Accounting & Finance Review

IJAFR VOL 11 NO 1 (2022) P-ISSN 2576-1285 E-ISSN 2576-1293

Available online at https://www.cribfb.com
Journal homepage: https://www.cribfb.com/journal/index.php/ijafr
Published by CRIBFB, USA

FINTECH STARTUP: A BIBLIOMETRIC ANALYSIS AND NETWORK VISUALIZATION

Roucham Benziane [(a)1] *Sagou Roqiya* [(b)] *Mahmoudi Houcine* [(c)]

[(a)] *Associate Professor, Faculty of Economics and Management, Bechar University, Algeria; E-mail: roucham.benziane@univ-bechar.dz*
[(b)] *PhD Student, Faculty of Economics and Management, Bechar University, Algeria; Laboratory LESLOD; E-mail: sagou.roqiya@univ-bechar.dz*
[(c)] *Professor, Faculty of Administrative Science, AAEI Laboratory, African University, Adrar, Algeria; E-mail: houcine.mahmoudi@univ-adrar.edu*

ARTICLE INFO

Article History:

Received: 7th February 2022
Accepted: 29th March 2022
Online Publication: 13rd May 2022

Keywords:

Fintech, Startup, Bibliometric
Scopus

JEL Classification Codes:

E51, M13, C55, C81

ABSTRACT

This research aims to investigate the Fintech Start-up phenomenon and trends through collecting 124 manuscripts published between 2016 and 2021 in Scopus database, A bibliometric analysis was used with their two main divisions; performance analysis and mapping sciences to find out the most productive and influential studies, journals, authors, in addition, to examine the level of collaboration, various soft programs were adopted such as VosViewer for network visualization and Biblioshiny which is a web application based on R-studio and have required open-source codes that carried out by the authors for citation metrics, The findings have revealed that the most productive journal is Sustainability Switzerland but the most influential is Business Horizon, besides, Leong has the most publications while have the record citations and Muthukannan is the furthermost collaborated, Univ of Sydney is the most active University, However, result don't comply neither Lotka nor Bradford Law, U.S. has led the production and was reference in the field, new keywords have emerged approximatively to the field like business model, Ecosystem, Blockchain and Crowdfunding, the study recommends to explore the targeted field in specified time and data bases using another quantitative or qualitative tools with developed softwares.

INTRODUCTION

Today we are witnessing widespread disruptions in profoundly regulated sectors such as banking and finance, thanks to digital changes and the march of technological advancements as a result of the linking and development of financial services with technologies. This broad umbrella process is used to characterize technologies that have the potential to disrupt the financial services industry over the Globe. During the last financial crisis around the world in 2008, advancements increased finance circle and technology innovation, notably in E-finance and mobile technologies for financial institutions, and gradually emerging the formulation of finance technology activities and businesses associated with this domain through the collaboration and the availability of several factors we mention specifically Firstly, since the financial crisis of 2008, trust and assurance in mandatory service providers has decreased; the development of multiple high-profile financial scandals has nourished the demand to alternative finance (Gelis, 2016). Secondly, new financial goods and services (such as digital wallets) provide greater convenience, efficacy, and inclusiveness at a lower cost; reducing reliance on traditional institutions. Thirdly, the convergence of multiple technological advances, particularly the availability and affordability of infrastructure (like Internet, sensors, mobile technology), the maturing technological applications (e.g., extensive data analysis, platform), and business activities (e.g., sharing the economy) among others, this all propels Finance Technology.

This new statement challenges many traditional financial institutions, like banks, to develop their business models more practically (Davis et al., 2017). Meanwhile, such circumstances allow several finance technology startups to get an actual possibility to be formed and developed since innovation is likely to enhance strategic opportunities for new firms which makes startups more plausible to succeed, thrive and grow. It is stipulated further that when exogenous innovation

[1]*Corresponding author: ORCID ID: 0000-0001-5389-9839*

https://doi.org/10.46281/ijafr.v11i1.1715

To cite this article: Benziane, R., Roqiya, S., & Houcine, M. (2022). FINTECH STARTUP: A BIBLIOMETRIC ANALYSIS AND NETWORK VISUALIZATION. *International Journal of Accounting & Finance Review*, *11*(1), 8-23. https://doi.org/10.46281/ijafr.v11i1.1715

reduces the complexity and cost of client-servicing tasks, such a case renders advancement particularly advantageous to startups. It levels the playing field between large incumbents and small startup firms (Berman et al., 2022). Here, two kinds of startups are relevant to these researches and missions, the e-commerce and financial technology (Fintech) object of our interest (Suryono et al., 2020). Several accelerators/incubators have assisted startups, including those specializing in finance, serving co-working spaces, consulting, training, and networks to partnerships, investments, and potential customers. (Failory, 2022) has compiled a list of the 152 favored accelerators/incubators forming FinTech startups; these organizations consider the appropriate climate that has allowed the creation of business models for Fintech Startups like Small ticket loans, insurance services, Peer-2-peer lending, wealth Management , crowdfunding, e- banking, Payment gateways, Transaction delivery and capital market (Guest, 2022; Lee & Shin, 2018). Thus, startups saw this as an opportunity to enter the financial services industry outside of banks) (Zavolokina et al., 2016). FinTech businesses have become one of the most well-known startup subsectors (Harris, 2021); Crunchbase Institution has received an increasing number of worldwide Fintech Startups, reaching a 17% in 2018 (Crunchbase, 2020).

Fintech Startup issues piqued the interest of many researchers. They reflected the birth of scientific publication, which accompanies and assesses different experiments and practices conducted by fintech startups after recommending solutions for them. These valuable publications should be reviewed using both quantitative and qualitative methods. The Bibliometric analysis classifies the current literature by identifying the most notable pioneers of journals, authors, affiliations, and countries… As a result, it is feasible to anticipate the future of research more correctly, which will benefit researchers. The best method to carry out these tasks is the Bibliometric approach which exploits both main categories; performance analysis and science mapping; thus, the matter form that is necessary to be discussed and conducted here is Fintech Startup's Bibliometric analysis.

Importance of the Problem

The subject importance resides and inspires from the purpose importance and results targeted through the exploration and evaluation of the outputs topic statements and trends, which means interest to:

- Identifying the prominent authorship, sources, authors' affiliations Countries
- Mapping out the most influence between the items of each variable mentioned just above.
- Measuring the level of collaboration by using Network Visualization.

BACKGROUND

In fact, FinTech has been widely discussed in the news and communications media and has been fast consolidated in human life in recent years. Still, it is recorded less agreement on the term meaning in the scientific literature and on significant study issues and trends.

Early (Bettinger, 1972) was the first who mention FinTech as "a merger assembling banking experience and competence with information technology". Currently, Fintech has numerous definitions, stretching from the concatenation of the terms "financial" and "technology" (Hill, 2018).

Matveevskii et al. (2019) supposed that Fintech is a collection of technologies built around the Internet, computing equipment, and gadgets and dedicated to creating and selling financial services 24 hours a day, seven days a week. Also FinTech refers to how digital technologies like the Internet, mobile computing, and data analytics facilitate, develop, or disrupt financial services.

This development, previously according to financial institution function, was characterized by the classification of FinTechs into five different services: (1) financing (deposit, credit, lending, and capital-raising services); (2) payment, settlement, and clearing services, including Numeric currencies; (3) investment management (trading included); (4) insurance and risk management (E-Insurance) and (5) regulatory technology (Haddad & Hornuf, 2019; Lee & Shin, 2018; Thakor, 2020). Fintech has gone through three stages. However, by steps of formulation or development, Fintech has gone through three stages. FinTech 1.0 relied heavily on enabling technology such as the trans-Atlantic transmission line and mainframe computers. These technologies result in financial technology products such as SWIFT and ATMs. FinTech 2.0 focuses on the Internet and IoT, whereas FinTech 3.0 will focus on data technologies. We are currently in a transition era between FinTech 2.0 and FinTech 3.0 (Ahmi et al., 2020; Leong & Sung, 2018).

In the context of technology advancement, (Xia & Roper, 2016) have confirmed for small high-tech startups that exploitative partnerships are developed to commercialize their existing technology and secure their current Sustainability by increasing efficiencies in exploiting what they currently know about. According to James Bessen, between 1996 and 2006, the size of patent-holding startups, the same enterprises frequently regarded as the champions of innovation, increased significantly (Anderson, 2015). Blank and Dorf (2020) affirmed that a startup is not a smaller version of a large company. A startup is a transient organization digging for a scalable, repeatable, and profitable business model, which could specifically belong to the finance field where Fintech Startups act.

FinTech startups are new firms that provide financial services using FinTech (Gimpel et al., 2018), as the study has looked at the non-functional aspects of consumer-facing FinTech startup service offerings and presented a taxonomy; in addition, both (Haddad & Hornuf, 2019; Zarrouk et al., 2021) have looked into the economic and technical factors that have aided the growth of fintech startups, But exclusively, the case studies (Kijkasiwat, 2021; Leong et al., 2017) have highlighted the potential and obstacles that FinTech startups face in Thailand and China, respectively.

LITERATURE REVIEW

To measure and determine trends and create a comprehensive framework for startups Fintech; first we track both studies concerning Fintech and startups separately to get a deeper understanding of the topic and then assess the merger of those researches. In this circle, several studies, on the one hand, may use qualitative analysis like Literature Review (L.R.), Systematic Literature Review (SLR), Content Analysis (Q.A.), On the other hand, could use a Quantitative analysis such as Bibliometrics, Mapping and social networks techniques.

Numerous studies have sought a consensual and coherent definition of FinTech (Haddad & Hornuf, 2019; Milian et al., 2019; Thakor, 2020). Based on the economic function of firms that develop in this field, the research (Imerman & Fabozzi, 2020) has categorized the financial technology ecosystem into horizontal and vertical Fintech. While (Gomber et al., 2017; Suryono et al., 2020) Have identified a set of fintech research challenges and trends.

Moroni et al. (2015) has examined how a strategy centred on design-driven innovation might assist startups in developing design concepts or business innovators to enhance the long-term success of such businesses. While the research of (Tripathi et al., 2019) aims to determine the following: definitions of a startup ecosystem key factors that make up a startup ecosystem -roles that these elements play in the product development phases of startups. Then (Salamzadeh & Kesim, n.d.) have pointed out the lifecycle of startups to describe and comprehend them; the lifespan is divided into three stages: bootstrapping, seeding, and creation. Here, we have reviewed some studies that conducted a qualitative analysis of either Fintech or startup; although the increase of scientific contributions to fintech startups, no studies have provided a qualitative analysis using (L.R. and SLR) to evaluate scientific publishing on the topic to offer their conceptual framework.

As for the quantitative analysis, A few studies have used bibliometrics to examine Fintech but linked with other phenomena, block chain and digital finance (Aysan & Unal, 2021; Brika, 2022), but in different contexts; (Aysan & Unal, 2021) have selected the Islamic finance field. Ahmi et al. (2020; Tepe et al. (2022) and Wu (2017) have sought to identify the most influential research and authors in the FinTech field and the distribution and authorship citations either in the Scopus or Web of Science databases. Li and Xu (2021) have used science mapping analysis as an additional tool besides bibliometrics to present Insights and comprehensive analysis of FinTech; using the Scientometric Analysis (Xu et al., 2020) have mapped out the critical research fronts of Fintech.

Search Gap

However, no study is interested in Fintech startups using qualitative or quantitative measurements, which motivates us to select the bibliometric analysis method; the term "bibliometric" appeared for the first time in the Journal of Documentation (Fairthorne, 1969). Bibliometrics (referred to as Scientometrics sometimes) is a branch of statistics that focuses on quantitative analysis, the primary tool of information science. It does statistical analysis on data, such as the size of citations to journal articles. It gives accurate evaluation and broader research prospects from a different angle than the academician studies had thus far. While bibliometric analyses are gaining popularity, their novelty means that there are currently no studies that examine Fintech Startups directly. Therefore, our research aspires to fill this gap and deal with these entities by building a bridge between them and quantitatively deciphering this topic using bibliometric analysis.

METHODOLOGY

This study contributes to the current literature concerning the Fintech startup issue by extension examining the relationship between Startups and Fintech. The bibliometric study data are included in the overall research outputs on Startups and FinTech simultaneously in the Scopus database. The primary goal of adopting a bibliometric analysis approach is to gather prior literature and related subjects on the research issue to produce objective findings that can be checked and replicated. In addition, past studies are classified, and the research outputs are subjected to a rigorous methodological assessment and ensuring that the work adds to the existing body of new knowledge.

On the other side, Scopus provided the literature data for this article, and Numerous academics frequently choose Scopus for bibliometric review; this article's literature data came from Scopus, which is often referred to by academics for bibliometric assessment because Firstly, on the side of coverage, Scopus is more exhaustive than Web of Science (Falagas et al., 2008; Zhu & Liu, 2020). Secondly, it is highly mentioned by academicians (Martín-Martín et al., 2018. Thirdly, it offers more advanced exporting features than Google Scholar. Its exporting capabilities are more sophisticated than Google Scholar's fourthly, according to (Hallinger & Nguyen, 2020); Scopus was selected because its paper indexing follows a uniform standard.

Sampling Procedures and Data Collection

We have limited the research of fintech startups to accessible studies by title, abstract, and keywords for further determining relevant academic publications on the study subject; 2016–2022 is the time frame. (The data were collected in March 2022). As a result, a mass of 124 documents was downloaded.

Tools and Materials for Measurement

The techniques of bibliometric analysis have been adopted using software (Rstudio and Vosviewer, the formalization of the methods used was encoded by the authors see Appendix A&B); these techniques are manifested across two categories; the first one represents the Performance analysis which assesses the contributions of research components to a specific field, it is an ordinary practice in reviews to exhibit the performance of different research elements.

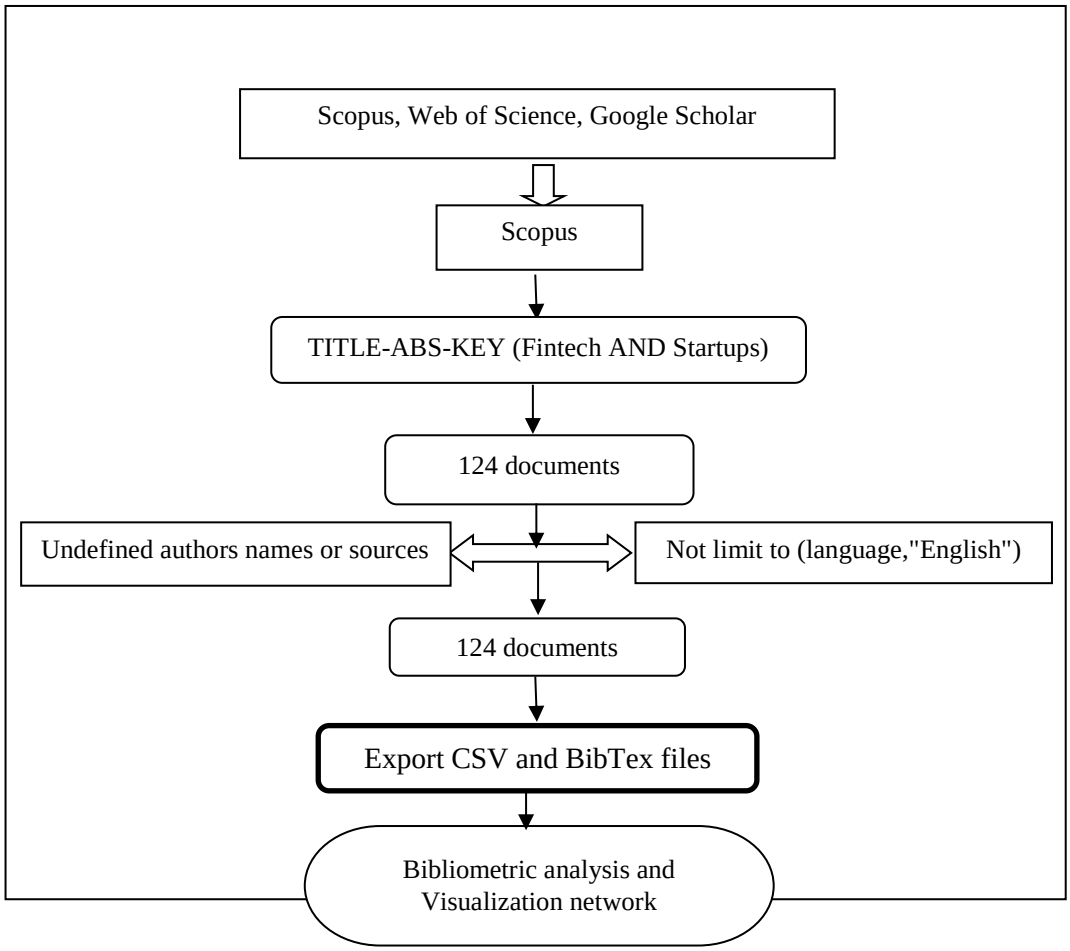


Figure 1. Research Design
Source: Drew by the authors

The most widely used indicators are the citations per year or research constituent and the number of publications, with publication serving as a proxy for productivity and citation serving as a measure of impact and influence. In addition, other metrics, such as the h-index and citations per publication, while combining citations and publications to assess the performance of research contributors.

The Second one points out the Science mapping, which examines the relationships between research elements. The techniques for science mapping contain co-authorship analysis, citation analysis, co-citation analysis, co-word analysis and bibliographic coupling, when the network analysis associated with the previous techniques forms another instrument in displaying the bibliometric structure and the intellectual structure of the research area.

RESULTS

The bibliometric analysis contains two main divisions: First, performance analysis explores the contributions of studies descriptively; this stage presents the basic information of a given phenomenon that has been examined. The second is science mapping, which highlights the relationships between studies collected; it uses Network visualization to clarify the Most Influential Feature such as co-citation and co-word analysis and degree of collaboration (Braam et al., 1991; Cobo et al., 2011; Donthu et al., 2021).

Our study does not use each section individually but uses them together for each variable; for example, an author can write dozens of research papers, but in any case, he will not be the most cited, or his keywords will be the most common in other research.

Main Information about Data

Table 1 shows the primary information about data; 124 manuscripts were published from 2016 to March 2022 in 103 different Sources; 285 authors published these manuscripts, where 28 authors have published uniquely; in addition, they used around 5465 References; and obtained 10.93 citations for each doc (and 2.51 yearly citation).

Table 1. Descriptive statistics

Description	Results
Timespan	2016 to March 2022
Sources (Journals, Books, etc)	103

Documents	124
Average citations per document (%)	10.93
Average citations per year per doc (%)	2.517
References	5465
Authors	285
Authors of single-authored documents	28
Authors of multi-authored documents	257
Documents per Author (%)	0.435
Authors per Document (%)	2.3
Co-Authors per Documents (%)	2.48

Source: Elaborated by authors based on R Studio using biblioshiny.

Analysis by Year

We have deliberately included the first trio of 2022 to show that researchers are still interested in publishing on this subject. FinTech Startups have risen exponentially since it first appeared as a concept in 2016; between 2018 and 2021, yearly publications grew by 86.27%; we expect publications to reach around 30 papers by the end of the year.

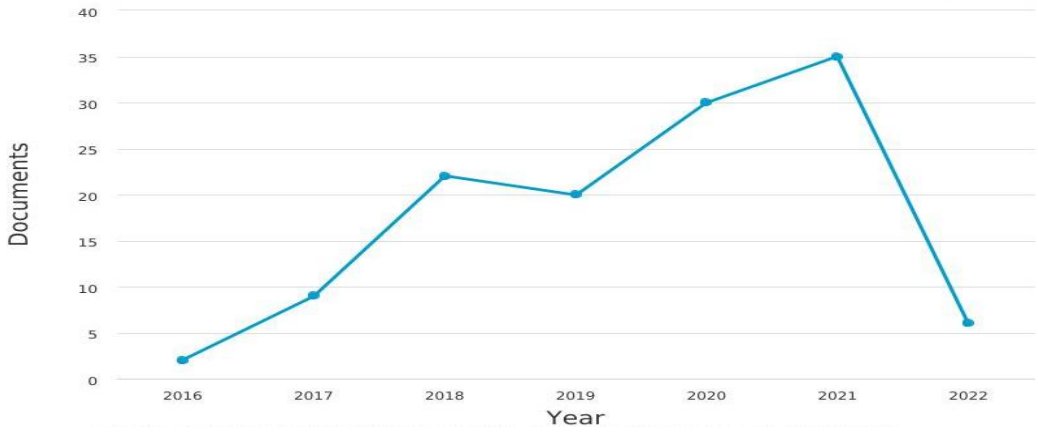


Figure 2. Annual publication during 2016 to March 2022.
Note: This curve retrieved from Scopus Results analysis using keyword "Fintech Startup"

Analysis by Document and Source Type

Additionally, we analyze the documents extracted from the Scopus database based on the type and source of documents and source title. For example, the document type is perhaps a journal article, book, or book chapter conference paper. There are many document kinds for published FinTech startups manuscripts; this study also found several categories of source types.

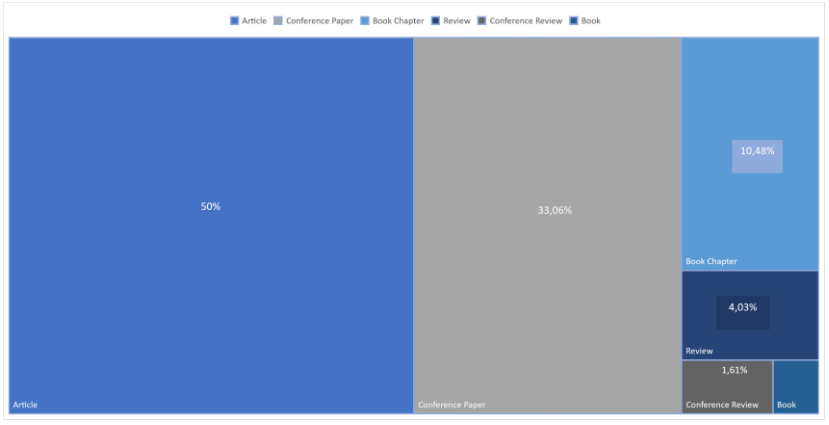


Figure 3. Document type performance analyze
Note: This chart Elaborated by the authors used excel charts based on data retrieved from the Scopus database

Most papers are published in journals compared to books and proceedings. Figure 3 shows the chart of the kind of Fintech startups documents. Again, articles lead the types in the field (account for 50% of all contributions), followed by paper conferences in the second place (33.06%), book chapters (10.48%) occupying the third position, and finally, review papers (4.03%), with the remaining categories accounted for less than 3%.

Table 2. The Most productive and influential sources

Journal Title	T.P.	TC	CPP (%)	h-index
Sustainability (Switzerland)	5	61	12.20	3
ACM International Conference Proceeding Series	4	3	0.75	1
ICIC Express Letters, Part B : Applications	3	4	1.33	1
International Journal of Information Management	3	123	41.00	1
Palgrave Studies in Democracy, Innovation and Entrepreneurship for Growth	3	0	0.00	1
Small Business Economics	3	137	45.67	3
40th International Conference on Information Systems, ICIS 2019	2	2	1.00	1
Business Horizons	2	336	168.00	2
Perspectives in Law, Business and Innovation	2	6	3.00	1
Journal of Open Innovation: Technology, Market, and Complexity	2	5	2.50	1

Source: Adapted by authors based on many data analysis applied on biblioshiny (used by R Studio)

Total Publications (T.P.), Total Citations (T.C.) and Citations Per Publication of each journal were calculated to compare the top sources of the Fintech startups field. According to table 2 and in terms of its T.P., it is evident that the most productive journal is Sustainability (Switzerland); it also ranked first in terms of H-index; 3 articles published in Sustainability (Switzerland) have been cited at least three times.

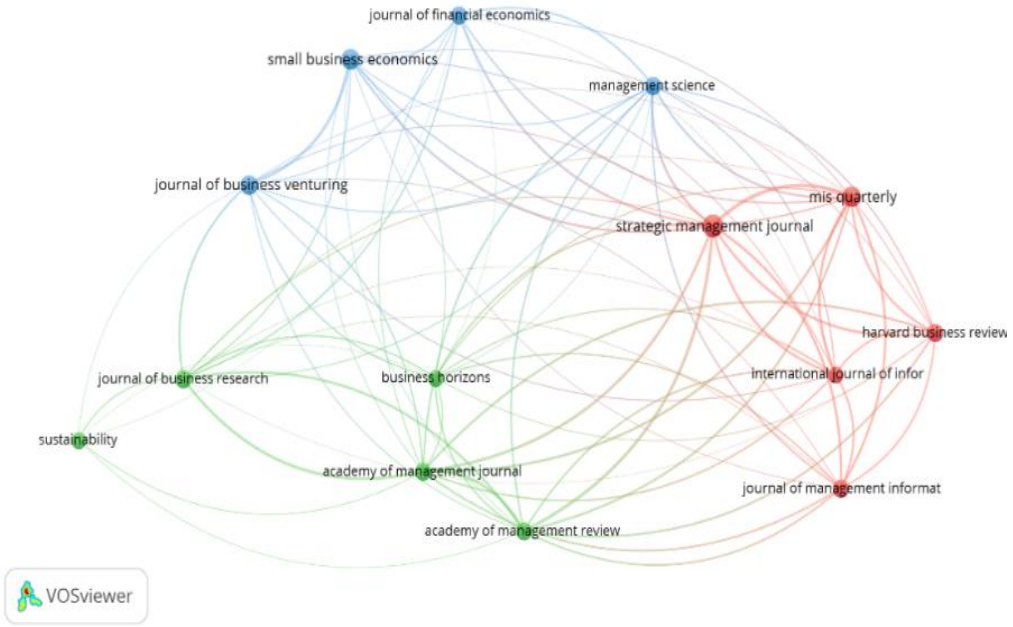


Figure 4. Influential sources Network Visualization
Source: Mapped out by authors based on Vos Viewer (used CSV exported result from Scopus)

T.P. classification depends on the size of papers, Even the H index checks how often citations are cited irrespective of their size, unlike C.T. and CPP, which are concerned with citation size, so we note from Figure 4 that the most influential journal with its highest CPP is Business Horizons.

Applying Bradford's Law to sources

This section will examine the extent to which the productivity of sources follows Bradford Law, which divides the productivity of publications for articles into three equal groups according to the following equation (1: n: n 2: n 3), with the first group representing journals that contributed a third of the articles, the second group representing journals that contributed a third of the articles, and so on. A small handful of publications devoted to the subject, which together publish nearly one-third of all works on called the core, A second zone, with the same number of articles as the first but more journals, where the mathematical relationship between the number of journals in the core and the first zone is n, while the relationship between the core and the second zone is n2.

Table 3. Three zones of Bradford's Law

Zone	One third	N Articles	N sources	Rate (%)
Zone 1 (core)	33%	41	20	19.61%
Zone 2	33%	41	42	41.18%
Zone 3	33%	42	40	39.22%

Source: calculated by authors based on biblioshiny outputs

Table 3 shows that the prominent periodicals in the field of Fintech Startup amounted to 20 journals or 19.61% of the total Sources and that the second group amounted to 42 journals or 41.18%. Finally, the third group amounted to 40 sources or 39.22%. Accordingly, it can be said that Bradford's Law of dispersion does not match the current study, as a significant source on the core contributed 19.61% of one-third of articles, It is equal to half of the second group, while the second and third groups are almost similar; there is no room to apply the n2 proportionality between the groups.

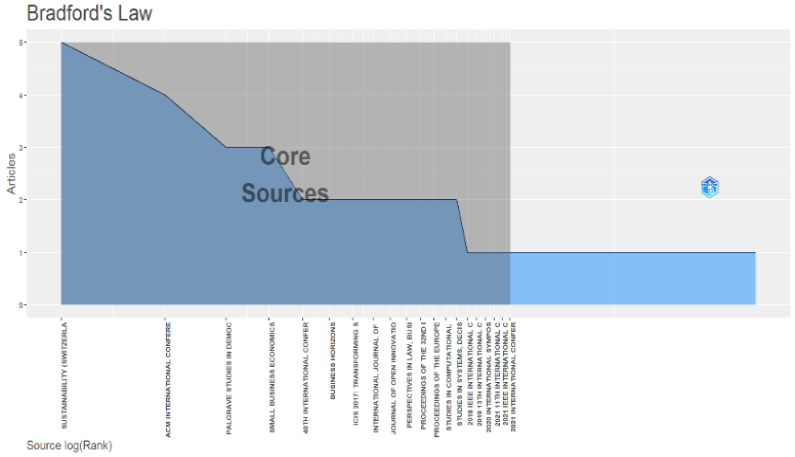


Figure 5. Bradford's Law curve
Source: Elaborated by authors based on R Studio using biblioshiny

Analysis by Subject Area

In this section, documents are classified into topic areas, as shown in Figure 6.

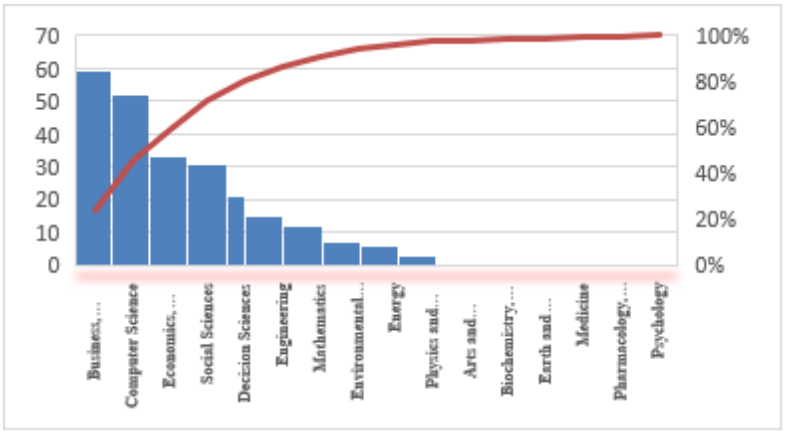


Figure 6. Subject area performance analyzes
Source: Drew via Excel based on Scopus outputs

The majority proportion of FinTech Startups research comes from Business, Management, and Accounting (24.08%), Computer Science (21.22%), and Economics, Econometrics, Finance, and Social Sciences (13.47%). Moreover, as seen in figure 6, other academic areas such as Decision Science, Engineering, and Environmental Science have also contributed to the field; it touches on many disciplines.

Analyze by Country Affiliation

Table 4. Top 10 University Affiliation/document published

AFFILIATION	TP	TC	CPP (%)
The University of Sydney	6	119	19.83
SKEMA Business School	5	187	37.40
Universidad Anáhuac México	4	76	19.00
UNSW Sydney	4	117	29.25
Bina Nusantara University	4	14	3.50
Université Côte d'Azur	4	40	10.00
Ahlia University	3	0	0.00
Westfälische Wilhelms-Universität Münster	2	24	12.00
Friedrich-Alexander-Universität Erlangen-Nürnberg	2	8	4.00
Korea Credit Guarantee Fund	2	0	0.00

Source: Created by authors based on R studio Biblioshiny and Scopus via CSV

Table 4 shows that The University of Sydney has the most significant Total Production (T.P.) and SKEMA Business School has the most prominent Total Citations (T.C.) and Citations Per Publication (CPP), respectively with 187 citations and 37.40 citations per publication

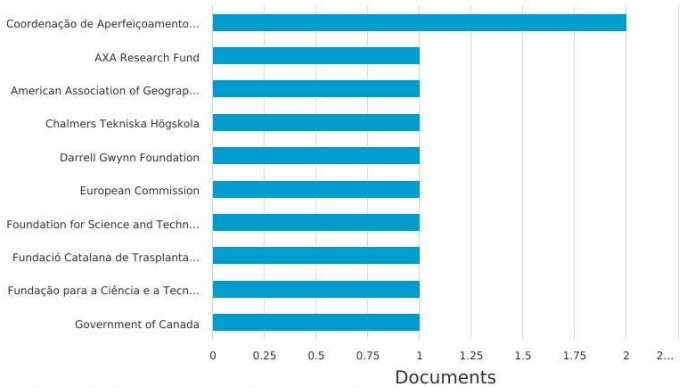


Figure 7. The top 10 funding sponsors Fintech Startups Scientific works
Source: Retrieved from Scopus Results analysis using the keyword "Fintech Startup."

This figure depicts the Top 10 funding sponsors institutes that supported the most scholarly publications on FinTech Startups. The most sponsor was Coordenação de Aperfeiçoamento de Pessoal de Nível Superior.

Most Productive Countries

The map below divides into three colored zones; the grey one contains no contribution in the field, the blue light zone has low contributors' countries than the dark blue; more details are shown in Table 5.

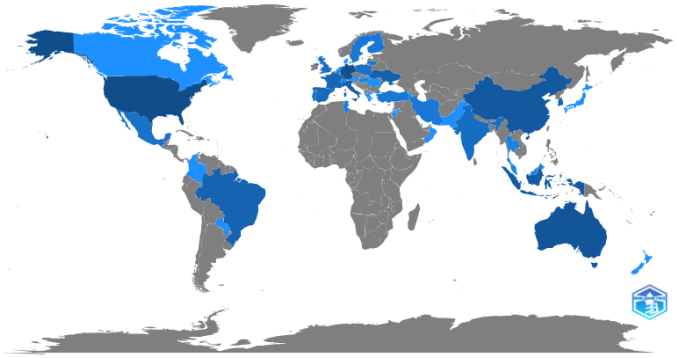


Figure 8. The centrality of contributions by countries
Source: Created with a dataset from Scopus via Biblioshiny based on R Studio

In all, 51 countries contributed to the papers on FinTech and startups, as shown in Figure 8. The region was calculated based on the contributors' affiliation. According to the findings, the United States published the most publications with 483 citations and 30.19 CPP, followed by Germany, the Russian Federation, Indonesia, Australia, and South Korea, which has been the most citations per publication 41.43.

Table 5. The prominent productive countries

N	Country	TP	TC	CPP (%)
1	United States	16	483	30.19
2	Germany	11	226	20.55
3	Russian Federation	10	20	2.00
4	Indonesia	9	26	2.89
5	Australia	8	128	16.00
6	South Korea	7	290	41.43
7	Italy	6	212	35.33
8	Brazil	5	8	1.60
9	France	5	187	37.40

Source: The table was created based on VosViewer and Scopus via CSV

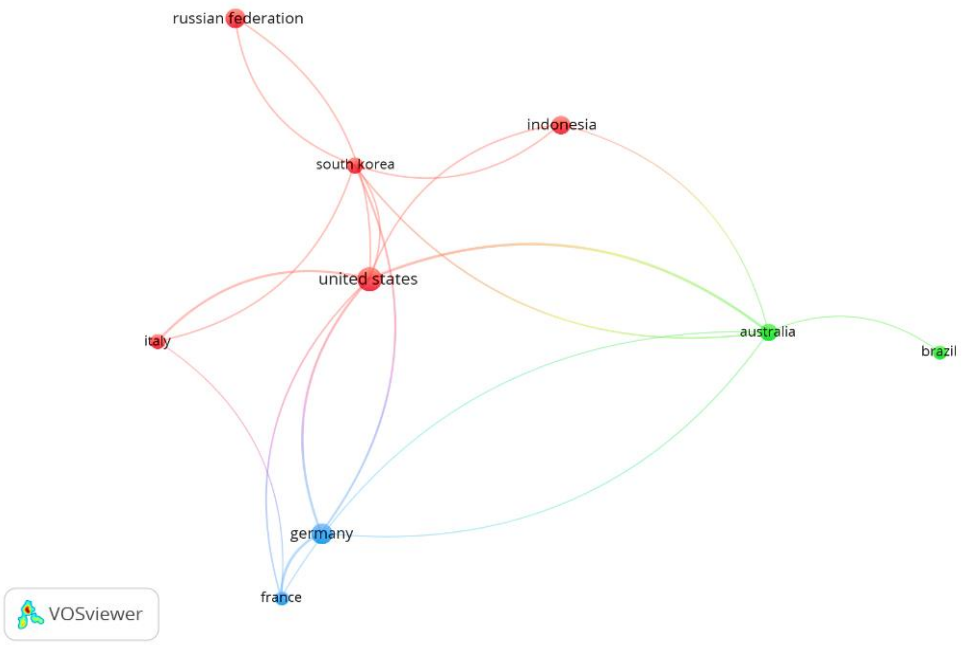


Figure 9. The centrality of citation and across countries collaboration
Source: Mapped by authors based on Vos Viewer outputs.

