

Evolution of fintech in supply chain: a literature based review on bibliometric analysis

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ABSTRACT

Adopting fintech for supply chain finance can have a positive influence on the performance of supply chain with respective to flow of information and funds. The shift of traditional financing to fintech solutions will soon be adopted by firms in the near future to mitigate delays and align operations with financial flow along the supply chain. This paper aims to present a bibliometric analysis based literature review of the growth and adoption of fintech in supply chain financing by analyzing 1,139 articles on fintech, 2,244 publications on supply chain financing and 15 core publications on fintech in supply chain finance. The analysis is supported by some visualization tools. The paper aims to be a helpful resource for researchers, academicians and practitioners in the field of supply chain as well as fintech by capturing trends of evolution, summarized literature and investigating research topics for further discussion.

Keywords:

Supply Chain Finance, Fintech, Bibliometric analysis, Supply chain technology

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1. Introduction

Fintech is a growing global phenomenon to which many innovators, academicians and industry regulators have contributed (Anne-Laure Mention, 2019). The growth of Fintech can have a measurable impact on other primary and auxiliary industries and the way business functions in the twentieth century. This era is raided with disruptions under the blanket term of Industry 4.0 such as artificial intelligence, blockchain, big data analytics, cyber security, etc. Although supply chain is characterized by the three flows; information, material and funds, the latter remains a less explored domain in firms and enterprises to eliminate losses. The research stated in this paper will serve threefold purpose: Firstly, the objective of the paper lies in providing a detailed comprehensive review; the second goal of this paper is to report the results of the bibliometric analysis, which will quantify the available research on this topic and the peripheral areas. Lastly, and the most significant goal remains to provide academicians, scholars and other professionals in the supply chain finance domain with a summary of all existing work in this area which will pave the way for further research opportunities and carry the discussion forward.

1.1. Understanding Supply Chain Finance

The financial supply chain largely consists of 'procure-to-pay' and 'order-to-cash' cycles. Due to uncertainties, time delays, inefficiencies and human error it is possible that the operational flow may not align with the flow of funds. Working capital acts as an indicator of assessing the liquidity in the firm on a regular basis so as to implement operations in a manner to maintain supply chain surplus stated by Enrico Camerinelli (2008). This remains a priority in supply chain if a firm wishes to maintain a profitable venture especially when the supply chain is a core competency. The concept of supply chain finance includes long term and short term financing, credit lines, treasury services and working capital optimization. Traditional banking systems limited services, depended heavily on banking experience, limited to small service channels and required additional time and cost. The rise of fintech can address these challenges in supply chain financing and develop new avenues for business efficiency.

1.2. Defining supply chain finance

Supply chain is not just a singular relationship between suppliers, manufacturers, logistic partners or consumers. Supply chain is a network of various stakeholders involved in delivering a product, service or range of product or services to the customer or consumer. This network is deeply connected by flow of products, information and

funds (Chopra, Meindl & Kalra, 2016). The idea of supply chain finance was bought into being and proposed by various scholars. Hofmann and Zumsteg defined supply chain finance as a specific implementation framework for financing of SMEs. Gradually, the definition of supply chain finance has changed to an offering as a set of products or services to facilitate the flow of information in the supply chain given by Camerinelli in 2009. Subsequently, Pfohl and Gomm suggested that supply chain finance is an optimization of intercompany financing which offers to allow integration of suppliers, manufacturers, service providers and consumers. The definition makes a shift in perspective from finance driven to supply chain driven in the beginning of 2010 and is defined as an innovating financial solution instead of the aforementioned service to decrease the mismatch of supply and demand in the flow of funds so as to eliminate constraints associated with capital. Grose-Ruyken et. al. (2011) defines SCF as an integrated approach to provide visibility and control in all the financial processes of supply chain thus providing a scope of inventory optimization. The buyer driven perspective can be cited to Wuttke et al (2013) which defines SCF as automated solution so as to enable use of Reverse Factoring in the entire supplier base and reiterated the significance of visibility and flexibility of financing options in supply chain performance. The most recent definition by More and Basu (2003) only adds the management perspective which highlights the involvement of stakeholders to improve working capital. Thus it can be suggested that the definitions of supply chain finance have evolved from merely a supply chain transaction to a supply chain solution so as to facilitate maximum value generation. The importance of SCF is highlighted as an aiding factor to drive supply chain agility and overall improvement in operations management.

1.3. Understanding Fintech

According to PwC author Nicolacakis, Dean (2016) fintech which is short for financial technology is an intersection between financial services and technology. Continuing the definition it is assumed that fintech is an umbrella term for startups, technology companies and to some extent legacy providers. Fintech largely implies all existing financial technology services at lower

costs to provide a data driven credit solutions. It can be said that a fintech is characterized by; technology, payment tools and low cost.

The research areas of fintech are largely clouded by lack of firm definitions, changing nature of regulatory regimes, disruptive technologies like influence of block chain, big data analytics, artificial intelligence or the inherent shift in labour demanded by fintech industry. The nature of jobs and skills required to enhance and sustain the industry will change rapidly, not just in financial sector but also in IT, consulting, accounting and law (Iman & Nofie, 2020).

1.4. Defining fintech

The raw definition of fintech originates in about 1972 given by Bettinger that fintech is only the combination of financial services and technology and restricts the definition to banking. Later, Micu & Micu add a perspective of innovation while defining fintech as a new sector in finance which will adopt technology to facilitate trade, business and overall services delivered to the customer (2016). Shim & Shim for the first time defined fintech as not just a new sector but specifically gave a third party services an introduction in the fintech domain (2017). 'FinTech' is technologically enabled financial innovation that could result in new business models, applications, processes, products, or services with an associated material effect on financial markets and institutions and the provision of financial services (John Schindler, 2017). One classic observation that needs to be made before discussing fintech is how it is viewed as a service and not as a product in the financing domain. The innovation in technology will hence influence the nature of fintech services offered overtime. The term has gained popularity on Google only after 2013 making it a very nascent topic for rigid definitions (Schueffel & Patrick, 2017).

2. Data Sources and Methodology

2.1. Data collection

The core objective of the study is to learn about the existing literature on fintech in supply chain finance and thereby discover new opportunities for research in this domain.

The data source used for this research plays a vital role in conducting the study and will heavily influence the results for this bibliometric analysis.

For conducting this study, data for existing literature was retrieved from the Web of Science collection of around 19,000 high quality journals and 1.3 billion cited references beginning in 1900 (Wang 2018). The literature review presents a summarized version of existing publications in the past three decades. The topics and research gaps thus found should be able to provide a development path in the domain of supply chain finance. The inherent drawbacks of data retrieval are not accounted for while collecting the data.

First, the summarized data is visualized by deploying visualization tools like Statistical Analysis Toolkit for Informetrics (SATI) is C #language-based software developed by Liu and Ye (2012). The software was used to extract frequency of keywords and derive further understanding between the occurrence and development of literature in supply chain finance domain. Second, combination charts are used to display the trends in literature of supply chain and technology. The shifts in trends will be crucial to identify the impact on subsequent publications. Third, a trend in citation was also captured using a combination chart between supply chain finance and technology publications over a period of last five years. Fourth, VOSview was deployed to conduct a mapping analysis and representation of keywords. The bibliometric tool provided a deep understanding of the emerging topics in supply chain finance domain. A causal relationship could be interpreted from the clustering of co-occurrence in text.

2.2. Data analysis

Before conducting a circumstantial research for fintech and supply chain, peripheral data retrieval was done for publications in the supply chain domain and technology. The thought process of doing so was to get a general idea of the evolution of technology landscape in supply chain domain. To do this, the literature was fetched from advanced search and specific strategies stated below:

TS = (Supply Chain Finance) AND
TS = (Technology)

Languages = 'All languages'

Document types = 'All document types'

Timespan = '1980-2021'

Databases = 'WoS Core Collection'

After executing this query a total of 2244 publications appeared.

The following table summarizes the data available from various databases on fintech and fintech in supply chain:

Table 1 Publications available in various sources (Source: Author's compilation)

Sr. No.	Sources	Keyword "Fintech"	Query "Fintech" + "Supply Chain"
1	Web of Science	1139	16
2	Emerald Insight	408	237
3	JSTOR	147	34
4	ScienceDirect	930	245
5	EBSCOhost	1706	242

It is noteworthy to observe that emerald insight fetches more results for the topic under discussion than Web of Science. However, the lack of open access and RIS file unavailability, the study was conducted using Web of Science database.

The literature was fetched from advanced search and specific strategies stated below:

TS = (Fintech) AND TS = (Supply chain)

Languages = 'All languages'

Document types = 'All document types'

Timespan = '1980-2021'

Databases = 'WoS Core Collection'

For trend in citation, following query was used:

The literature was fetched from advanced search and specific strategies stated below:

TS = (Supply Chain Finance) AND
TS = (Technology)

Languages = 'All languages'

Document types = 'All document types'

Timespan = '1980-2021'

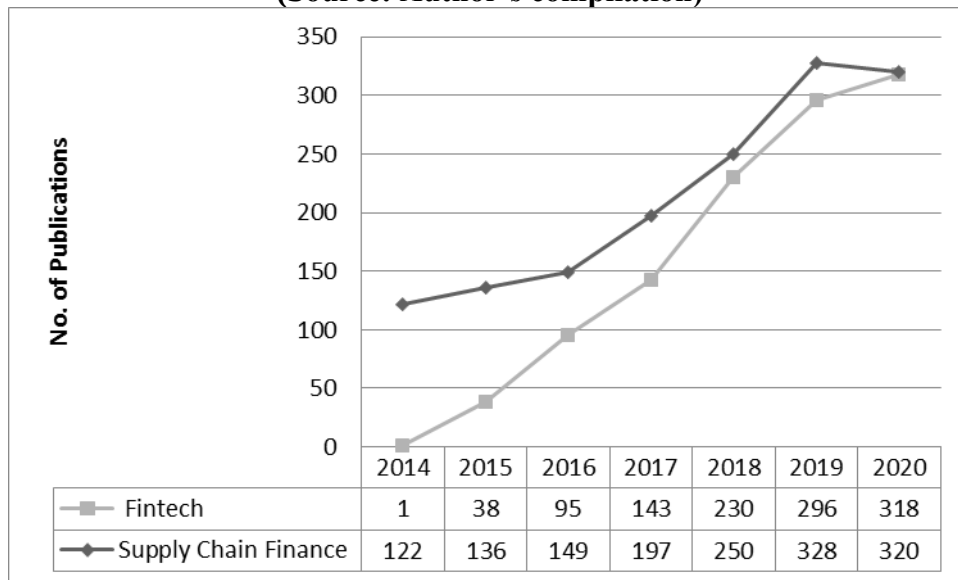
Databases = 'WoS Core Collection'

3. Results and interpretation

The analysis presents the current status of the field of fintech and supply chain finance literature. It is clearly visible that the research on these subjects has grown exponentially in the past five years owing to the introduction of industry 4.0 technologies. The fintech trend has a steeper slope after 2017 showing an increased interest to research and publish in this area. The growth in supply chain finance shows a gradual increase

overtime with more or less fixed increase in literature annually.

Figure 1 Trend in publication of fintech and supply chain finance
(Source: Author's compilation)



15 publications appear in the field of supply chain finance and fintech space. The articles contain research on aspects of fintech with relevance to Industry 4.0, Blockchain technology and Fintech revolution. It can be seen from Table 1 that

fintech and supply chain finance literature is only available for the recent decade leaving ample space for further research and exploration. The topics are aligned in a spectrum of new age disruptive technologies and have shown a promising trend for more qualifying research.

Table 2 Literature on Fintech and Supply Chain Finance
(Source: Author's compilation)

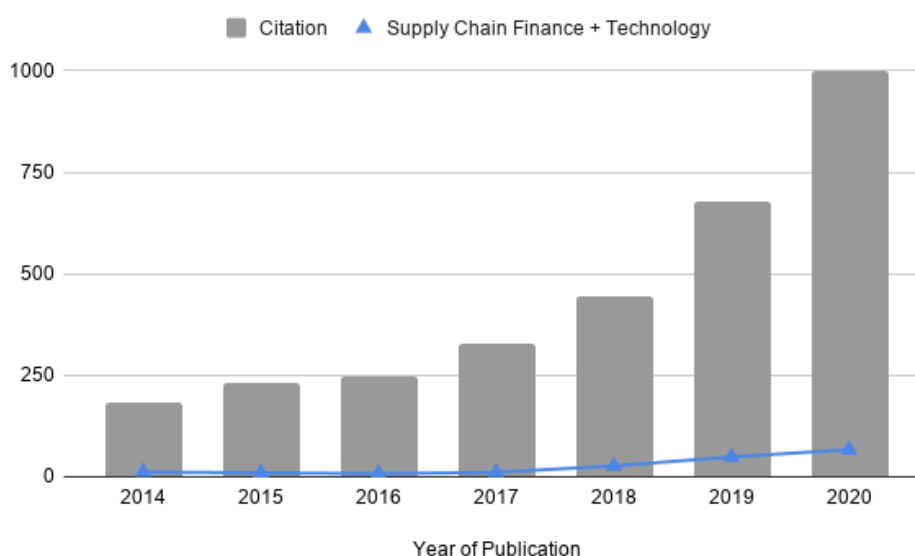
Publication Year	Article Title	Author Full Names
2020	Blockchain, business and the fourth industrial revolution: Whence, whither, wherefore and how?	Kimani, Danson; Adams, Kweku; Attah-Boakye
2020	Supply Chain Finance Innovation Using Blockchain	Du, Mingxiao; Chen, Qijun; Xiao, Jie; Yang, Houhao; Ma, Xiaofeng
2020	A Survey of the Application of Blockchain in Multiple Fields of Financial Services	Wang, Yiran; Kim, Dae-Kyoo; Jeong, Dongwon
2020	Big data analytics for supply chain relationship in banking	Hung, Jui-Long; He, Wu; Shen, Jiancheng
2020	Trade finance in Qatar: blockchain and economic diversification	Dahdal, Andrew; Truby, Jon; Botosh, Husam
2020	Bitcoin, Blockchain and Fintech: a systematic review and case studies in the supply chain	Wamba, Samuel Fosso; Kamdjoug, Jean Robert Kala; Bawack, Ransome
2020	Impact of customers' digital banking adoption on hidden defection: A combined analytical-empirical approach	Son, Yoonseock; Kwon, Hyeokkoo Eric; Tayi, Giri K.; Oh, Wonseok
2019	A systematic review of blockchain	Xu, Min; Chen, Xingtong; Kou, Gang
2019	Fintech and the Innovation Trilemma	Brummer, Chris; Yadav, Yesha

2019	The role of supply chain finance in improving the competitive advantage of online retailing enterprises	Chen, Xiangfeng; Liu, Chuanjun; Li, Shuting
2018	Research in Operations Management and Information Systems Interface	Kumar, Subodha; Mookerjee, Vijay;
2018	Is mobile payment still relevant in the fintech era?	Iman, Nofie
2018	Governance on the Drug Supply Chain via Gcoin Blockchain	Tseng, