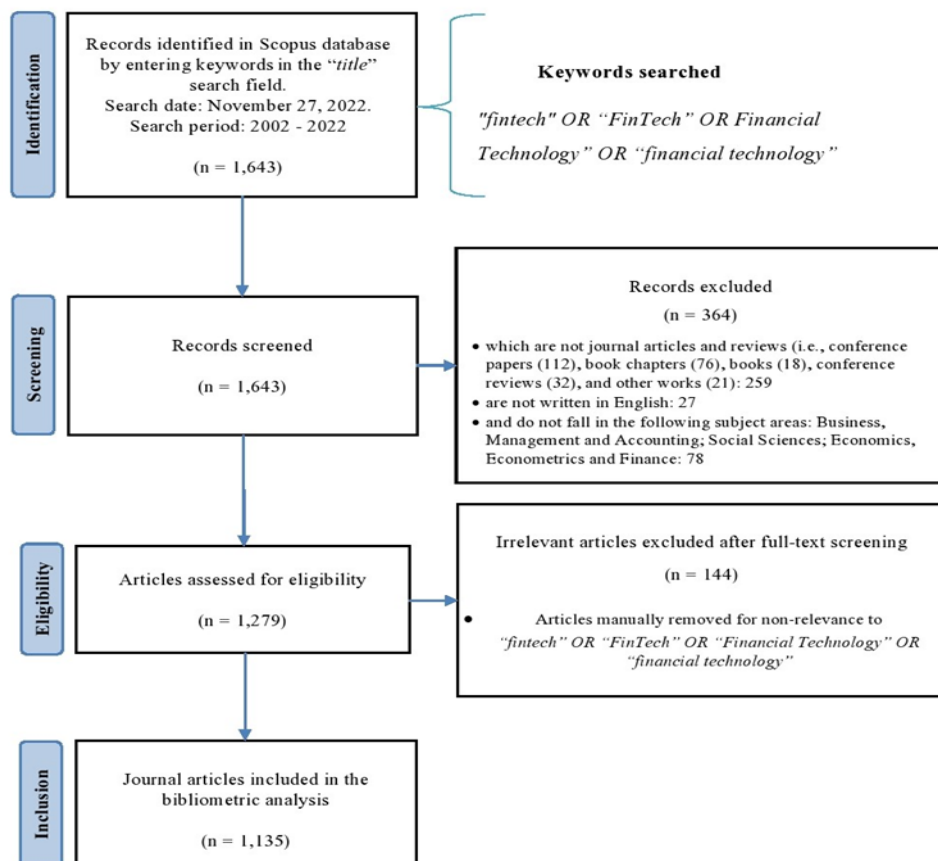
Data Collection

The data was acquired through Scopus database because it possess information regarding thousands of articles, it is a database that covers maximum indexed publications in the particular field of art based management (Ferreira, [2018](#)). Scopus is a trustworthy database because its coverage of journals is more comprehensive than other databases (Benckendorff & Zehrer, [2013](#)). Easy access to peer-reviewed publications, including books, journals, and proceedings, is provided by Scopus, a larger Elsevier analytics and information organization (Martín-Martín et al., [2018](#);

Mingers & Leydesdorff, [2015](#); Nanaeva & Aysan, [2022](#)). Moreover, the Scopus database provides a prestigious and reliable foundation for bibliometric study (Biancone et al., [2020](#)). Documents assembled in Scopus database included most significant abstracts and citations having more than 16,000 journals offering the broadest possible scope for the research (Abdullah & Othman, [2022](#)). Figure 1 presents the inclusion and exclusion criteria of the final selected articles.

Figure 1

PRISMA Flowchart of the Article Selection Process for Bibliometric Analysis



Searching Technique

The title of an article is a very important part of the research study because it contains the most relevant and significant key terms related to the

topic, research area, and objective of the study (Ahmi et al., [2020](#)). The first step concerned to identify the keyword and database to be used for the research. For this purpose, the keyword "*Fintech*" OR "*FinTech*" OR "*Financial Technology*" OR "*financial technology*" is searched within the title of documents indexed on Scopus. Based on the question, a total number of 1,135 documents were retrieved to perform bibliometric analysis. There are some available tools, which have been used to examine the data, while conducting bibliometric analysis. For this purpose, to calculate some frequencies and to design frequency based important charts Microsoft Excel and VOS viewer were used for visualizing the bibliometric networks.