Through network visualization, each node in the network is an entity. The node size shows how many citations there are between countries and others. The threads show how the citations flow; selected nations have the most vital overall connection strength. The built network indicates that the U.S., South Korea, and Germany were more centralized.

Most Relevant Authors

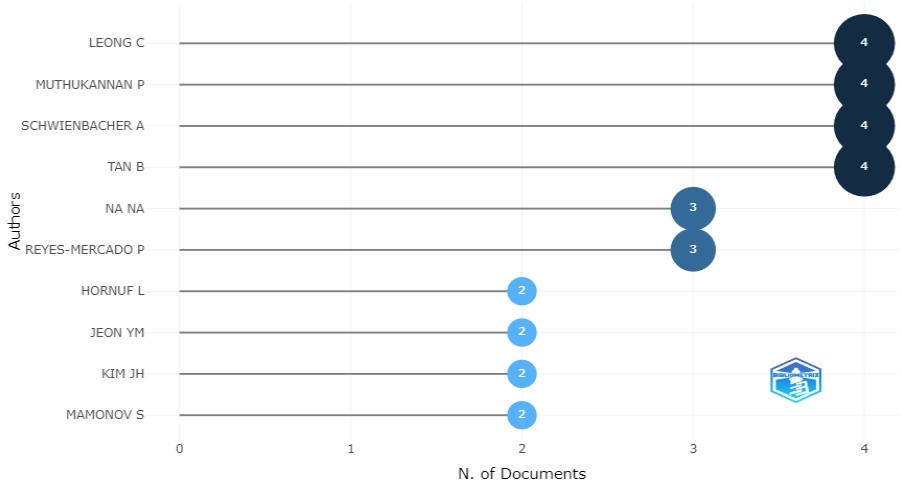


Figure 10. The Most productive authors

As are figured in Table 6 and Figure 10, Leong, Muthukannan and Schwienbacher are the most productive, with four publications for each one and 117, 4 and 73 citations, respectively. On the other hand, Muthukannan has just four citations and H-index 1 (from its four articles, just one has been cited). Descriptively is one of the top productive. Still, with less influential scientific production, which indicated a poor association between the author's quantity of works and their influence, on the contrary side, Hornuf ranked in the middle with (TP=2). Still, with 129 citations and H-index 2 (Both articles were cited), citation analysis is needed for more comprehension.

Table 6. Top ten productive authors

Authors	H-index	TP	TC	CPP (%)
Leong	2	4	117	29.25
Muthukannan	1	4	4	1.00
Schwienbacher	4	4	73	18.25
Tan	2	4	117	29.25
Undefined name	/	3	/	/
Reyes-mercado	1	3	2	0.67

Hornuf	2	2	129	64.50
Jeon	0	2	0	0.00
Kim	1	2	2	1.00
Mamonov	1	2	1	0.50

Table 7 indicates the overall number of citations obtained, whereas it includes the number of citations received by a single study. Out of 124 documents, the ten most cited were selected, with a minimum of 36 citations.

Table 7. Frequency of each article's citations

Authors	<2016	%	2016	%	2017	%	2018	%	2019	%	2020	%	2021	%	2022	%	total
Lee and Shin (2018)	0	0	0	0	0	0	7	2.69	32	12.31	81	31.15	99	38.08	41	15.77	260
Adhami et al. (2018)	0	0	0	0	0	0	12	6.15	44	22.56	57	29.23	65	33.33	17	8.72	195
Haddad and Hornuf (2019)	0	0	0	0	0	0	0	0.00	6	5.26	33	28.95	57	50.00	18	15.79	114
Leong et al. (2017)	0	0	0	0	2	2	9	7.89	21	18.42	33	28.95	35	30.70	14	12.28	114
Chen et al (2019)	0	0	0	0	0	0	0	0.00	4	4.21	28	29.47	44	46.32	19	20.00	95
Larios-Hernandez (2017)	0	0	0	0	0	0	5	6.58	16	21.05	23	30.26	24	31.58	8	10.53	76
Zhao et al. (2019)	0	0	0	0	0	0	0	0.00	5	12.20	14	34.15	17	41.46	5	12.20	41
Van Loo (2018)	0	0	0	0	0	0	2	5.41	6	16.22	9	24.32	16	43.24	4	10.81	37
Stewart and Jurjens (2018)	0	0	0	0	0	0	0	0.00	3	8.11	11	29.73	13	35.14	10	27.03	37
Cumming and Schwienbacher (2018)	0	0	0	0	0	0	1	2.78	1	2.78	12	33.33	13	36.11	9	25.00	36

Sources: Calculated by the authors based on an overview citation provided from Scopus

From 2018 to 2022, the Lee and Shin (2018) paper ranked top with 260 citations. Adhami et al. (2018) comes in second with 195 citations, followed by Haddad and Hornuf (2019) and Leong et al. (2017), all with the same amount of citations (114). In the year 2021, the highest rate of citations was recorded.

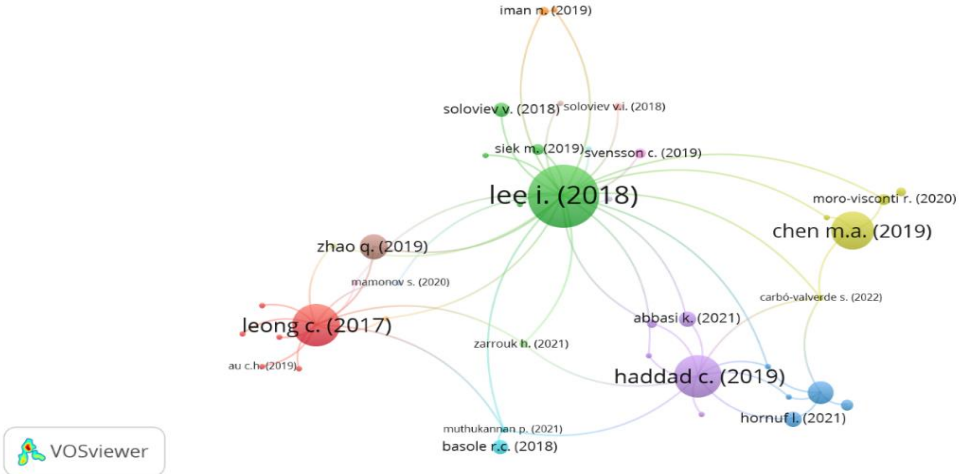


Figure 11. Citation network of papers
Source: Mapped by authors based on Vos Viewer outputs.

Co-authorship Analysis

Table 8. Co-authorship in the total publications

Authorship type	T.P.	%
Co-authorship	91	73.39
Single-authorship	30	24.19
Undefined	3	2.42
Total	124	100

Source: Elaborated by authors based on Scopus database via CSV

It has been used to examine the social connections or ties between authors and their affiliations and their influence on the study field's evolution.

Table 8 demonstrates that co-authorship outnumbers single-authorship by 49.2%. There were 91 research papers co-authored by multiple authors, compared to only 30 for single-authorship.as a result of the current level of collaboration.

Undefined Authorship and Co-Authorship

Contrasting many studies that clean up or ignore documents of undefined authorship in the analysis, our study aspires to provide explanations for this issue for the following reasons:

- How do we explain its neglect and many studies cite it;
- Indeed, academics interested in the methodology of scientific publishing always suggest ways to quote it.

After investigation, we found that the undefined authorship document type is usually a conference paper review done by the conference publisher.

Co-authorship Collaboration

Out of 285 writers in the database, there are 257 co-authorships. Furthermore, they have a strong relationship as has depicted in the following figure Muthukannan has emerged as the most collaborated authorship.

