

## Review

# Trends and Directions of Financial Technology (Fintech) in Society and Environment: A Bibliometric Study

Adeel Nasir <sup>1,†</sup> , Kamran Shaukat <sup>2,3,\*,†</sup> , Kanwal Iqbal Khan <sup>4,\*</sup>, Ibrahim A. Hameed <sup>5,\*</sup> ,  
Talha Mahboob Alam <sup>6</sup>  and Suhuai Luo <sup>2</sup>

- <sup>1</sup> Department of Management Sciences, Lahore College for Women University, Lahore 54000, Pakistan; adeel.nasir@lcwu.edu.pk
- <sup>2</sup> School of Information and Physical Sciences, The University of Newcastle, Callaghan, NSW 2308, Australia; attari\_Ghosia@hotmail.com
- <sup>3</sup> Department of Data Science, University of the Punjab, Lahore 54890, Pakistan
- <sup>4</sup> Institute of Business & Management, University of Engineering and Technology, Lahore 54000, Pakistan
- <sup>5</sup> Department of ICT and Natural Sciences, Norwegian University of Science and Technology, 7491 Trondheim, Norway
- <sup>6</sup> Department of Computer Science and Information Technology, Virtual University of Pakistan, Lahore 54890, Pakistan; talhamahboob95@gmail.com
- \* Correspondence: kamran.shaukat@uon.edu.au (K.S.); kanwal.khan@uet.edu.pk (K.I.K.); ibib@ntnu.no (I.A.H.)
- † Adeel Nasir and Kamran Shaukat contributed equally to this work.



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**Abstract:** The contemporary innovations in financial technology (fintech) serve society with an environmentally friendly atmosphere. Fintech covers an enormous range of activities from data security to financial service deliverables that enable the companies to automate their existing business structure and introduce innovative products and services. Therefore, there is an increasing demand for scholars and professionals to identify the future trends and directions of the topic. This is why the present study conducted a bibliometric analysis in social, environmental, and computer sciences fields to analyse the implementation of environment-friendly computer applications to benefit societal growth and well-being. We have used the ‘bibliometrix 3.0’ package of the r-program to analyse the core aspects of fintech systematically. The study suggests that ‘ACM International Conference Proceedings’ is the core source of published fintech literature. China leads in both multiple and single country production of fintech publications. Bina Nusantara University is the most relevant affiliation. Arner and Buckley provide impactful fintech literature. In the conceptual framework, we analyse relationships between different topics of fintech and address dynamic research streams and themes. These research streams and themes highlight the future directions and core topics of fintech. The study deploys a co-occurrence network to differentiate the entire fintech literature into three research streams. These research streams are related to ‘cryptocurrencies, smart contracts, financial technology’, ‘financial industry stability, service, innovation, regulatory technology (regtech)’, and ‘machine learning and deep learning innovations’. The study deploys a thematic map to identify basic, emerging, dropping, isolated, and motor themes based on centrality and density. These various themes and streams are designed to lead the researchers, academicians, policymakers, and practitioners to narrow, distinctive, and significant topics.

**Keywords:** fintech; financial technology; blockchain; deep learning; regtech; environment; social sciences

## 1. Introduction

As the world is entering the digitalisation age, many organisations are adopting and investing in new technologies to cope with societal and environmental needs. The financial industry is not so different; it evolves day by day with various fintech technologies. Fintech

is the combination of financial technology used to enhance financial operations' effectiveness and efficiency. Its rise has changed the ways of businesses of commercial banking systems [1]. It is implied that it is an emerging area of finance with a significant contribution to technology [2,3]. Nowadays, it has become an industry that successfully takes advantage of the recent development of information technology tools such as cloud computing, big data, the internet of things, social computing, etc. [4]. This advancement supports the existing business structure but also helps the financial service industry to introduce new processes, systems, products, and services that can enhance their efficiency [5]. The companies are intended to restructure their businesses and are more inclined towards hybrid client interactions and more customer self-services, [6], particularly during Covid-19.

The latest fintech technology trends include categorising and assessing various artificial intelligence technologies based on their availability and maturity [7]. Furthermore, it provides studies such as the contextualisation of users' facilities and experience of the web interface in the financial service industry [8], machine learning tools in electronic finance market trading [9], and advanced modelling for stock movements [10] and settlement models with renewable energy that are based on blockchain technology [11]. The researchers believe that there is a need to develop a conceptual framework to understand the perspectives of Fintech [12]. Few researchers presented the Fintech framework based on the flow of money theories applied in the E-commerce system. However, still required is a suitable conceptual framework developed in the context of relevant fields [13]. As well, there is a still need to identify the core contributors in the field of computer, social, and environmental sciences, as well as the future research streams and themes that will lead the scholars to make a significant contribution in the area. Therefore, the purpose of the current study is to conduct a bibliometric analysis for the period of 2010 to 2021.

The current study highlights various influential and conceptual aspects of fintech technology in computer, social, and environmental sciences from the last decade. The significant growth of fintech technologies has raised specific questions for academicians and practitioners. These questions are: (1) What are the contributory key authors and journals of the fintech literature? (2) What are core affiliations, sources and contributing countries in the field of fintech and computer, management, and environmental sciences? (3) What key themes does fintech offer in the field of computer, management, and environmental sciences? (4) With the help of research streams offered by fintech literature, what are the future research gaps to fill by researchers, academicians, and practitioners? The workflow of the study is presented in Figure 1.

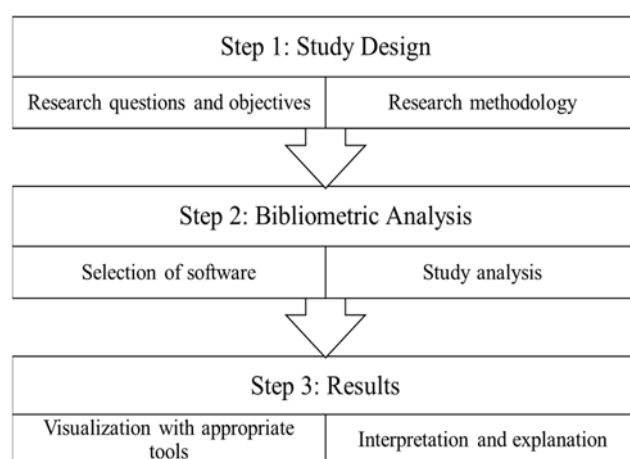


Figure 1. Workflow of study.

## 2. Study Design and Descriptive Outlook

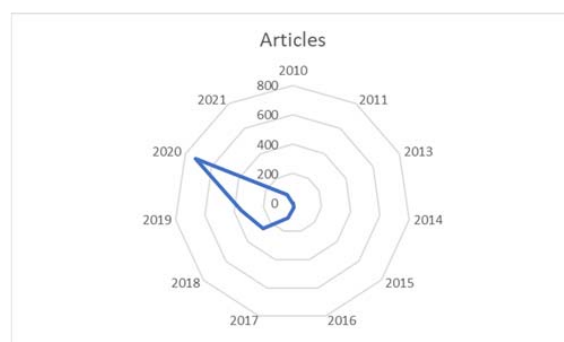
This study aims to conduct a comprehensive bibliometric analysis to identify the influential and conceptual structure of the fintech literature in computer, social, and environmental sciences. The procedure and steps of studies are shown in Figure 1, using

the workflow followed by Nasir et al. [14]. The study proceeds with the study design, where we define our research questions and methodology in step 1. We have used the 'bibliometrix 3.0' package of r-studio to analyse various influential and conceptual aspects of fintech literature [15]. We have used Scopus, emerald, and science direct databases for searching fintech literature. The finalised search query is simply fintech in the computer, social, and environmental science fields. We analysed on 17 March 2021. There is a minimum contribution of fintech literature in the rest of the areas. Furthermore, we have removed the duplicates from our data and ended up with 1556 documents, from which 786 are research articles, 26 are books, 86 are book chapters, 553 are conference papers, 61 are reviews, and 22 are conference reviews and editorials.

Table 1 also highlights the total number of author keywords and keyword plus used by the literature; furthermore, we have taken the literature from 2010 to 2021. The table describes various characteristics such as the collaboration between countries index, authors per documents, and single and multiple-authored documents in fintech literature. Figure 2 represents the annual production of publications per year; fintech is a recent trend globally as, in 2020, there were 724 publications. The growth is substantial, from 1 publication in 2010, to 10 publications in 2015, to 724 publications in 2020. The year 2021 is still ongoing, however, we can see 69 publications in fintech, more than the 30 publications in 2016. The relevant growth in financial technology literature starts in 2017, where we can see 107 publications, followed by 262 in 2018 and 348 in 2019.

**Table 1.** Main information about fintech literature.

Description	Results
Documents	1556
Sources (Journals, Books, etc.)	759
Keywords Plus (ID)	4453
Author's Keywords (DE)	3454
Period	2010–2021
Average citations per document	3.611
Authors	3483
Author Appearances	4325
Authors of single-authored documents	298
Authors of multi-authored documents	3185
Single-authored documents	373
Documents per Author	0.447
Authors per Document	2.24
Co-Authors per Documents	2.78
Collaboration Index	2.69
Document types	
Article	786
Book	26
Book chapter	86
Conference paper	553
Conference review	22
Editorial	22
Review	61



**Figure 2.** Annual publications production radar.

### 3. Bibliometric Analysis

The forthcoming segment represents the holistic bibliometric analysis of fintech literature. The bibliometric analysis is twofold. First, we study dynamic, influential aspects such as core authors having a considerable impact in fintech. We highlight core sources and how they impact the literature on various topics. We propose the main countries and corresponding countries of fintech literature. Then, we discuss primary affiliations or institutions conducting significant research on multiple topics of fintech. We discuss the main contributions of highly ranked documents. We lastly indicate the main keywords in fintech literature.

The second part of the bibliometric analysis provides a conceptual framework. In this section, we discuss various themes and streams of fintech literature. It provides an understanding of the core topics of fintech in computer, social, and environmental sciences, and helps us propose what the future holds for fintech technologies. This section presents a co-occurrence network which creates a matrix of keywords and links them together in various clusters that suggest the main topics. Furthermore, we investigate the thematic map, which divides multiple topics into four quadrants with different characteristics. Finally, from emerging and developing issues, we propose a future research agenda in fintech literature.

#### 3.1. Influential Aspects

##### 3.1.1. Core Sources

Figure 3 represents the top 10 critical influential sources of fintech literature. ACM International Conference Proceedings is the core source in the field. Contemporary research is often presented at the ACM international conference. The core source represents recent studies of diverse, agile tailoring models [16], the advanced mechanism for agricultural marketing and smart contracts using blockchains [17], and the facilitation of decentralised ledger technology for financial derivative markets [18]. The second leading source of fintech literature is *Advances in Intelligent Systems and Computing*. This journal publishes literature on the digitalisation of the banking and insurance sector [19], introducing the QR-code-based payment systems at fintech future [20] and dynamic uses of blockchain technology such as e-voting [21]. The third primary source is lecture notes in computer sciences that involve literature on fintech innovation with patent data [22], the role of information technology (IT) in developing fintech business model canvases [23], and the use of fintech AI that is interpretable in evaluating the efficiency of lending risk [24]. IEEE access provides literature on the development of a blockchain-based microgrid transaction model for optimised bidding [25], market settlement models based on blockchain technology while securing efficient energy trading mechanisms [26], and contract production and transaction with dynamic technology such as a block-enabled integrated marketing platform [27].

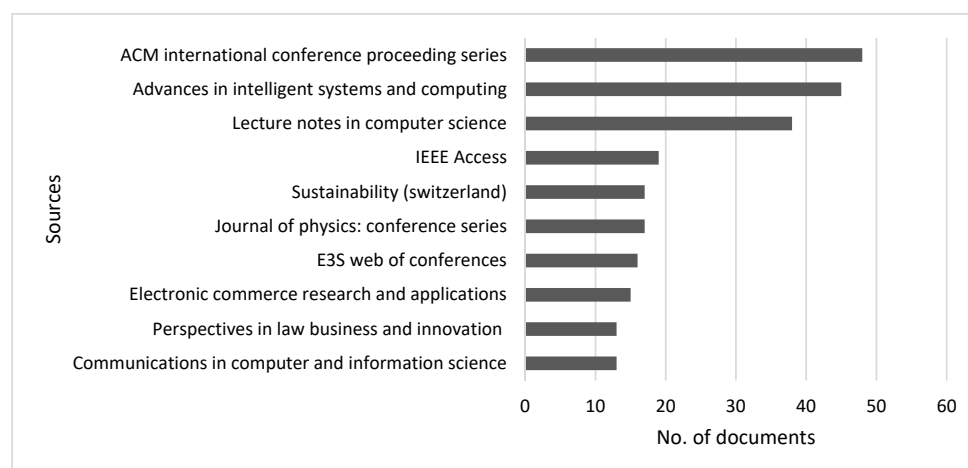


Figure 3. Most relevant sources, according to publications.

Table 2 represents the primary sources listed and arranged based on h-index and g-index. It shows the impact of the journal on fintech literature. Electronic commerce, research, and applications are top-ranked sources for producing fintech literature with an h-index of 7 and a g-index of 13. Its 15 publications have 186 total citations, and the first article on fintech was published in 2015. The journal highlights the key areas of fintech, which are initial coin offerings (ICO) and information asymmetries associated with it [28], the proposed value created by the mobile payment ecosystem [29], and contract signing protocol with blockchain technologies [30]. Financial innovation comes on the second number in the source impact list with an h-index of seven, a g-index of nine, and its total 9 publications having 148 total citations. It covers the main topics of fintech governance and emergence in Peer to Peer (P2P) lending [31,32] and the growth of digital banking in the financial industry [33]. The first article on technological forecasting and social change (ranked third) was published in 2018; however, it comes in third place with 89 total citations with 11 fintech technology publications.

**Table 2.** Top ten sources with impact.

Source	h_Index	g_Index	m_Index	TC	NP	PY_Start
Electronic commerce research and applications	7	13	1	186	15	2015
Financial innovation	7	9	1	148	9	2015
Technological forecasting and social change	5	9	1.25	89	11	2018
European business organisation law review	5	7	1.25	53	9	2018
Handbook of blockchain, digital finance, and inclusion	5	5	1	38	9	2017
IT professional	5	7	1	150	7	2017
Electronic markets	5	6	1.25	124	6	2018
Industrial management and data systems	5	6	1.25	85	6	2018
Journal of economics and business	5	6	1.25	231	6	2018
Journal of management information systems	5	6	1.25	204	6	2018

### 3.1.2. Influential Authors in Fintech Literature

This section represents the core authors who contributed significantly to fintech in the computer, social and environmental sciences. Table 3 describes the ranking of the principal authors and divides the order into two panels. Panel A represents ranking according to h, g and m-index, while panel B grades authors according to total citations.

**Table 3.** Top authors in fintech literature.

Authors	h_Index	g_Index	m_Index	TC	NP	PY_Start
Panel A: Ranked according to h,g,m index						
Arner DW	4	8	0.67	79	10	2016
Buckley RP	4	8	0.80	77	8	2017
Kauffman RI	4	5	0.57	150	5	2015
Li Y	3	7	0.60	51	11	2017
Wang S	3	3	0.60	14	8	2017
Panel B: Ranked according to total citations						
Gomber P	3	3	0.60	223	3	2017
Kauffman RI	4	5	0.57	150	5	2015
Giudici G	1	2	0.25	127	2	2018
Martinazzi S	1	2	0.25	127	2	2018
Adhami S	1	1	0.25	126	1	2018

D.W. Arner is ranked first according to the top five author list in panel A. one of his main contributions is drivers of financial inclusion and compliance with sustainable development goals (SDGs) [34]. Furthermore, his work covers the protection against fraud and detection through digital identity infrastructure to fulfil the obligations of knowing

your customers [35]. He also worked on fintech regulations, digitalisation of manual reporting, and compliance processes such as regtech (regulation technology) [36–38]. In panel A, R.P. Buckley (ranked second) collaborated with D.W. Arner in most of his work [39]. His work as the principal author is related to dependence on digital technologies and cybersecurity during the time of the COVID-19 pandemic [40]. With D.W. Arner, he worked on regtech to control systematic risk in financial crisis, data protection rules, and electronic identification legislation [41]. P. Gomber in Panel B has the highest rank concerning the number of citations. His most cited work is related to technology innovation, transformation, and disruption in financial services [42]. The common name in both panels is R.J. Kauffman, with five publications from 2015. He is the second-highest cited author in the field of fintech in computer, social, and environmental sciences. His apparent work represents the computational social sciences [43] and the changing environment concerning payments through cards [44].

The most cited publication is done by S. Adhami, with only one publication in 2018 and with a total number of citations of 126. He is the fifth most highly cited author because he has produced only one publication in fintech technologies. His work is about the ICOs phenomena, and he addressed the success of token offerings [45].

### 3.1.3. Most Relevant Affiliations

This section deals with the most relevant affiliations. As shown in Figure 4, Bina Nusantara University is the core affiliation, with 33 publications in fintech technology. The university evolved from a computer training institute founded on 21 October 1974 [46]. The affiliation conducts studies on asset backed tokens with blockchain networks [47], consumer protection in lending transactions [48,49], mobile payment application and acceptance [50], and unified theory of acceptance and use of technology [51].

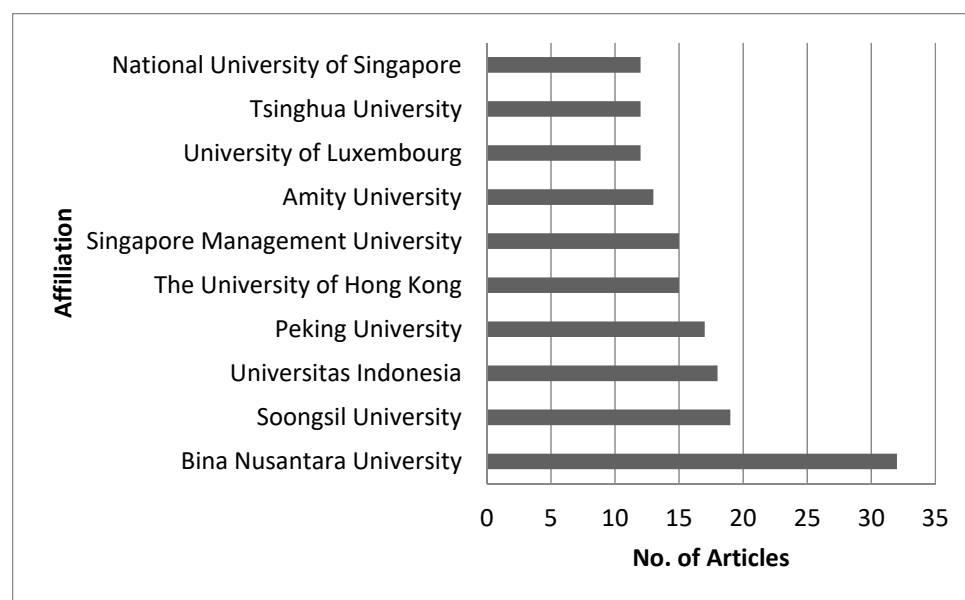


Figure 4. Most relevant affiliations.

Soongsil University is the second-largest affiliation with 18 publications. The university was founded in 1897 by William M. Baird as a private school. Soongsil pioneered a computer science program in Korea, ranked number two in Seoul National University [52]. The main topics that Soongsil University covers are small foreign currency remittance with blockchain technology [53], machine learning and adaptive fintech security provision [54], the emergence of mobile-accessible payment services [55,56], and peer to peer (P2P) lending applications [57]. In third place, Universitas Indonesia published 17 documents. The significant studies conducted are related to the effect of fintech on stock returns [58], fintec-



based financial instructions, financial performance and consumer behaviour [59] and P2P lending, and women's empowerment [60].

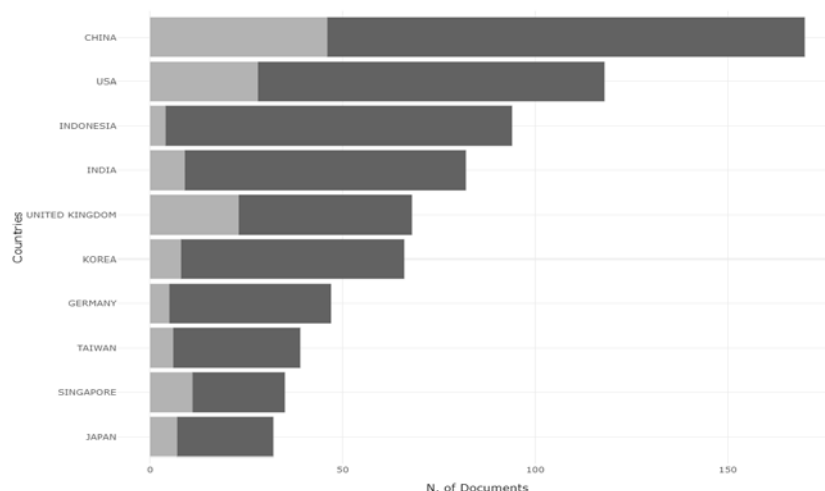
### 3.1.4. Influential Countries

Concerning Table 4, the USA and China are leading in terms of citations and number of publications. It is seen that China has well over 400 publications, which is 41% higher than the USA's number of publications. Still, on the other hand, in the citations section, the USA has published some of the most fascinating and citable work in fintech and has secured 742 citations. China has 419 publications got 457 citations. There are 114 publications from South Korea; however, the country earned 411 citations. The UK is in the third position in terms of publications; however, UK publications obtained 394 citations. Indonesia and India are in the fourth and fifth positions in terms of publications; however, these countries are not on the citations list. In contrast, Italy and Taiwan are the last two countries in terms of the number of publications. However, a small number of publications from these two countries have significant contributions, as their publications are cited significantly.

**Table 4.** Core Countries in Terms of Number and Citations.

Country	Total Citations	Country	Number of Publications
USA	742	China	419
China	457	USA	296
South Korea	411	UK	189
United Kingdom (UK)	394	Indonesia	171
Germany	376	India	157
Italy	288	Germany	117
Taiwan	211	South Korea	114
Switzerland	185	Australia	97
Hong Kong	168	Taiwan	87
Spain	144	Italy	75

Figure 5 represents the top 10 corresponding author countries, and it is divided into two parts. The figure's first part shows that the orange colour represents many multiple country publications (MCP). These publications are collaborated on by at least one foreign country author. Bars in green represent single country publications (SCP), where correspondence and collaborations are from the same country [61].



**Figure 5.** Corresponding author country.

As shown in Figure 5, China has the highest number of both SCP and MCP. The country has produced 170 corresponding articles, of which 124 are SCP, and 46 are MCP.

USA comes in second place with 118 corresponding articles, 90 SCP, and 28 MCP. The exact amount of SCP is produced by Indonesia (ranked third); however, it lacks in MCP with only four publications. India (ranked fourth) and the United Kingdom (ranked fifth) have more inter-country collaboration than Indonesia. India has 9 MCP, and the United Kingdom has 23 MCPs.

### 3.1.5. Keyword Analysis

Keywords are an essential factor in searching the literature. We have found essential keywords in fintech literature, shown in the shape of word clouds in Figure 6. It is evident that fintech is the main keyword for the literature; our focus is on other keywords representing various topics or fields. In the abstract, financial is the most commonly used keyword in studies relating to technology, market, and blockchain. Similar keywords are found in the study's title; besides, the title covers keywords related to the digital market and banks, as shown in Table 5.

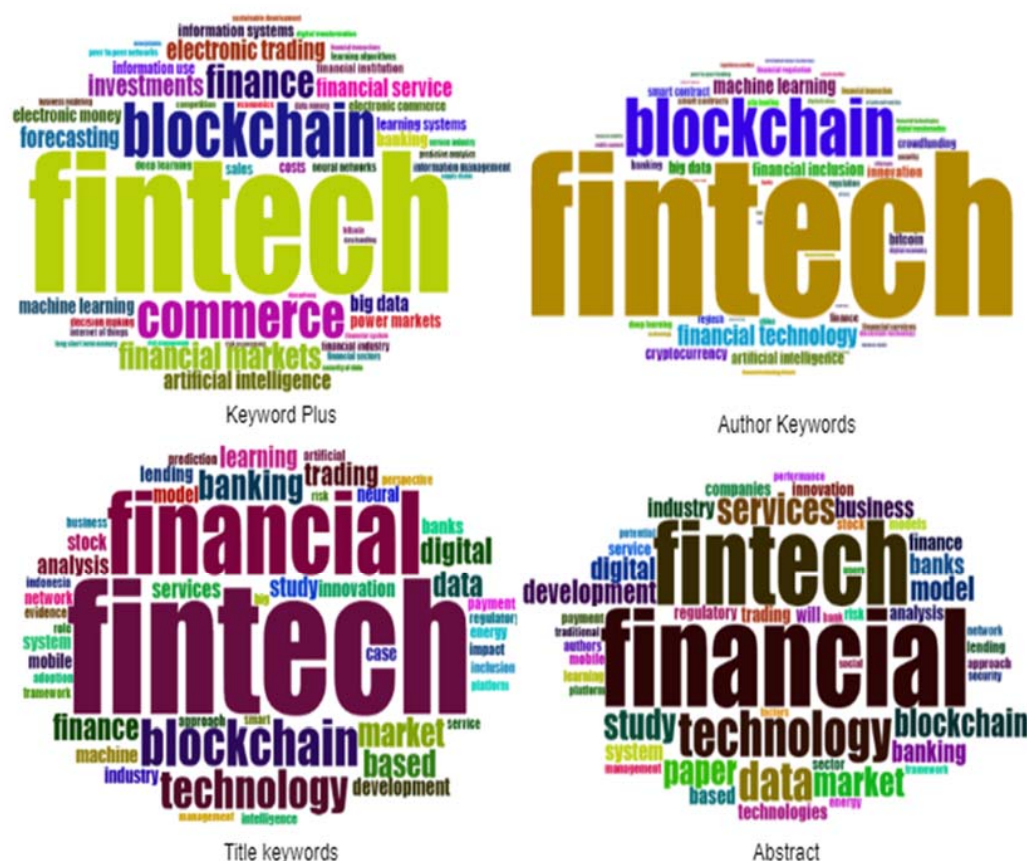


Figure 6. Word clouds.

Keyword plus author represents authentic fintech topics such as financial markets, investments, electronic trading, artificial intelligence, financial services, blockchain, and commerce. In addition to keyword plus author, keywords represent thematic topics in fintech such as blockchain technologies, financial technology, machine learning, financial inclusion, big data, artificial intelligence, and cryptocurrency bitcoin fintech innovation.