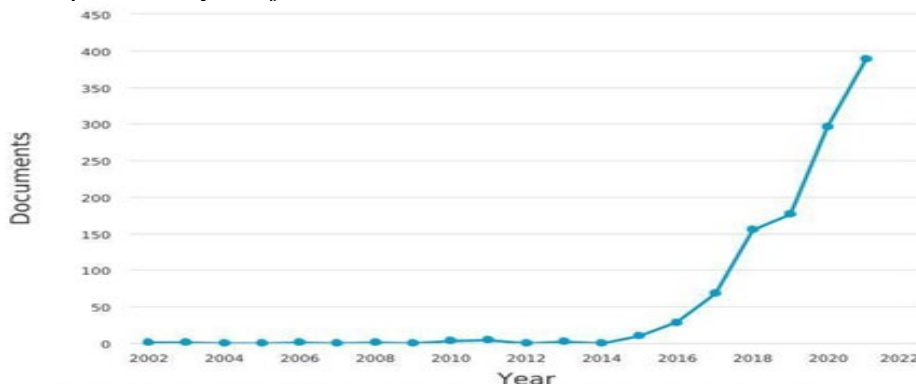
Results and Analysis

Descriptive Analysis of Annual Publications

The first publication among 1,135 publications, in the field of Financial Technology (Fintech) was performed by Seibel and Khadka ([2002](#)) which was a research article titled as, *SHG Banking: A financial technology for very poor micro entrepreneurs*. The average number of publications is 81, which is near to the ground because a lot of publications have burst out in the most recent five years (Li & Xu, [2021](#)) which is 96% of 1,135 publications. Figure 2 and Table 1 demonstrate the annual publications per year and the percentage value of per year respectively, which shows that 2021 had the maximum number of 389 publications, which is 34.3% of total publications. All the above facts reflect that Fintech is a comparatively new field, which has attracted scholars and practitioners.

Figure 2

Descriptive Analysis of Annual Publications



Note. Source: Scopus

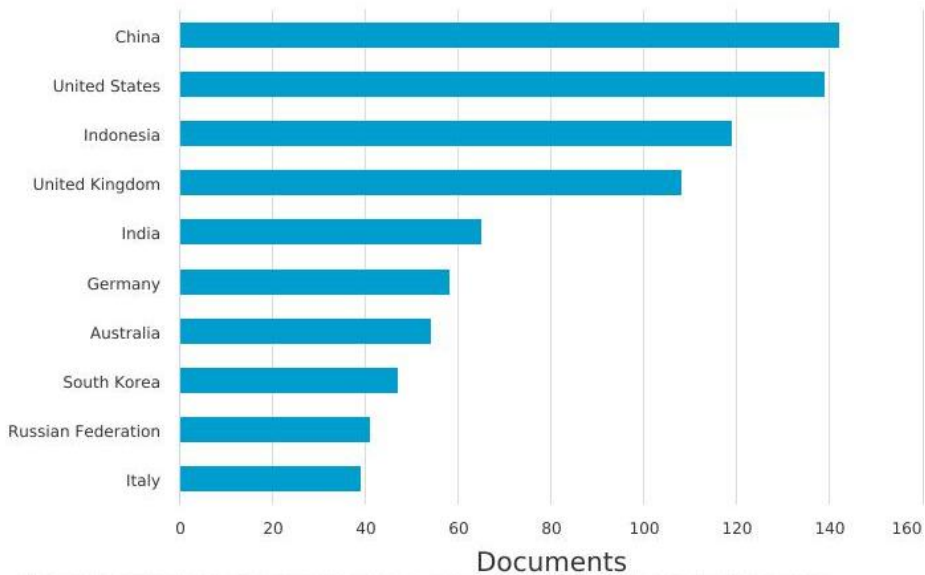
Table 1*The Trend of Annual Publications*

Year	Numbers	%
2021	389	34.3
2020	296	26.1
2019	176	15.5
2018	155	13.7
2017	68	6.0
2016	28	2.5
2015	10	0.9
2013	2	0.2
2011	4	0.4
2010	3	0.3
2008	1	0.1
2006	1	0.1
2003	1	0.1
2002	1	0.1

Note. Source: Scopus

Top Ten Productive Countries

Figure 3 and Table 2 illustrate a list of ten productive countries with maximum publications and rate of publications, respectively. As shown in Figure 3 and Table 2, China is the most productive country with 142 publications and 12.5% of total number of publications. United States ranks second with 139 publications and with a percentage of 12.2% of the total publications. After that, Indonesia (119, 10.5%), United Kingdom (108, 9.5%), India (65, 5.7%), Germany (58, 5.1%), Australia (54, 4.8%), South Korea (47, 4.1%), Russian Federation (41, 3.6%), and Italy (39, 3.4%) are third to tenth, respectively. These are the top 10 countries, which account for the 71% of the 1,135 publications.

Figure 3*Top Ten Productive Countries*

Note. Source: Scopus

Table 2*Top Ten Productive Countries*

Countries	Numbers	%
China	142	12.5
United States	139	12.2
Indonesia	119	10.5
United Kingdom	108	9.5
India	65	5.7
Germany	58	5.1
Australia	54	4.8
South Korea	47	4.1
Russian Federation	41	3.6
Italy	39	3.4

Note. Source: Scopus

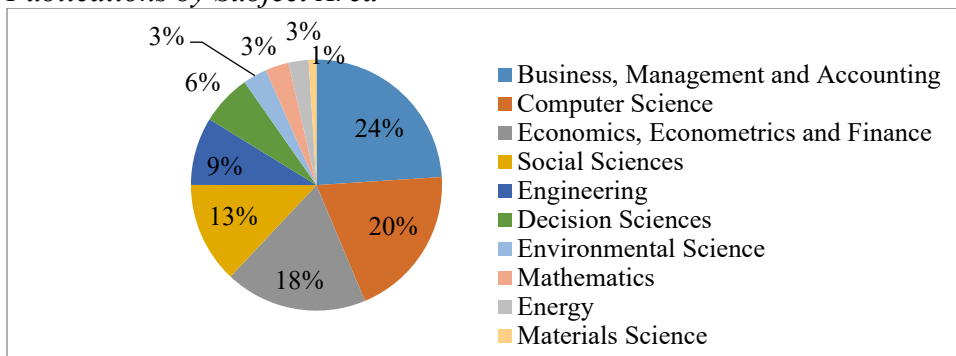
Publications by Subject Area

Figure 4 displays the publications' most well-liked research areas. The trend of the most popular research directions in Fintech over the past years

indicates a multidisciplinary approach towards the field. Business, management and accounting, computer science, and economics are the most accepted research directions by the scholars and practitioners. The number of publications in business, management, and accounting accounts for 24%, in computer science it accounts for 20%, and in economics it accounts for 18%, whereas econometrics and finance from a total of 1,135 publications. The popularity of business, management, and accounting research direction shows that many scholars and practitioners are interested in examining the impact of Fintech on traditional financial institutions and their operations. However, the research directions for computer science indicated that Fintech is highly dependent on the technological advancements made in the field of computer science. Economics, econometrics, and finance research direction reflects the significant impact of Fintech on financial markets and the economy.

Moreover, research is widespread in social sciences (13%), engineering (9%), decision sciences (6%), environment science (3%), mathematics (3%), energy (3%), and material sciences (1%). The Fintech field covers many areas and encourages the development of various research directions. The widespread research in social sciences, engineering, decision sciences, environment science, mathematics, energy, and material sciences indicated the diverse range of applications and implications of Fintech. For instance, Fintech can facilitate financial inclusion by providing access to financial services to underprivileged people, which is a prime concern in social sciences. Additionally, Fintech relies on engineering to design and develop new technologies to enhance its operations.

Figure 4
Publications by Subject Area



Note. Source: Scopus

Co-Citation Analysis

The co-citation analysis is a widely used method in bibliometric analysis to discover the logical formation of most influential documents in research (Goyal & Kumar, [2020](#)). When two documents are co-cited more than once, it usually suggests that they have comparable study topics (Culnan, [1987](#)). Too-old and too-new documents fail to have an impact on the research domain (Pilkington & Fitzgerald, [2006](#)). When a researcher references the work of another author and another researcher in the same new document, this is known as co-citing authors (Culnan, [1987](#)). Author co-citation analysis is applied in this study by applying a threshold of 30 citations per author and 207 authors were concluded. To pick an appropriate level of threshold, several trials have been conducted in this study. Firstly, 15 citations per author were applied and 584 authors were finalized; however, it proves more complicated visualization. Secondly, 45 citations per author were applied and only 98 authors were decided, which may lead to missing more important and reliable authors. If the threshold is set too high, it would miss significant and reliable authors, and if it is set too low, it would produce complicated visuals (Zupic & Čater, [2014](#)). Table 3 presents 10 leading authors with the highest co-citation and total link strength.

Co-citation reveals that two journals, references, sources, and authors are cited in one paper at the same time (Li & Xu, [2021](#)). The co-citation of author network is presented in Figure 5 and they are further divided into 5 clusters. The nodes and size of nodes symbolizes the authors and the citation degree, respectively. The greater nodes represent, the author is cited more times (Li & Xu, [2021](#)). According to the results, Buckley, R.P. and Arner, D.W from cluster 2 are among the most cited authors with 337 and 336 citations and 10726 and 10500 total link strength, respectively.

Table 3

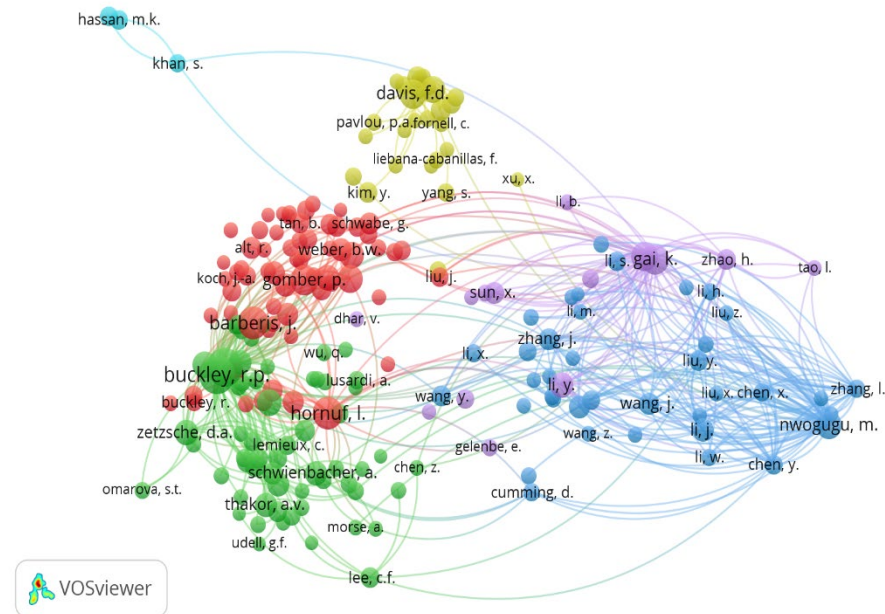
Ten Leading Authors with Highest Co-Citations

Authors	Cluster	Citations	Total link strength
Buckley, R.P.	2	337	10726
Arner, D.W.	2	336	10500
Barberis, J.	1	217	4529
Hornuf, L.	1	216	7207
Gai, K.	5	183	10472
Gomber, P.	1	169	5173

Authors	Cluster	Citations	Total link strength
Davis, F.D.	4	168	3715
Qiu, M.	5	161	9171
Kauffman, R.J.	1	149	4378
Nwogugu, M.	3	147	26313

Note. Source: Scopus

Figure 5
Co-citation of Authors



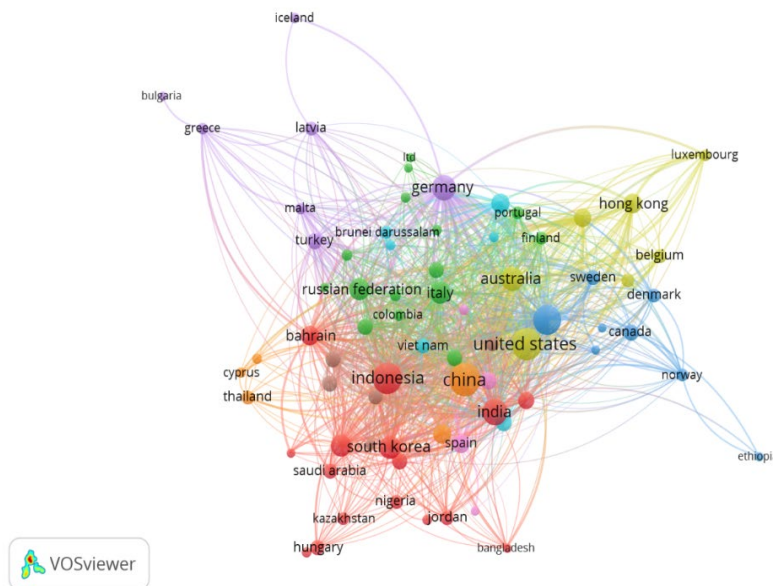
Bibliographic Coupling Analysis

Bibliographic coupling analysis uses the references shared by two articles and more bibliographies denote stronger connection between them (Zupic & Čater, 2014). The number of citations between two documents is motionless over time, in other words the number of references within the article is unchanged (Glänzel & Thijs, 2011). Highly co-cited articles mean that each article is individually high cited. This means that articles selected through co-citation are considered more significant for the researchers who are citing them but bibliographic coupling cannot be used in such a way.

Therefore, it is a complicated job to identify the more important documents by applying bibliographic coupling (JARNEVING, [2005](#); Zupic & Čater, [2014](#)). Figure 6 represents bibliographic coupling of countries. This study represents 9 (nine) clusters and the findings showed that United States, China, and Indonesia are among the most co-cited countries.

Figure 6

Bibliographic Coupling of Countries



Citation Analysis

The citation analysis presents a decisive summary of the most dominant and highly cited documents in the field of Fintech. By applying threshold of 20 citations, 122 documents were finalized for citation analysis. The top 10 cited documents with citations are presented in Table 4 and network visualization is exposed in Figure 7.

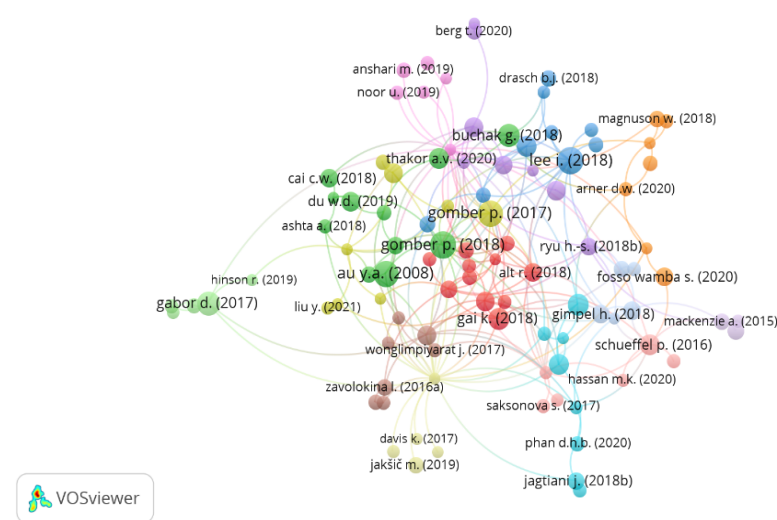
The citation analysis of documents presented that highly cited documents were published in recent 5 years, which indicated that Fintech attracted the scholars and practitioners a lot. The results of citation analysis revealed that Gomber et al. ([2018](#)) and Lee and Shin ([2018](#)) are most influential and highly cited studies.

Table 4
Top 10 Cited Documents

Authors	Cluster	Citations	Total link strength
Gomber et al. (2018)	2	304	13
Lee and Shin (2018)	3	293	12
Au and Kauffman (2008)	2	270	4
Gomber et al. (2017)	4	247	10
Gabor and Brooks (2017)	11	191	7
Buchak et al. (2018)	2	179	5
Gai et al. (2018)	1	142	7
Haddad and Hornuf (2019)	6	133	5
Schueffel (2016)	10	129	10

Note. Source: Scopus

Figure 7
Citation Analysis of Documents



Co-occurrence of Keywords Analysis

The database used in previous techniques, used the same co-occurrence of keywords analysis. From the 2,250 keywords, none of the 108 keywords met the threshold at least 5 times. Co-occurrence keywords analysis constructed 9 (nine) clusters and highest co-occurrence keywords are

Fintech (471), financial technology (127), block chain (54), financial inclusion (48), innovation (46), banking (29), and crowd funding (28). Table 5 presents the top 10 keywords; number of occurrence and total link strength, which are presented in Figure 8, considering the network visualization of co-occurrence of keyword analysis.

Table 5

Top 10 Co-Occurrence of Keywords

Keyword	Cluster	Occurrence	Total link strength
Fintech	1	471	756
Financial technology	8	127	172
Blockchain	7	54	154
Financial inclusion	2	48	111
Innovation	4	46	108
Banking	9	29	75
Artificial intelligence	3	29	70
Crowd funding	5	28	81
Financial services	7	26	67
Machine learning	7	24	49

Note. Source: Scopus

The top 10 co-occurring keywords in Fintech are Fintech, financial technology, block chain, financial inclusion, innovation, banking, artificial intelligence, crowd funding, financial services, and machine learning. These keywords demonstrated the diverse aspects of Fintech research and development, including financial services, technology innovation, and financial inclusion (Suryono et al., [2020](#)). Fintech, which is the most frequent keyword, has a high occurrence and total link strength, indicating its significance in the Fintech field. Financial technology is another frequently used keyword, indicating its synonymy with Fintech. Block chain and financial inclusion are also common topics of research in the Fintech domain (Schuetz & Venkatesh, [2020](#)). Block chain is being applied in a variety of financial applications, such as digital identity verification, payment processing, and smart contracts (Morkunas et al., [2019](#); Schuetz & Venkatesh, [2020](#)). Financial inclusion is another important keyword in Fintech research, reflecting the importance of expanding access to financial services to underserved populations (Schuetz & Venkatesh, [2020](#)). Innovation is a key driver of Fintech and its co-occurrence with Fintech emphasized the importance of innovation in shaping the Fintech landscape

(Ma et al., [2020](#)). Banking, despite being a traditional industry, has been influenced significantly by Fintech innovation (Nguyen et al., [2020](#)). Artificial intelligence and machine learning, which are prominent technologies in the Fintech industry, have also been widely researched (Ashta & Herrmann, [2021](#)). Crowd funding and financial services are other areas that are being revolutionized by Fintech, leading to their co-occurrence with Fintech in the literature (Bouncken et al., [2015](#); Dibrova, [2016](#)).