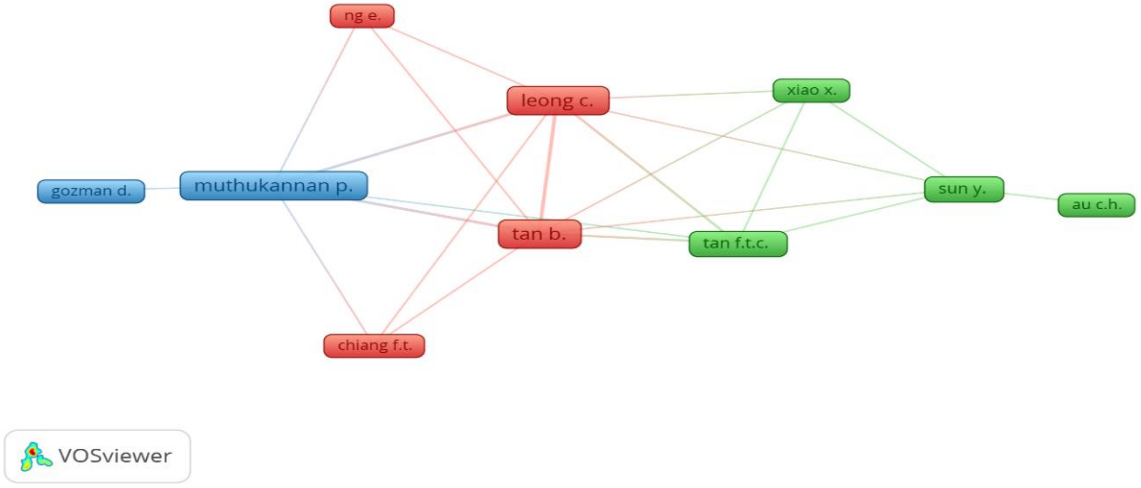


Figure 12. Network analysis of co-authorship

Institutions Collaboration

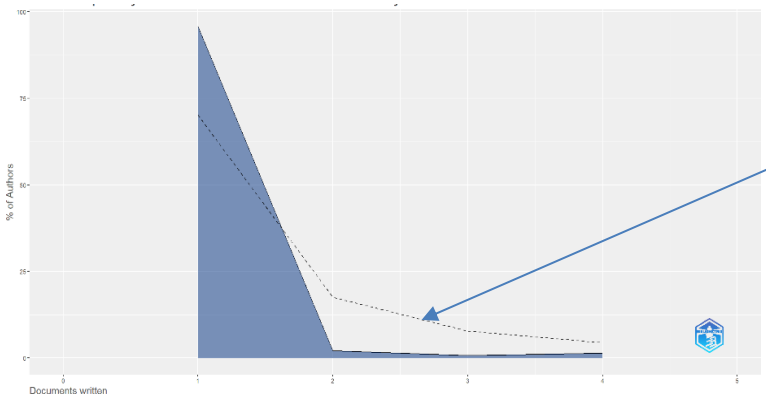
The big node figured below shows that University of New South Wales (UNSW) is the most collaborated institution.

Figure 13. The most collaborated institution

Conformity of Lotka's Law with Study

Alfred J. Lotka offered an inverse square law in 1926, relying on the size of scientific contributions performed by each researcher to the number of scientific papers. Lotka's Law measures the frequency with which authors publish in a specific field. It indicates that "the rate of authors who produce n contributions is around 1/n2 of one researcher, and the proportion of all contributors who make a single contribution is approximately 60%." This suggests that 60% of authors in a given topic will have only one publication, 15% will have 2 ($1/2^2$ x 0.60), 7% will have 3 ($1/3^2$ x 0.60), etc. According to Lotka's Law of Scientific Productivity, just 6% of authors will publish more than ten articles in any discipline.

The results for FinTech Startup papers are shown in Figure 14, along with the Lotka-predicted distribution. It reveals that 95.8 percent of authors have published only once, 2.1 percent have published twice, and 0.7 percent have published three times. This demonstrates that Fintech Startup authorship doesn't obey Lotka's Law.



The discontinued line represents the graph that should be comply with Lotka's Law

Figure 14. Lotka's Law Chart
Source: Created with a dataset from Scopus via Biblioshiny based on R Studio

Co-Word Analysis and Conceptual Structure

Authors Keywords

To describe their work, the authors have used keywords the (Table 9.) gives an analysis of the terms that they utilize most typically as keywords

Table 9. Authors Keywords

Keyword	Occurrences	Total Link Strength
Fintech	71	44
Startup	15	20
Blockchain	6	11
Startups	10	10
Innovation	8	9
Banking	5	8
Case study	6	7
Digital banking	5	4
Financial technology	9	3

Source: VosViewer outputs

Only the top 9 keywords out of 376 are displayed figure 15. Each term must appear five times at least in the document using this constraint. The most significant node, i.e. the most commonly used keyword, is Fintech (Table 9). It also has a solid link to startups.

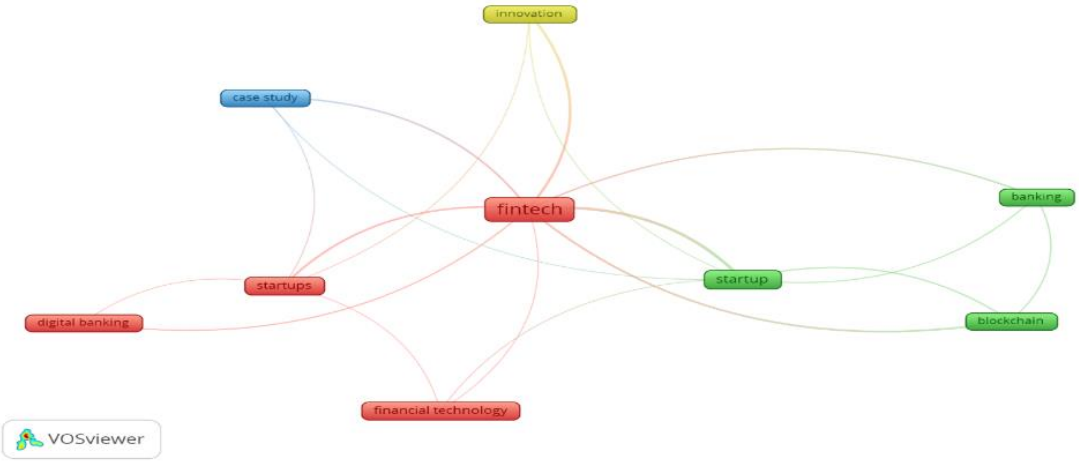


Figure 15. Authors Keywords

Thematic Network

Network maps show the proximity or similarity things; the approach entails depicting networks on a map in which the distance between two items indicates the strength of their association.

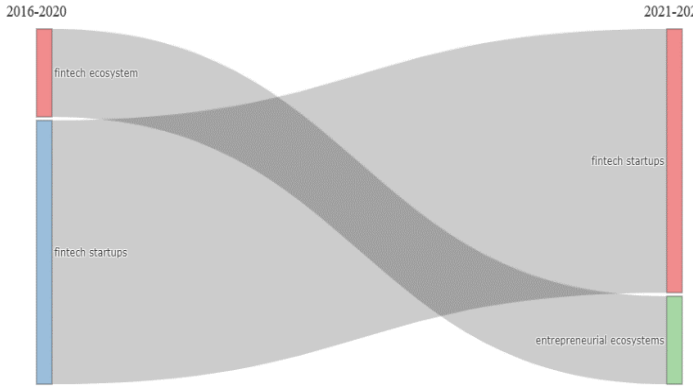


Figure 16. Thematic Evolution

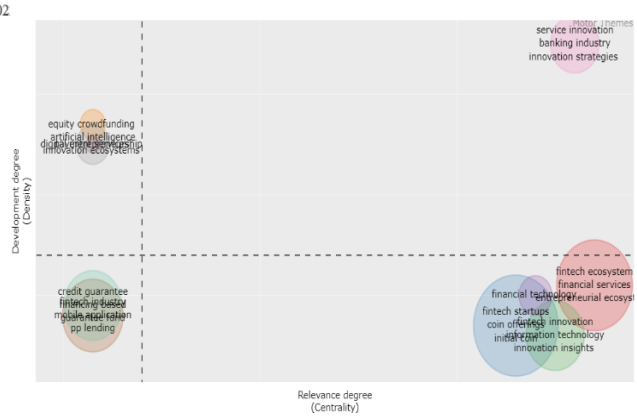


Figure 17. Thematic map

Note: This conceptual structure Created with a dataset from Scopus via Biblioshiny based on R Studio

Fintech, along with startups, has dominated the conceptual structure since 2016. However, startups used other descriptors such as "plan Startup", "Startups". Moreover, the success factors of Startups like the business model and EcoSystem have often been associated with Fintech in the title, keywords or abstracts, and the most cited article which evidence referred to; "Lee and Shin (2018), Fintech: Ecosystem, business models, investment decisions, and challenges"; which generates a remarkable terminological convergence between FinTech and Startup, On the other side, some important terms such as technological innovation in finance, crowdfunding and blockchain took place alongside synonymous terms for startups, which formed a distinct coupling of the two terms. While there are outliers, such as the banking industry is a marginally significant specific theme.