This study suggests that author keywords represent significant and authentic keywords compared to other sources, and these keywords cover and analyse a wide variety of topics in fintech. We can find and propose key themes and streams in fintech in computer, social, and environmental sciences by analysing the author's keywords.



**Table 5.** Research stream of Fintech literature.

Keywords	Clusters	Research Stream
Blockchain, bitcoin, cryptocurrency, entrepreneurial finance, smart contracts, security, internet of things, venture capital, the financial industry	Red	Cryptocurrencies, smart contracts, and financial technology
Fintech, financial inclusion, regulatory sandbox, innovation, financial technology, big data, regulations, regtech, banking, artificial intelligence, financial# (regulations, innovations, service, and stability), digital economy, digitalisation, mobile payment, p2p lending, business model, digital finance.	Blue	Financial industry stability, service, innovation, and regulatory technology (regtech)
Deep learning, machine learning, financial technology, stock market.	Green	Machine learning, deep learning and artificial intelligence

### 3.2. Conceptual Framework

This section will study various themes and streams that are a significant part of the fintech literature. In addition to tools such as co-occurrence network, thematic map, and thematic evolution, we have proposed a potential future agenda for researchers, educationists, engineers, and policymakers.

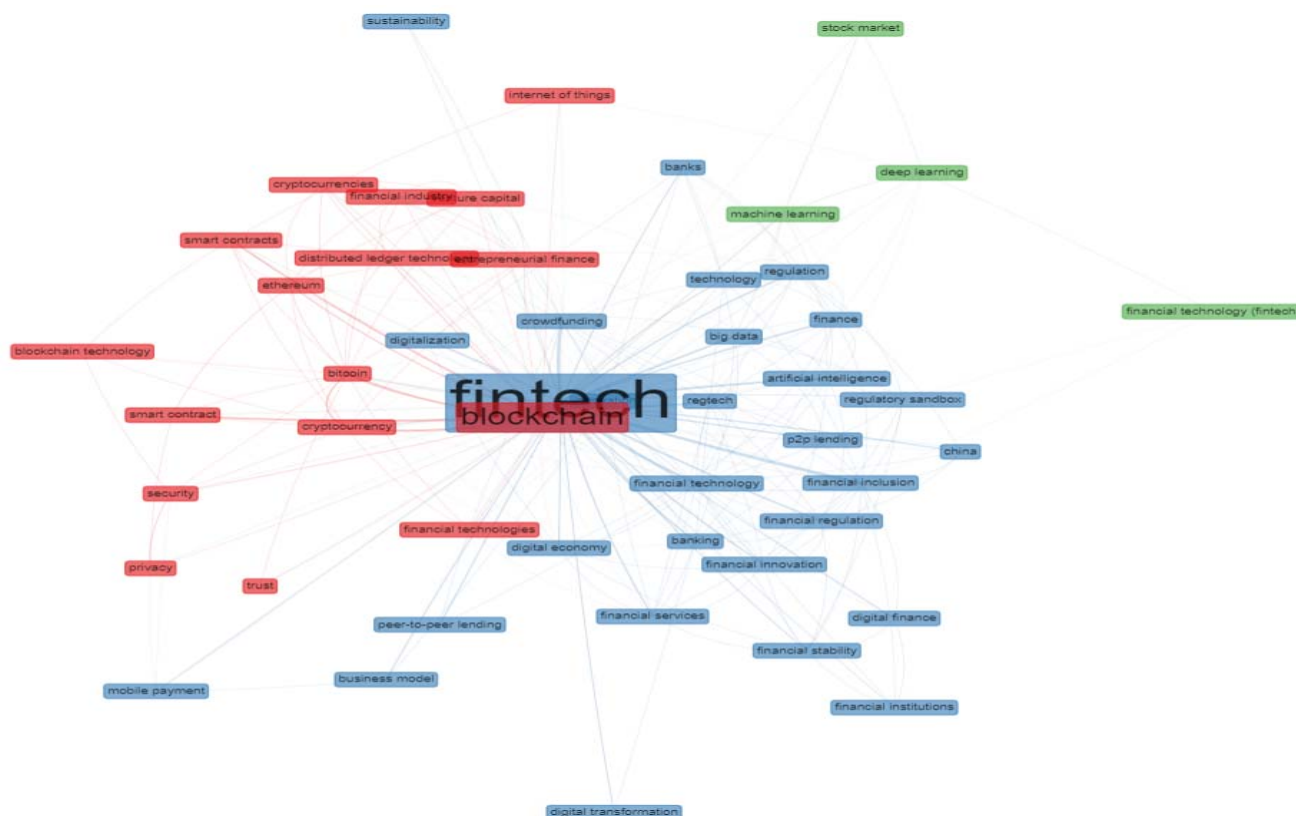
#### 3.2.1. Co-Occurrence Network

We have conducted the co-occurrence analysis using the author keyword and identified three main clusters of fintech literature, as shown in Figure 7. These clusters represent distinct research streams which can help the researchers to differentiate the literature significantly. A highly centralised cluster is a blue cluster representing the research stream we have given the name of digital transformation, innovation financial industry, and regulations. There are many topics to seek in this research stream, most prominently, the regulations related to analysing the application and implementation of fintech technologies. Skilful regulations are required for the outbreak of financial innovations throughout the economic systems [62].

Regulatory technology or regtech is a prominent topic that uses information technology for monitoring, compliance, and reporting [39]. Regtech is a better financial solution. Furthermore, certain shared ledger technologies provide potential solutions for finance and banking procedures [63].

Financial regulatory technology would help shape the digital currency's internationalisation by strengthening blockchain's legal context [64]. Tsai et al. [65] introduced the framework for online supply chain finance for small and medium enterprises and suggested replacing it with a traditional supply chain financial mechanism. The innovative regulatory framework streamed by fintech provides a conducive innovative environment, protecting consumer rights and ensuring financial stability with advanced ecosystems [66–72]. The red stream proposed by the co-occurrence network represents the overall research stream of financial technology in cryptocurrencies and smart contracts. Some of the literature is dedicated to the combination of the latest financial technologies and environmental sciences. Le et al. [73] studied the spillovers and connections among green bonds, fintech, and cryptocurrencies, and found long term hedging benefits among them. Many traditional offline activities have been become easy, comfortable, and secure with the penetration of blockchain technology. Rao et al. [21] suggest that the Ethereum blockchain has made e-voting secure and transparent. It has enhanced the scope of smart contracts. Fintech technologies have helped to develop new innovative financial products that transform traditional payment systems into mobile-based application payment systems [74]. Various fields of research are yet to be explored in fintech in relation with the blockchain technology.

Nasir et al. [55] studied blockchain technologies' core theme and research streams, and identified fintech technologies as the key emerging and developing theme. A part of fintech is about making smart contracts, and from the passage of time, the smart contract procedures have evolved significantly. They have become secure, regulated, and user friendly [75,76]. Fintech is making progress in preserving the environment. Hu et al. [77] proposed the trading system that is blockchain distributed carbon emission.



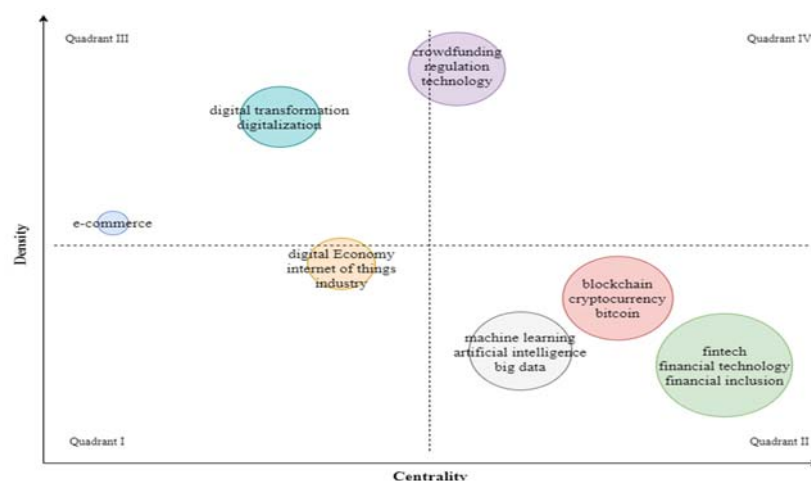
**Figure 7.** Co-occurrence network.

The green research stream is away from centrality, indicating that some potential topics can set the future research agenda. The stream relates fintech literature with machine learning, deep learning, and stock markets. Certain studies study machine learning techniques to simplify, develop, and increase the online financial market trading systems [6]. Oliveira et al. [78] use machine learning techniques such as the k-mean algorithm, long short term memory (LSTM), and the density-based spatial clustering (DBSC) algorithm to forecast stock market price movements. Abe et al. [79] deploy deep learning on cross-sections of various stock markets with multifactor models and indicate that deep learning is a significant model for the prediction of the cross-section of stock returns. There is a substantial development in the machine and deep learning techniques to propose the prediction model for stock markets [80–82]. Machine learning is also helpful in portfolio risk management [83].

### 3.2.2. Thematic Map

We have a thematic map (Figure 8) in the study that proposes research themes according to four quadrants. According to Nasir et al. [14], the thematic map divides themes according to two factors (centrality and density). Centrality represents the high volume of work in a specific theme, and density means the importance of a particular theme. The first quadrant in Figure 8 indicates low-density themes with low centrality. These themes are either new, developing, or emerging because they have low density and low centrality. The

second quadrant represents basic themes that provide high volume (centrality) but that are less critical (density). The third quadrant represents essential themes in the field; however, less work has been done in such areas. This field should be discussed significantly because these themes can provide potential future directions. The fourth quadrant has themes with both high centrality and density.



**Figure 8.** Thematic map.

Digital economy, internet of things, and financial industry-related themes are in the first quadrant. These keywords represent the topic with low centrality and low density. These themes either emerge as a strong future agenda or drop out from the future literature.

In the digital economy, Rozi et al. [84] study innovations and privacy issues for startup companies. In the digital economy era, Jiang et al. [85] analysed the significant risk profile by deploying conditional value at risk models on China's financial banks and found significant systematic risk exposure of small banks compared to big financial institutions. The digital economy is possessed with considerable challenges, such as centralisation of technology, trust, and security; e-commerce transactions are shaping the digital economy's future. Ferrer-Gomila [30] uses the blockchain for contract signing between various parties, making e-commerce transactions easy and cost-effective. One of the emerging topics is industry 4.0. Li et al. [86] use blockchain for immutable, secure, transparent, and auditable peer to peer energy transactions in the industrial internet of things. Moreover, the industrial and financial internet of things is discussed by [87–90].

The basic themes of fintech literature are filled with various significant topics. It is obvious that, for topics related to financial technology, fintech will have strong centrality in the literature. Furthermore, in recent times, blockchain technology for auditable, immutable, transparent, and secure transactions is considered the main fintech tool [91–95]. The blockchain also reduces financial comfort and cost efficiency, as Šapkauskienė [92] studied initial coin offerings of new companies and explained how blockchain reduces cost with ICOs. Machine learning, artificial intelligence, and big data themes are also common in the fintech literature. Significant machine learning literature is related to estimating the movement and pricing of financial assets [96–102]. Kulshrestha et al. [103] deploy technical, fundamental, and artificial intelligence to propose optimal portfolio performance. Big data is about considering various techniques to ensure the quality of the data and its estimations and prediction ability [104]. Fintech has a significant role in shaping the architecture of big data [105].

E-commerce is a highly developed theme; however, its centrality is very low. The growth of e-commerce is significant, and there is a lot to offer by deploying various fin-techs such as payment applications, blockchain, bitcoins, price disruption, and channel modelling [106]. Certain issues related to e-commerce business proliferation include online payment models and B2C market supply chain management [107]. There are certain gaps

and challenges related to digital wallet payments [108]. Government regulations and understanding of the mobile payment system is another challenge for e-commerce development [109]. Furthermore, fintech contributions in e-commerce is studied by [110–114].

Crowdfunding, regulations, and technology are the motor theme, which indicates high centrality and high density. In contemporary times, raising capital from many people to fund innovative projects is an integral part of startup growth. Jin [115] studies the various patterns of crowdfunding and the various stages of the project. Various technologies and topologies of crowdfunding are studied by [116]. Zetzsche et al. [117] consider studying crowdfunding and propose harmonising or standardising the crowdfunding procedure. It is the stepping stone towards developing and changing businesses' technological environments and significantly achieving entrepreneurial goals [118]. Regtech represents regulation technology and is mainly associated with data protection [41], algorithmic regulations [112], decentralized blockchain [70,118,119], financial markets and risk management [119,120], artificial intelligence [121], anti-money laundering [29], and superior supply chain management [122].

#### 4. Future Research

With the help of fintech literature, we can identify critical areas where further research can be pursued. The following are some recommendations for researchers, policymakers, academicians, and information technology people.

- Using financial technology to achieve sustainable development goals;
- Identify limitations and proliferate industry 4.0 with the internet of things, blockchain, and digital transformation mechanism;
- Will the world see fintech as the opportunity for a new era after the COVID-19 outbreak, or are there challenges ahead;
- Ecommerce proliferation: gap-filling regarding government regulations regarding online payments, supply chain management, blockchain and bitcoin penetration, product differentiation, logistic financial methods, fraud detection, safety policies, law enforcement, ease of startups, and reshaping financial orders;
- Identify and implement various crowdfunding techniques such as blockchain and bitcoin investment with proper regulations to fund multiple new ventures;
- Implementing fintech tools in Islamic banking and finance. Digital transformation of Islamic instruments such as Mudarabah, Musharakah, Islisna, Salam, Ijarah, Sukuk, and Takaful;
- In developing models, applications of fintech technologies, especially blockchains, ensure standard recording, reporting, and companies' disclosure requirements such as technological transformation regarding corporate governance-related recordings [123];
- Using fintech, such as machine learning and neural networks tools, develops banking operations such as know-your-customer, risk management, and forecasting;
- Analysis of Asset pricing models, such as Fama et al.'s [124] three-factor model and five-factor model [125], and other models [126–129], using machine learning [130,131], artificial intelligence [132,133], and deep learning techniques;
- Identify opportunities, gaps, and challenges for implementing and developing regulatory technology.

#### 5. Limitation of Study

- The search query is conducted at one point in time, i.e., 17 March 2021; this is a limitation because these studies may change as new literature may be added on future dates.
- There is limited literature available on fintech literature related to social and environmental sciences. More literature will refine the concept.

## 6. Conclusions

The study suggests that fintech is the future of business, economy, and information technology, and will help preserve the world's environment. The research indicates various influential and conceptual aspects of the fintech literature from the past decade. We have discovered some of the core factors of fintech literature. It is worth considering that the development of fintech is contemporary, and research has grown substantially in recent years. Among influential aspects, it is observed that the ACM International Conference Proceedings is the core source of fintech publications. It is the source with the highest impact in fintech literature is Electronic commerce research and applications. D.W. Arner is the most prolific author in fintech publications, while P. Gomber can capture the highest number of citations in the field of fintech. With 33 publications, Bina Nusantara University is the top affiliation. Among top countries, China, the USA, and the UK scored in the top three in terms of publications; however, the USA scores total citations.

Overall, China is the core country, ranked first with the highest correspondence in multiple and single country publications. We have addressed conceptual aspects of fintech literature with a co-occurrence network and thematic map. We have shortlisted three main research streams of fintech literature to narrow down. The first research stream is 'cryptocurrency, smart contract, and financial technology.' The second research stream is 'financial industry stability, service, innovation, and regulatory technology (regtech).' The third research stream, which divides the overall fintech literature, is 'machine learning, deep learning, and artificial intelligence.' These research streams have narrowed down the vast literature of fintech into parts to understand mechanics. We further conceptually differentiate the fintech literature in terms of emerging, basic, isolated, and motor themes. We found that blockchain, cryptocurrency, financial inclusions, machine learning, artificial intelligence, and big data-related topics have high centrality and low density in the fintech literature. It may be difficult to find gaps in said topics. E-commerce is a highly anticipated topic as it is isolated with low centrality and high density. The digital economy, internet of things, and financial industry in fintech are emerging and dropping themes. Crowdfunding and regtech are motor themes with high centrality and high importance.

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