Overall, these co-occurring keywords in Fintech research highlight the diverse and rapidly evolving nature of the field and demonstrate the importance of technology innovation and financial inclusion in shaping the future of the financial industry.

Cluster Analysis

In this study, the Fintech related keywords are categorized, labeled and evaluated based on 9 (nine) clusters. From the network visualization, it can be understood easily that the clusters hold hands of each other, and provide network of interrelated clusters.

Cluster 1 (Red)

Cluster 1 consists of 17 items and most influential keyword is Fintech and this cluster is labeled as “Role of Fintech in Financial Transactions”. The keyword “Fintech” is the central keyword of this study and interconnected with all other clusters. Fintech has emerged as a prominent field in the financial industry due to the advancement in digital technology and the increasing use of Fintech solutions such as mobile payment, online portfolio management, crowd funding platforms, and international money transfers. Fintech has dominated the financial industry's lexicon during the last decade (Pu et al., [2021](#)). Other most repeated terms in cluster 1 are financial literacy, lending, technology acceptance, technology adoption, mobile payments, and peer to peer lending.

Cluster 2 (Green)

Cluster 2 includes 16 items and keyword “financial inclusion” is the most repeated word that interlinks with Fintech, mobile payments, financial literacy, Islamic finance, block chain, and crowd funding, which are labeled as Fintech and financial inclusion. In economic and financial discourse, financial inclusion has played a key role to create interest both among the

academia and practitioners (Abel et al., [2018](#)). Commercial banks, customer satisfaction, digitization, ecosystem, risk, and sustainable development are other most replicated keywords. Fintech innovations such as mobile banking, digital payments, and peer-to-peer lending have been driving financial inclusion. For example, mobile banking has enabled the unbanked and under banked population to access, basic financial services such as savings accounts and microloans through their mobile devices. Moreover, Fintech has also made financial services more affordable and convenient, reducing the cost and time required to access these financial services.

Cluster 3 (Blue)

Financial technology is one of the 15 items in cluster 3, which has been repeated 127 times and created 172 total link strengths with other keywords such as artificial intelligence. This cluster is tagged as “artificial intelligence is a source of opportunities and risks in financial sector”. Artificial intelligence is creating a sprint of opportunities in the financial sector but one must be ready for risks in the use of technology. In-house, outsourced and ecosystem based operations of financial organizations are integrated with artificial intelligence (Ashta & Herrmann, [2021](#)).

Cluster 4 (Olive)

Cluster 4 labelled as “Fintech paved the way of innovation in financial products and services”. In the cluster innovation is the most repeated keyword, which occurred 46 times and created 108 total link strengths. Cluster 4 contains 12 items, which are Africa (8), banks (15), digitalization (19), disruptive innovation (7), emerging markets (5), financial services industry (7), Fintech (19), innovation (46), mobile money (5), open banking (6), performance (9), and psd2 (6). Fintech also known as financial technology raised more than 109 billion (\$) from 2009-2017, is one of the best innovations to provide financial services and products (Amuna et al., [2019](#)).

Cluster 5 (Purple)

This cluster characterized by 12 items and labelled as “crowd funding enhances the performance of banking sector”. Crowd funding is the most replicated keyword (28) in this cluster, which has created 81 total link strengths. As compared to traditional borrowing, crowd funding is another way of funding and it is open to everyone. A group of people (crowd) contributes some money in any project, idea, and product through

fundraisers (Bouncken et al., [2015](#)). Other important keywords of cluster 5 are bank performance (5), digital banking (9), entrepreneurship (13), financial institutions (7), Fintech innovation (9), p2p lending (16), peer-to-peer lending (12), regulation (18), shadow banking (6), start-ups (7), and venture capital (8).

Cluster 6 (Sky Blue)

Cluster 6 comprises 11 items and are labelled as “financial stability through digital finance”. The importance of digitalization in financial industry has grown in recent years and it helped to promote financial inclusion to eradicate financial problems in developing and emerging economics. Moreover, digital finance has played a vital role for financial stability and it is expected as the good strategy for financial stability in the near future (Luo et al., [2022](#)). In cluster 6, financial innovation (28) is the most repeated term and other duplicated keywords are digital finance (10), digital transformation (6), financial regulation (8), financial stability (13), Fintech ecosystem (5), insurtech (5), investment (6), regtech (15), regulatory sandbox (14), and sustainability (5).

Cluster 7 (Orange)

Cluster 7 labelled as “success of business model through blockchain technology”. Blockchain technology provides a decentralized digital database of transactions, which is retained and modernized by computer networks and approved before entering in ledger. Managers of the organizations can use the business model as a systematic framework to measure the impact of block chain technology on existing business models and to develop new business models (Morkunas et al., [2019](#)). Block chain is the most repeated keyword (54 times) in cluster 7 with 154 total link strengths. In the same cluster, business model (12), deep learning (5), disruption (5), finance (21), financial services (5), machine learning (24), AI (artificial intelligence) (7) mobile payments (7), and smart contracts (6) are the most repeated keywords.

Cluster 8 (Brown)

Cluster 8 consists of 8 items including bank (11), bitcoin (13), cryptocurrencies (9), cryptocurrency (15), digital economy (12), digital technology (5), financial services (26), and financial technologies (23). Among these financial services is the keyword that repeated more than other keywords. Same cluster is labelled as “financial technologies enhanced

Co-authorship Analysis

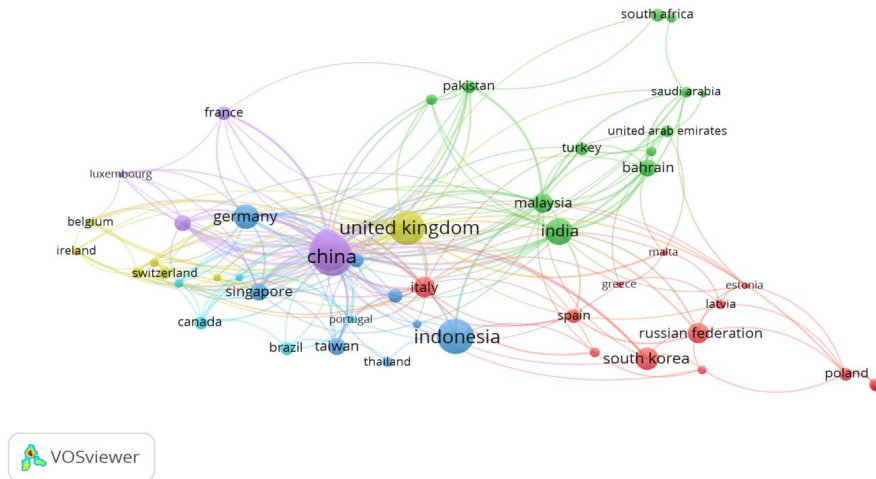
Co-authorship analysis is a tool, which is used to find the relationships between various studies produced by the researchers (Nugroho & Hamsal, 2021). Same database is used in co-authorship analysis to expose the visualization network of co-authorship analysis. Country co-authorship analysis is applied in this study by applying a threshold of minimum 5 documents and minimum 5 citations per country, and out of 124 countries only 51 countries met the threshold. Table 6 presents 10 leading countries with maximum documents and number of citations and network visualization of country co-authorship as presented in Figure 9. According to the Table 6, China and United State are the leading countries in terms of co-authorship with 143 and 140 documents, respectively but in terms of number of citations (2816) and total link strength (92), United States is at the top, which means that United States has built valuable links with other countries. On the other hand, network visualization of co-authorship reveals that China, United States, United Kingdom, and Indonesia are the more connected countries with other countries.

Table 6
10 Leading Countries with Highest Co-Authorship

Country	Cluster	Documents	Citations	Total link strength
China	5	143	1594	68
United States	5	140	2816	92
Indonesia	3	119	390	11
United Kingdom	4	109	1294	89
India	2	67	237	27
Germany	3	58	1407	32
Australia	5	56	872	57
South Korea	1	47	916	10
Russian Federation	1	41	93	11
Italy	1	39	284	27

Note. Source: Scopus

Figure 9
Co-authorship Analysis Based on Region



Discussion

The start of the financial technology in banking sector has facilitated the customers through financial products and services. The financial technology has capability to facilitate the banking sector through internet and mobile devices (Broby, [2021](#)). With the passage of time, the role of financial technology companies in banking sector is increasing day by day and producing more possibilities for consumers and risks as well (Pu et al., [2021](#)). In present financial industry, Fintech has played a vital role of innovation-driving area which has brought marvelous changes in financial industry (Nguyen et al., [2020](#)). Now clients have the access to financial services with less hustle as well as banks and financial institutions can reduce their overhead costs through financial technology (Said & Kaplelach, [2019](#)).

This study is a quantitative bibliometric analysis, which presents analysis through visualization and mapping of various clusters based on five different types of analysis, namely co-citation, bibliographic coupling, citation, co-occurrence of keywords, and co-authorship. From 1,135 documents on Fintech in banking sector, this analysis suggested that Fintech

research is a global and multidisciplinary field that involves the collaboration of researchers from different countries and backgrounds. The use of advanced technologies, such as block chain, artificial intelligence, and machine learning, is a prominent trend in Fintech research, and financial inclusion remains an important focus for researchers.

In terms of co-authorship, China and the United States are leading the field with the highest numbers of co-authored documents and total link strength. This result is consistent with the growing interest and investments in Fintech by these countries in recent years. For instance, China was considered among the countries whose financial system was underdeveloped and suffering from various institutional problems. Nowadays, Chinese traditional banking system is progressively transforming into cutting-edge system and Chinese Fintech industry encountered rapid growth with the increase of information and communications technology ecosystem. Moreover, China is the home of the biggest financial technological companies in the world (Shim & Shin, [2016](#)). Alibaba is the best example of Fintech, which started its business as an e-commerce company but now, it is a biggest Fintech company all over the world. Indonesia, with its growing financial sector and increasing use of digital financial services, also made it to the top three co-cited countries. The United Kingdom, India, and Germany are other notable countries in terms of their contribution to the Fintech literature.

Fintech made possible financial innovations, which resulted in new business processes, applications, models or products that have affected the financial institutions (Agarwal & Zhang, [2020](#)). Technologies play an important role in effective growth of Islamic banking industry by transformational waves, which can be compared to the traditional banking system. Due to innovations in financial technology, the quick changes in financial sector have been spread all over the world in banking sector and in Islamic banking sector in particular (Panjwani & Shili, [2020](#)). The innovation in information technology has emerged to ease daily banking commercial transactions. Innovated Fintech has created various business models and caters to the need of the customers.

Conclusion

This bibliometric analysis was designed to track the advancement and improvement in Fintech considering the traditional banking sector to

suggest the future trends and directions. The results of the study disclosed an upward trend of publications. Various bibliometric analysis techniques were applied, in which 9 clusters in co-occurrence in keywords analysis were identified, while 3 research themes namely banking sector and Fintech, innovation in banking sector, and sustainability in banking sector were established.

The results of the study disclosed the trends of Fintech and relations between Fintech and banking sector by reviewing the most influential works and emphasizing the links among the various publications. Moreover, the results indicated that the annual publication of papers in the field of Fintech was highest in 2021 with 389 papers having 34.3% of total publications. Furthermore, it was identified that China is the most productive country with 142 publications and 12.5% of total number of publications, while United States ranked at second with 139 publications and 12.2% of total publications. Co-occurrence of keywords analysis demonstrated that enterprise resource planning is the most repeated keyword used by the researchers.

Implications

Theoretical Implication

Present study presents awareness into the theoretical implication. Through thematic mapping analysis based on bibliometric analysis, this study sheds the light on current and future trends of financial technology (Fintech) in banking sector particularly. Moreover, this study offers an extensive and current bibliometric examination of the literature that has previously been explored from many angles. In this regard, our attempt to give a thorough and understandable image of the research area can serve as a guide for scholars working in this area. Additionally, by identifying the most prominent writers, journals, and nations that have affected the financial technology area, this study offers some significant insights into the subject. The bibliometric analysis discovers co-citation analysis, bibliographic coupling analysis, citation analysis, co-authorship analysis and co-occurrence of keywords analysis along with 9 clusters that give direction and guidance to identify most dominant research.

Practical and Managerial Implications

Technology in the banking industry is not new, but its significance and scope have increased significantly during the past ten years. Non-traditional

participants have entered in the field with well-built technological offerings to disrupt traditional modes of financial technology solutions (Coetzee, 2018). Through internet, Fintech is providing various financial services and not only changes the business models of traditional banks but also forms an industry of internet-only banks which have not physical branches and all financial services are available through mobile channels. In general, banks not only advance customer services but also build up customer relationships through new technologies.

Limitations

The limitation of the current bibliometric analysis was that this work only considered journal articles and ignored other types of documents such as books, book chapter, conference papers, editorial, review, short survey, and erratum. Overall, bibliometric analysis was an important tool for understanding the current state of research in the field of Fintech, as well as for identifying emerging trends and areas of interest. By providing a comprehensive overview of the research landscape in Fintech, bibliometric analysis can help to inform future research and development in the field, and can ultimately contribute to the continued growth and evolution of the banking and finance industry.

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