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Assessing The Evolution of Fintech Adoption In Traditional Banking: A Bibliometric Analysis Using R

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Abstract

The purpose to find scientific research publications of Fintech (financial technology) applications in banking institutions in the areas of artificial intelligence, machine learning, blockchain, and big data. The methodology includes bibliometric analysis in the scientific literature of Fintech application in banking institutions. The data of this study comprises relevant articles obtained from the Scopus database from 2016- 2022 using the RStudio programming. Results show the remarkable rise of scientific publications in Fintech after 2019, mainly in the fields of crowdfunding, digital finance, payment system. The two main centers of Fintech application research are China and the US. The influential studies are on Fintech and banks, authors and the distributions of scientific research are from China and the US. Citations and author's impact are very high in China and the US. **Originality –** The study contributes to the literature of bibliometric analysis of Fintech applications using the R-Studio program from 2016 to 2022 in banks related to artificial intelligence, machine learning, blockchain, and big data.

Keywords: 'Fintech, Bank, Artificial Intelligence, Blockchain, Big Data.

1. INTRODUCTION

Fintech is widely used in many banks as cost-effective, improving bank efficiency, increasing profitability, enhancing capacity, taking competitive advantage, etc. (Dabbeeru & Rao, 2021). The Fintech term and its origin traced back to the 1990s, its evolution initiated in 2008, contributed through various development stages, and emerged as a 21st century technology service for start-ups, new entrants, artificial intelligence, machine learning, big data, blockchain, etc., but it has attracted the banking industry since 2014 (Varma et al., 2022). Varga (2017) claims

that bank and start-up investment has fueled the growth of fintech development, with funding growing dramatically during the pandemic due to increased demand for mobile banking and competition. When utilizing advanced technology, banks must prioritize their competitiveness in increasing efficiency and cost-effectiveness (Siek & Sutanto, 2019). Growth and competitiveness are generated by fintech development since it increases bank efficiency (Singh & Jain, 2021). Fintech growth in banks is a crucial component of the developing financial markets, and the primary drivers of fintech applications include big data, blockchain, artificial intelligence, and machine learning (Siek & Sutanto, 2019).

The literature on scientific research covers a wide range of issues and is divided into many areas. But the particular focus of this study is on how fintech adoption has changed within conventional banks. Scientific research material is mostly sourced from scholarly journals that are accessible through online databases like WoS, Scopus, etc. To ensure full understanding of the subject, particularly fintech adoption in banks, as utilized in this study, it is essential to integrate these resources.

Depending on the topic and the particular area of research, there are differences in identifying the "leading" authors in scientific journals. On the other hand, a few names are well known for their important contributions and influence in a number of scientific fields. These people, along with a great number of others, have significantly influenced their disciplines by their study, findings, and contributions to scientific publications. Current and future generations of scientists are influenced and inspired by their work, especially those notable authors on fintech adoption research who have had a significant impact on the banking industry and are taken into consideration in this study.

The field of study, the type of research, etc., can all have a significant impact on the distribution and impact of publications over time. In this study, banks take into account developments in fintech when measuring various metrics, including citation counts, h-index, and journal impact factors, in an effort to quantify the impact of publications. A systematic bibliometric review might be helpful in understanding the development of fintech in order to completely comprehend a variety of qualitative and quantitative elements as well as the interactions between banks and fintech.

The purpose of the study is to examine how the literature on scientific research has evolved over the past ten years via significant fintech research conducted by a good number of notable authors and their impacts on publications over time. Fintech is widely used in banking institutions, however there are still obstacles in the way of realizing its full potential. This raises a concern about whether the banking industry has reliable information when making policies that transform traditional business practices and to understand that the main forces at work, including big data, blockchain, artificial intelligence, and machine learning, offer the possibility for banking systems to achieve desired levels of fintech services.

2. LITERATURE REVIEW

Fintech (Financial technology) transforms the banking industry and banks (Martincevic et al., 2022) are accepting this change and adapting Fintech in their banking products and services (Kumar et al., 2022). They applied qualitative analysis using Google Scholar with the help of

document and citations analysis of referred journals and authors of leading countries. They found significant topics of artificial intelligence, blockchain and robot-advisory and their usage in banking management. Brika (2022) studied bibliometric analysis of Fintech trends and digital finance. He used the Science Direct database of 343 articles using content analysis. The objective was to summarize how scientific research has developed on the connection between Fintech and digital finance. The method was a bibliometric measurement approach and analyzed publications in the database. They found the trend has been increasing on using digital finance, but publications have declined since 2006.