Trends Topics Bigrams

The temporal analysis indicates the research field's conceptual structure by discovering patterns, trends, seasonality, and outliers.

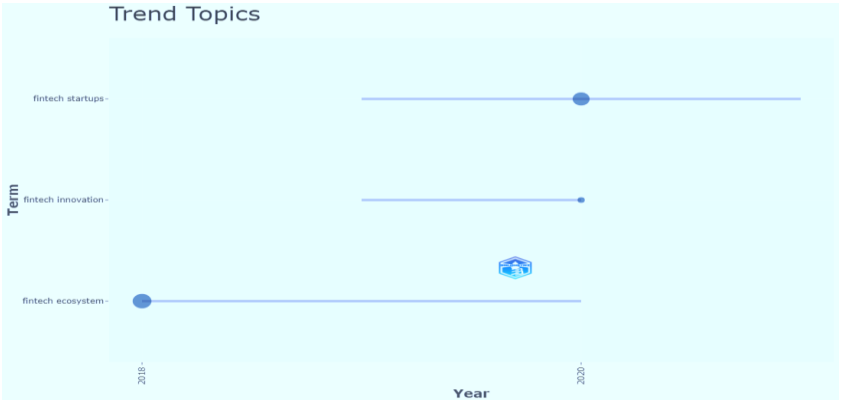


Figure 18. The trend topics of the field

Note: This conceptual structure Created with a dataset from Scopus via Biblioshiny based on R Studio

CONCLUSION

This research appeal to the bibliometric techniques of two main divisions where we used both of them for each constituent, and the study has contributed to the understanding of the FinTech startup research phenomenon and trends in the scope of 124 publications obtained from the Scopus database, which has covered the period of 2016 - 2022.

We have found that FinTech startup has gained a growing degree of attention in the academic community over this time; FinTech Startup has risen exponentially since it first appeared as a concept in 2016; between 2018 and 2021 yearly publications grew by 86.27%, with journals articles leading the document type in the field, and they represent 50% of 124 manuscripts contributions; The higher sponsor who finances the scientific researches concerning fintech startup was Coordenação de Aperfeiçoamento de Pessoal de Nível Superior; moreover the majority proportion related to research topic comes from Business, Management, and Accounting (24.08%).

In terms of the total production, from the findings, it is evident that the most productive journal is Sustainability (Switzerland) which is ranked first in terms of H-index; 3 articles published in Sustainability (Switzerland) have been cited at least three times, while The most influential (Most cited) journal with its highest CPP is Business Horizons.

Bradford's Law of dispersion doesn't match the current study because the most influential article is published in 20 sources instead to be published only in 5 sources at most in such case, which mean that there are no specialized sources in the field. The University of Sydney has the largest Total Production (T.P.), and SKEMA Business School is the Most cited with 187 citations, the authors of UNSW Sydney are the most collaborated with their peers.

According to the findings, the United States published the most publications, followed by Germany and then the Russian Federation, while citations are centralized in the USA, South Korea, and Germany. Leong, Muthukannan and Schwienbacher were the most productive on the subject of fintech startups. Still, from 2018 to 2022, the document written by Lee and Shin (2018) was identified as the most popular document and ranked top with 260 citations.

Co-authorship has reached 73.39 %, which means the significant part of the researches has been done with team researchers; the most collaborated in terms of authors is Muthukannan and for the institution is UNSW SYDNEY.

Fintech Startup authorship doesn't comply with Lotka's Law, as long as 95.8 % (≠60% standard) of authors have published only once.

Recommendations for the future

We suggest the following directions for researchers to consider:

- Using alternative methods of information measurement to assess FinTech Startups.
- Exploring FinTech Startup with qualitative analysis.
- Examining the field based on other databases than Scopus.
- Evaluation of FinTech Startup relies on another field such as Sustainability.

Implications for Scientific Research and Society

This study provides important insights into recent trends in fintech startups and has many implications for scientific research and society. This study will help academicians to explore new research opportunities (gaps, collaboration between authors, institutions, and countries); also, it is the guidance of Postdoc researchers and future PhD student which seek funded scholarships in exploring research prospects through analysis of patterns that have been provided for publications in terms of authors, sources, documents, institutions, and countries. Finally, however, this study allows investors (future Startuppers) to develop and invest in the flourishing field of Fintech.

Limitation and Scope

The scope of this study is about "Fintech Startup", whereas "Fintech" is one of the newest subsectors of "Startups". "Fintech Startup" is a pair of consecutive words (Bigrams), that the publications about "Fintech Startup" has appeared for the first time since 2016; which has been allowed us to obtain 124 publications from only Scopus databases for bibliometric analysis purpose; our study has used performance analysis and mapping sciences for specific bibliometric variables (Author, Document, Sources and Countries) but with a most extensive descriptive and citation-metrics information.

Author Contributions: Conceptualization, R.B., S.R. and M.H.; Data Curation, R.B., S.R. and M.H.; Methodology, R.B., S.R. and M.H.; Validation, R.B., S.R. and M.H.; Visualization, R.B. and S.R.; Formal Analysis, R.B. and S.R.; Investigation, R.B., S.R. and M.H.; Resources, R.B., S.R. and M.H.; Writing – Original Draft, R.B. and M.H.; Writing – Review & Editing, R.B. and M.H.; Supervision, R.B.; Software, R.B. and S.R.; Project Administration, R.B.; Funding Acquisition, R.B., S.R. and M.H. Authors have read and agreed to the published version of the manuscript.

Institutional Review Board Statement: Ethical review and approval were waived for this study, due to that the research does not deal with vulnerable groups or sensitive issues.

Funding: The authors received no direct funding for this research.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available on request from the corresponding author. The data are not publicly available due to restrictions.

Conflicts of Interest: The authors declare no conflict of interest.

REFERENCES

Adhami, S., Giudici, G., & Martinazzi, S. (2018). Why do businesses go crypto? An empirical analysis of initial coin offerings. *Journal of Economics and Business*, *100*, 64–75. https://doi.org/10.1016/j.jeconbus.2018.04.001

Ahmi, A., Tapa, A., & Hamzah, A. H. (2020). Mapping of financial technology (FinTech) Research: A bibliometric analysis. *International Journal of Advanced Science and Technology*, *29*(8), 379–372.

Anderson, S. D. (2015). Software, Abstractness, and Soft Physicality Requirements. *Harv. JL & Tech.*, *29*, 567.

Aysan, A. F., & Unal, I. M. (2021). A Bibliometric Analysis of Fintech and Blockchain in Islamic Finance. *Efil Journal of Economic Research*, *4*(3). Retrieved from https://efiljournal.com/ahmet-faruk-aysan-ibrahim-musa-unal-fintech-and-blockchain-in-islamic-finance-a-bibliometric-analysis-2/

Berman, A., Cano-Kollmann, M., & Mudambi, R. (2022). Innovation and entrepreneurial ecosystems: fintech in the financial services industry. *Review of Managerial Science*, *16*(1), 45–64. https://doi.org/10.1007/*s11846-020-00435-8*

Bettinger, A. (1972). Fintech: A series of 40 time shared models used at Manufacturers Hanover Trust Company. *Interfaces*, 62–63.

Blank, S., & Dorf, B. (2020). *The startup owner's manual: The step-by-step guide for building a great company*. John Wiley & Sons.

Braam, R. R., Moed, H. F., & Van Raan, A. F. J. (1991). Mapping of science by combined co-citation and word analysis. I. Structural aspects. *Journal of the American Society for Information Science*, *42*(4), 233–251.

Brika, S. K. M. (2022). A Bibliometric Analysis of Fintech Trends and Digital Finance. *Frontiers in Environmental Science*, 696. https://doi.org/10.3389/fenvs.2021.796495

Chen, M. A., Wu, Q., & Yang, B. (2019). How Valuable Is FinTech Innovation? The Review of Financial Studies, 32(5), 2062–2106. https://doi.org/10.1093/rfs/hhy130

Cobo, M. J., López-Herrera, A. G., Herrera-Viedma, E., & Herrera, F. (2011). An approach for detecting, quantifying, and visualizing the evolution of a research field: A practical application to the Fuzzy Sets Theory field. *Journal of Informetrics*, *5*(1), 146–166. https://doi.org/10.1016/j.joi.2010.10.002

Crunchbase. (2020). *Industry spotlight: FinTech*. Retrieved from Https://About.Crunchbase.Com/Wp-Cont Ent/Uploads/2020/04/Fintech_Report_v11.Pdf.

Cumming, D. J., & Schwienbacher, A. (2018). Fintech venture capital. Corporate Governance: An International Review, 26(5), 374–389. https://doi.org/10.1111/corg.12256

Davis, K., Maddock, R., & Foo, M. (2017). Catching up with Indonesia's fintech industry. *Law and Financial Markets Review*, *11*(1), 33–40. https://doi.org/10.1080/17521440.2017.1336398

Donthu, N., Kumar, S., Mukherjee, D., Pandey, N., & Lim, W. M. (2021). How to conduct a bibliometric analysis: An overview and guidelines. *Journal of Business Research*, *133*, 285–296.

Failory. (2022). *The 152 Best FinTech Accelerators and Incubators*. Retrieved from https://www.failory.com/startups/fintech-accelerators-incubators

Fairthorne, R. A. (1969). Empirical Hyperbolic Distributions (Bradford-Zipf-Mandelbrot) for Bibliometric Description and Prediction. *Journal of Documentation*, *25*(4), 319–343. https://doi.org/10.1108/eb026481

Falagas, M. E., Pitsouni, E. I., Malietzis, G. A., & Pappas, G. (2008). Comparison of PubMed, Scopus, web of science, and Google scholar: strengths and weaknesses. *The FASEB Journal*, *22*(2), 338–342. https://doi.org/10.1096/fj.07-9492lsf

Gelis, P. (2016). Why FinTech banks will rule the world. *The FinTech Book: The Financial Technology Handbook for Investors, Entrepreneurs and Visionaries*, 235–237.

Gimpel, H., Rau, D., & Röglinger, M. (2018). Understanding FinTech start-ups–a taxonomy of consumer-oriented service offerings. *Electronic Markets*, *28*(3), 245–264. https://doi.org/10.1007/s12525-017-0275-0

Gomber, P., Koch, J. A., & Siering, M. (2017). Digital Finance and FinTech: current research and future research directions. *Journal of Business Economics*, *87*(5), 537–580. https://doi.org/10.1007/s11573-017-0852-x

Guest. (2022). *10 innovative FinTech business models*. Board of Innovation. Retrieved from https://www.boardofinnovation.com/blog/10-innovative-fintech-business-models/

Haddad, C., & Hornuf, L. (2019). The emergence of the global fintech market: Economic and technological determinants. *Small Business Economics*, *53*(1), 81–105. https://doi.org/10.1007/s11187-018-9991-x

Hallinger, P., & Nguyen, V.-T. (2020). Mapping the landscape and structure of research on education for sustainable development: A bibliometric review. *Sustainability*, *12*(5), 1947. https://doi.org/10.3390/su12051947

Harris, J. L. (2021). Bridging the gap between 'Fin'and 'Tech': The role of accelerator networks in emerging FinTech entrepreneurial ecosystems. *Geoforum*, *122*, 174–182. https://doi.org/10.1016/j.geoforum.2021.04.010

Hill, J. (2018). *Fintech and the remaking of financial institutions*. Academic Press.

Imerman, M. B., & Fabozzi, F. J. (2020). A Conceptual Framework for FinTech Innovation. *Available at SSRN 3543810*.

Kijkasiwat, P. (2021). Kijkasiwat, P. (2021). Opportunities and Challenges for Fintech Startups: The Case Study of Thailand. *ABAC Journal*, *41*(2), 41-60.

Larios-Hernández, G. J. (2017). Blockchain entrepreneurship opportunity in the practices of the unbanked. Business Horizons, 60(6), 865–874. https://doi.org/10.1016/j.bushor.2017.07.012

Lee, I., & Shin, Y. J. (2018). Fintech: Ecosystem, business models, investment decisions, and challenges. *Business Horizons*, *61*(1), 35–46. https://doi.org/10.1016/j.bushor.2017.09.003

Leong, C., Tan, B., Xiao, X., Tan, F. T. C., & Sun, Y. (2017). Nurturing a FinTech ecosystem: The case of a youth microloan startup in China. *International Journal of Information Management*, *37*(2), 92–97. https://doi.org/10.1016/j.ijinfomgt.2016.11.006

Leong, K., & Sung, A. (2018). FinTech (Financial Technology): what is it and how to use technologies to create business value in fintech way? *International Journal of Innovation, Management and Technology*, *9*(2), 74–78.

Li, B., & Xu, Z. (2021). Insights into financial technology (FinTech): a bibliometric and visual study. *Financial Innovation*, *7*(1), 69. https://doi.org/10.1186/s40854-021-00285-7

Matveevskii, S. S., Berdyshev, A. V, Prokofiev, M. N., & Ryabchenko, L. I. (2019). Fintech in the banking system of Russia: problems and prospects. *GCPMED 2018-International Scientific Conference" Global Challenges and Prospects of the Modern Economic Development"*, 344–356.

Martín-Martín, A., Orduna-Malea, E., Thelwall, M., & López-Cózar, E. D. (2018). Google Scholar, Web of Science, and Scopus: A systematic comparison of citations in 252 subject categories. *Journal of informetrics*, *12*(4), 1160-1177.

Milian, E. Z., Spinola, M. de M., & Carvalho, M. M. de. (2019). Fintechs: A literature review and research agenda. *Electronic Commerce Research and Applications*, *34*, 100833. https://doi.org/10.1016/j.elerap.2019.100833

Moroni, I., Arruda, A., & Araujo, K. (2015). The Design and Technological Innovation: How to Understand the Growth of Startups Companies in Competitive Business Environment. *Procedia M*anu—Type equation here.*facturing*, *3*, 2199–2204. https://doi.org/10.1016/j.promfg.2015.07.361

Salamzadeh, A., & Kesim, H. K. (n.d.). *Startup Companies: Life Cycle and Challenges*. Retrieved from https://ssrn.com/abstract=2628861

Stewart, H., & Jürjens, J. (2018). Data security and consumer trust in FinTech innovation in Germany. *Information & Computer Security*. . *https://doi.org/10.1108/ICS-06-2017-0039*

Suryono, R. R., Budi, I., & Purwandari, B. (2020). Challenges and trends of financial technology (Fintech): a systematic literature review. *Information*, *11*(12), 590. https://doi.org/10.3390/info11120590

Tepe, G., Geyikci, U. B., & Sancak, F. M. (2022). FinTech Companies: A Bibliometric Analysis. *International Journal of Financial Studies*, *10*(1). https://doi.org/10.3390/ijfs10010002

Thakor, A. V. (2020). Fintech and banking: What do we know? *Journal of Financial Intermediation*, *41*, 100833. https://doi.org/10.1016/j.jfi.2019.100833

Tripathi, N., Seppänen, P., Boominathan, G., Oivo, M., & Liukkunen, K. (2019). Insights into startup ecosystems through exploration of multi-vocal literature. *Information and Software Technology*, *105*, 56–77. https://doi.org/10.1016/j.infsof.2018.08.005

Van Loo, R. (2018). Making innovation more competitive: The case of fintech. UCLA L. Rev., 65, 232.

Wu, P. (2017). Fintech trends relationships research: A bibliometric citation meta-analysis. *Proceedings of the 17th International Conference on Electronic Business, ICEB, Dubai, UAE*, 99–105.

Xia, T., & Roper, S. (2016). Unpacking open innovation: absorptive capacity, exploratory and exploitative openness, and the growth of entrepreneurial biopharmaceutical firms. *Journal of Small Business Management*, *54*(3), 931–952. https://doi.org/10.1111/jsbm.12220

Xu, Z., Liao, H.-T., Pan, C.-L., & Mo, W. (2020). Exploring the Research Fronts of Fintech: A Scientometric Analysis. *5th International Conference on Financial Innovation and Economic Development (ICFIED 2020)*, 5–11.

Zarrouk, H., Ghak, T. El, & Bakhouche, A. (2021). Exploring economic and technological determinants of fintech startups' success and growth in the United Arab Emirates. *Journal of Open Innovation: Technology, Market, and Complexity*, *7*(1), 1–24. https://doi.org/10.3390/joitmc7010050

Zavolokina, L., Dolata, M., & Schwabe, G. (2016). FinTech transformation: How IT-enabled innovations shape the financial sector. *FinanceCom 2016*, 75–88. Retrieved from https://citations.springernature.com/item?doi=10.1007/978-3-319-52764-2_6

Zhao, Q., Tsai, P.-H., & Wang, J.-L. (2019). Improving Financial Service Innovation Strategies for Enhancing China's Banking Industry Competitive Advantage during the Fintech Revolution: A Hybrid MCDM Model. In *Sustainability* (Vol. 11, Issue 5). https://doi.org/10.3390/su11051419

Zhu, J., & Liu, W. (2020). A tale of two databases: The use of Web of Science and Scopus in academic papers. *Scientometrics*, *123*(1), 321–335. https://doi.org/10.1007/s11192-020-03387-8

APPENDICES

Appendix A: Data Running of R Studio

Join rstudio
Type: install.package(*bi bibliometrix*)
Type: library(bibliometrix)
To start with the shiny web-interface, please digit:
Biblioshiny()
Web application opened
Select: data
Select: import or load file
Select: import raw file (s)
Select:database
Select: Scopus
Start your analysis with the criteria selected
Note:
Database imported has been exported before with *.bib format from Scopus after obtaining your search result about your field

Appendix B: Data Running of VosViewer

Export *.csv format from Scopus after obtaining your search result about your field
Run VosViewer
Import the file
Start your analysis with the criteria selected

Publisher's Note: CRIBFB stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.