Cuenca-Jimenez (2022) examined bibliometric analysis of financial services technology companies between the periods of 2008- 2021. The objective was to summarize scientific literature on Fintech for financial services. Method was collecting previous studies from the Scopus and Web of Science database. Their results disclose that attention is growing towards the study of Fintech as publications have been increased and this will support a better understanding of Fintech development which has a potential social impact, efficiency of financial markets, and mitigation of transaction related risks (Thakor, 2019).

Ali et al. (2022) studied bibliometric analysis of microfinance on a global trend. The method was quantitative using the Scopus database. The objective was to analyze historical trends of publications, authors, journals, renowned academic institutions and highlight the shortcoming of the Scopus database. Their analysis shows emerging Fintech, crowdfunding, and financial literacy but limited attention towards using them for poverty alleviation. Li and Xu (2021) examined Fintech bibliometric and science mapping analysis. The objective was to systematically analyze the past and present studies of Insights in Fintech. The method was bibliometric and science mapping analysis obtaining data from the Web of Science. They took 848 publications and fundamental characteristics they analyzed are types, annual publications, hot research directions, countries, institutions, authors and journals. Their findings reveal the cited authors, journals, and references that help scholars find appropriate research entry points and conduct in-depth research.

Nobanee (2021) examined big data in Finance and method was bibliometric analysis to highlight the current trends. Their findings suggest a future research agenda in this field. Martínez-Climent et al. (2018) studied financial return crowdfunding and the aim was how crowdfunding generates financial return. The method was analyzing articles published in Web of Science in the field of crowdfunding. Their findings suggest future research. Yao and Song (2021) studied the impact of Fintech on different sizes of banks economic capital through the application of Fintech. The method used the GMM estimation technique from 2011-2019. They found large banks have benefits in scale, capital and experience compared to small and medium size banks. Also, findings show that the impact of Fintech is significantly heterogeneity on the profitability of different types of banks (Saphyra et al., 2021).

Yao and Song (2021) examines the relationship between Fintech and economic capital of commercial banks in China. The method was a panel dynamic system method of moment approach for the period 2011-2019. They found Fintech has reduced cost of information on both sides of the transactions, increased the transparency, and reduced the economic capital. The

study also found that Fintech provides a large amount of data for banks to conduct market analysis, makes banks profit driven preferences, and higher risk tolerance. The impact is different depending on the size of the banks. Nguyen et al. (2020) studied Fintech applications for the modernization of the banking system in Vietnam. The method was based on a survey on 40 experts and their findings suggest that Fintech companies in Vietnam faced challenges in legal corridor, infrastructure, Fintech companies, customers and human resources which are very low and need to be better addressed in the future to support modernization of the banking system (Thakor, 2019).

Bholat & Susskind (2021) studied on artificial intelligence and financial services. They found the effect of AI on financial services is transformative, but the impact remains complex and uncertain. Dashottar & Srivastava (2020) studied the use of blockchain on credit decisions although blockchain has leveraged the effectiveness of corporate banking products. Their findings suggest improving the regulatory framework using Regtech (regulatory technology) to support unified data available in the banking system which will help make more informed credit decisions. Chang et al. (2020) examined the application of big data and IoT (Internet of Things) by banks. Their findings suggest that the banking industry frequently generates big data from off and online channels and social banking activities. Banks can use big data to reduce financial risks, develop more accurate marketing strategies, reduce transaction costs, and provide better service to customers (Sanga and (Aziakpono, 2023).

There are a good number of studies on bibliometric analysis in Fintech such as Fintech and Islamic Finance, Fintech companies, Fintech and micro-finance, Fintech and crowdfunding, Supply Chain and Finance using big data analytics. But very few studies are found on specific bibliometric analysis of Fintech and banking. However, no studies are found on bibliometric analysis of Fintech application in banking which means literature is still insufficient in scientific publication and not systematic in this area. The author has considered this as a research gap, and to bridge this gap a bibliometric analysis needs to be performed from 2016-2022.

In the current study, Fintech application-related publications and researchers were subjected to structural categorical analysis. The following six basic research questions are formulated to address.

RQ1. How has the literature on scientific research developed between 2016 and 2022?

RQ2. What are the most leading authors?

RQ3. What are the major studies in Fintech application?

RQ4. What are the distributions and impacts of publications over time?

RQ5. Are the results compatible with Lotka's Law?

RQ6. Are the results compatible with Bradford's Law?

3. METHODOLOGY

Fintech has been applying in different fields as it is not limited to only business and economics. Following Ali et al. (2022) and Brika (2022), a keyword search with only Fintech, there are 2385 documents published in Scopus database (limiting with business, finance and economics, there

are only 860 articles). As our study is focused on purposely in the banking industry, we applied specific keyword search. The keyword search with 'artificial intelligence AND bank' (16 articles) 'machine learning AND bank' (33 articles) 'big data AND bank' (11 articles) and 'blockchain AND bank' (22 articles) provide very few articles in the Scopus database. However, when we apply keyword search with 'Fintech AND bank' there are 85 articles, keyword search with 'Fintech and application' there are 7 articles, keyword search with 'Fintech application AND banking' there are 2 articles, keyword search with 'Fintech application' there are 3 articles.

Since the keywords search with 'Fintech and bank' has 85 articles including all other articles related to Fintech application in banks under different keywords search. Therefore, this study considers applying RStudio programming for bibliometric analysis of 85 articles (Cuenca-Jiménez, 2022). Database selection is from the Scopus which is a large database for bibliometric analysis. The author has applied automated search of relevant articles from the Scopus database, manual filtering of those articles limiting subject area to Economics, Econometrics, Finance, Business, and Management including the keywords limited to Fintech, Banking, Banks, Bank, Application, and the language is English with only articles.

4. RESULTS AND DISCUSSION

Scientific Productions on Fintech and Banks

The table 1 shows annual scientific publications have increased gradually from 2016 (only 1 publication) but there was a rapid change in publication in 2020 (18 publications), 2021 (25 publications) and 2022 (32 publications). So, Fintech and bank related articles published highly in the last few years as it has been drawing attention for banking industry development. There was a growth and an increasing trend since 2016 in Fintech and bank related scientific research publications.

Table 1. Annual Scientific Productions

Year	Articles	Percentage	Cumulative (%)	Growth (%)
2016	1	1.17647059	1.176470588	-
2017	2	2.35294118	3.529411765	200
2018	3	3.52941176	7.058823529	100
2019	4	4.70588235	11.76470588	66.66667
2020	18	21.1764706	32.94117647	180
2021	25	29.4117647	62.35294118	89.28571
2022	32	37.6470588	100	60.37736
N	85			

The table 2 under the following shows average citation per year per article. As the number of publications was very low in 2016-2019, average citation was higher than the later years in which publications have been increasing rapidly. However, average citation has been increased from 2020 onwards.

Table 2. Average Citations Per Year

Year	N	Mean TC per Article	Mean TC per Year	Citable Years
2016	1	37.00	6.17	6
2017	2	49.00	9.80	5
2018	3	87.33	21.83	4
2019	4	7.75	2.58	3
2020	18	6.00	3.00	2
2021	25	10.04	10.04	1
2022	32	1.84	-	0

Most relevant sources

The following figure 1 represents the most relevant sources of Fintech and bank related scientific research have been published. The highest is the Finance Research Letter (6), then Financial Innovation (4) followed by Business and Management (2), International Journal of Electronic Finance (2), International Journal of Islamic and Middle Easter (2), International Review of Financial Analysis (2), Journal of Banking Regulation (2), Journal of Payment Strategy and Systems (2), Technological Forecasting and Social Change (2) and the remaining articles have each with one publication.

Figure 1. Most relevant sources

Bradford's law

The following table 3 shows source clustering using Bradford's law. Out of 85 relevant sources on Fintech and bank related articles, Bradford's law trends them from top down and of them first ten publisher's names are presented in the table. Finance Research Letters are still highest for sources followed by Financial Innovation the second.

Table 3. Source Clustering Through Bradford's Law

source	rank	Frequency	Cum. frequency
Finance Research Letters	1	6	6
Financial Innovation	2	4	10
COGENT Business and Management	3	2	12
International Journal of Electronic Finance	4	2	14
International Journal of Islamic and Middle Eastern Finance and Management	5	2	16
International Review of Financial Analysis	6	2	18
Journal of Banking Regulation	7	2	20
journal of Payments Strategy and Systems	8	2	22
Technological Forecasting and Social Change	9	2	24
Accounting and Finance	10	1	25

Most relevant authors

The following table 4 shows the most relevant authors clustered through Bradford's Law. In the author information, as the most relevant author is shown in the table 4 below, Barber H. is on top by publishing 3 articles and other 9 authors in a row published 2 articles each.

Table 4. Relevant authors

Authors	Articles	Articles Fractionalized
Baber H.	3	3.00
Banna H.	2	0.58
Brochado A.	2	0.67
Campino J.	2	0.67

Kowalewski O.	2	1.00
Jiu J.	2	0.67
Pisany P.	2	1.00
Rabbani M.R.	2	1.50
Rosa A.	2	0.67
Shen Y.	2	0.67

Lotka's law

The Lotka's law presented in the Figure 2 shows the author's productivity through frequency of publication during the period of 2016-2022. The figure shows the productivity of 92% where authors (95) published scientific research articles on Fintech and banks. Proportion is very high on a single topic, only 6% authors (14) published scientific articles related to Fintech and less than 1% author (1) published article in another topic related to Fintech.

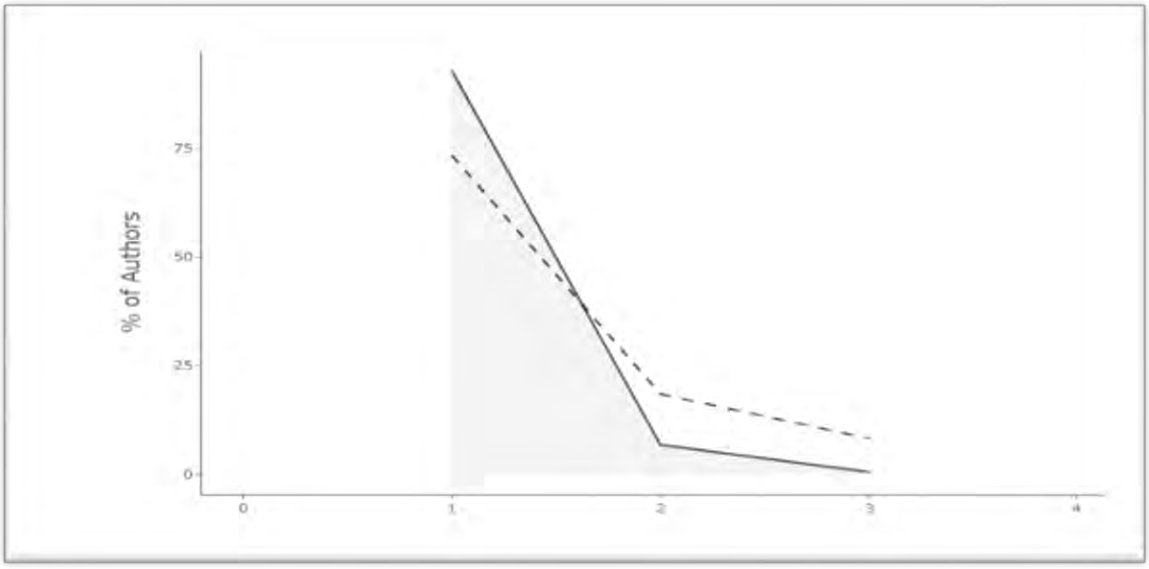

Figure 2. Author Productivity Through Lotka's Law

The most cited 10 authors and their impacts through h- index ((shows in table 5) which is a measure for a scientist's productivity and impact. Here, the most cited author is Baber H. (25 citations) for 3 publications. Banna H., Liu J., Rabbani M.R. and Wang R. are the second highest cited authors with productivity of 2 publications each in the year of 2020 and 2021. Agarwal S., (15 citations) and Ali M.H., (10 citations) for 1 publication each are also the most cited authors.

Table 5. Author's Impact

Authors	High Index	Total Citation	Number Publication	Publication Year
Baber H.	3	25	3	2019
Banna H.	2	15	2	2021
Liu J.	2	24	2	2020
Rabbani M.R.	2	18	2	2020
Wang R.	2	27	2	2021
Agarwal S.	1	15	1	2020
Ahmed R.	1	6	1	2022
Alam M.M.	1	4	1	2021
Alam M.R.	1	6	1	2022
Ali M.H.	1	10	1	2020

The figure 3 below shows the affiliation of the most cited authors by ranks of which University of Economics and Law has 7 articles published (2022) followed by Southwestern University of Finance and Economics (5 publications), Universitas Indonesia (4 publications), ZheJiang University of Finance and Economics (4 publications), Erasmus University Rotterdam, Hunan University, Imam Abdul Rahman Bin Faisal University, ISCTE- Instituto Universitário de Lisboa, Jilin University, Murdoch University each with 3 publications.

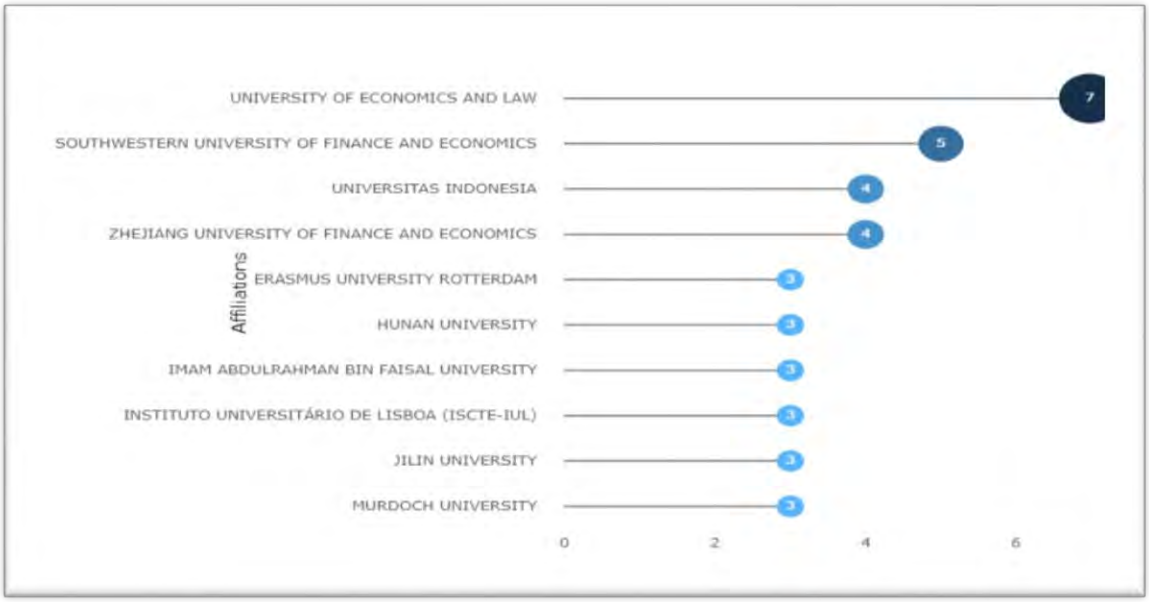

Figure 3. Author's Affiliation

Country scientific production

The Figure 4 below shows the country specific production where the articles published in Scopus database. Among them, the top scientific production represents in China (54), the US (22) is the second and third is Indonesia (13) followed by Italy, UK, Ukraine, and Malaysia each with 10 publications.

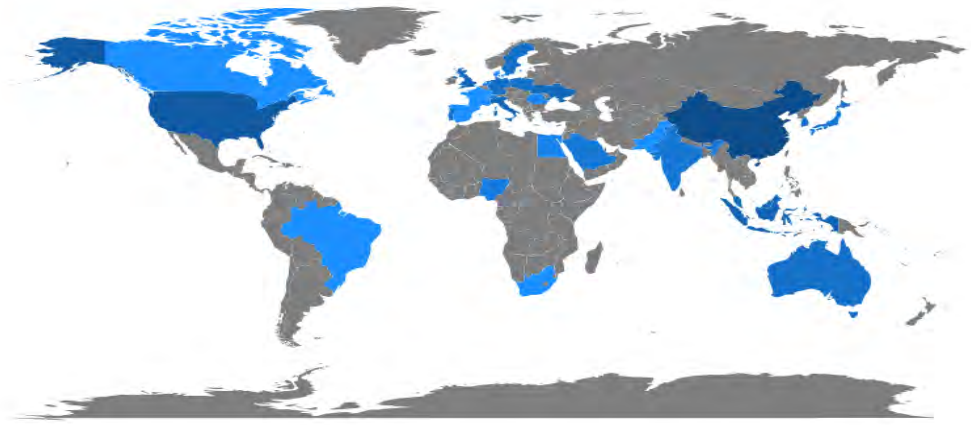

Figure 4. Country Scientific Production

Corresponding author's country

The corresponding author's country is shown in the Figure 5 below. According to figure 5, 16 articles have been published in China out of which 13 articles are SCP (single country production) and 3 articles are MCP (multiple country production) while in the US, out of 7 scientific publications 4 MCP and 3 SCP. From Asia, Indonesia, Korea, Malaysia, Vietnam, Japan, and Singapore are also included for corresponding authors but no MCP except Malaysia and Singapore. From Europe, Germany, Italy, Poland, UK, Sweden, Switzerland, Netherland are mostly with the SCP. Overall, China is the top for highest publications including SCP and the US is the second highest for MCP publications and Malaysia is the third for MCP publications.

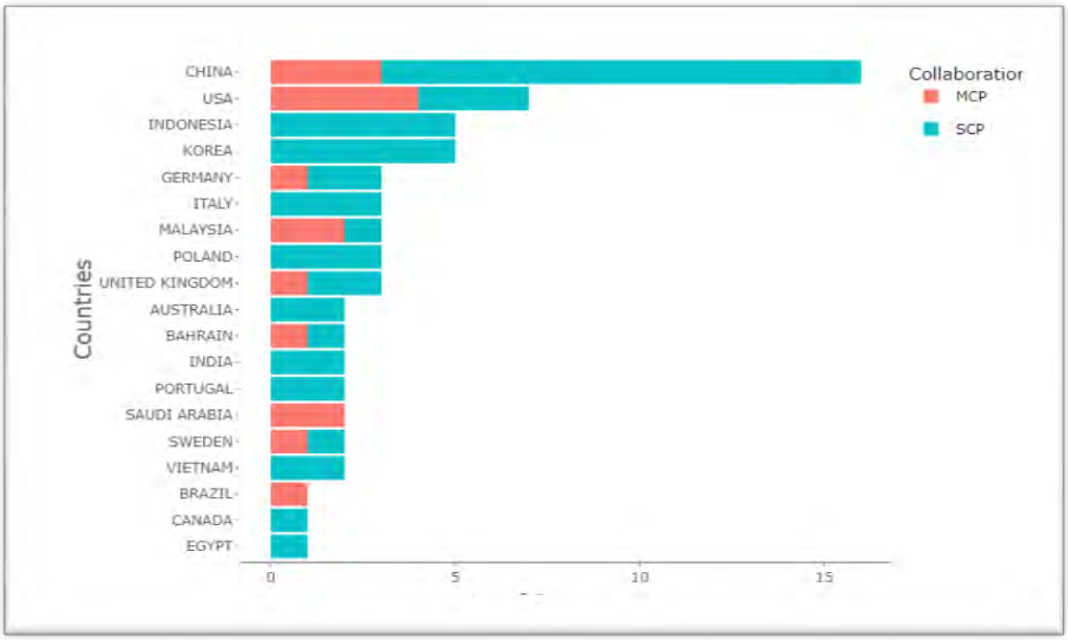

Figure 5. Corresponding Author's Country

5. CONCLUSION AND FURTHER RESEARCH

In conclusion, the study is focused on Fintech and bank related scientific literature on artificial intelligence, machine learning, blockchain, and big data that has been developed in the last 7 years from 2016-2022. Although there are very few articles published on artificial intelligence, machine learning, big data and IoT, blockchain application in banking industry but Fintech and bank related articles are a good number (85 scientific publications). The most influential studies are on finance, banking, payment system, technological change etc. and the leading authors are Baber H. with 25 citations for 3 publications, Banna H., Liu J., Rabbani M.R. and Wang R. are the second highest with productivity of 2 publications each. Agarwal S., with 15 citations and Ali M.H. with 10 citations for 1 publication each are also the most dominant authors. The main studies are modernization of commercial banking system, economic capital of commercial banks risk and promotion of Fintech application.

The distributions of literature on scientific research published related to Fintech and banking are mostly in Asia where China is on top followed by the US is the second. Indonesia, Korea, Malaysia have also contributed to Fintech related scientific publications. The impact of the publications over time are found as Baber H. (25 citations) for 3 publications, Banna H., Liu J., Rabbani M.R. and Wang R. are the second highest with productivity of 2 publications each. Agarwal S. with 15 citations and Ali M.H. with 10 citations for 1 publication each.

Both the Lotka's and Bradford's law support the compatibility of the results. Productivity is high which is 92 percent of scientific research publications on a single topic related to Fintech and bank. Author's impact is also very high with a good number of citations with the affiliation of the authors. However, there are scopes of doing scientific research on Fintech applications using cutting edge-technologies such as artificial intelligence, big data, machine learning, and blockchain in the future.

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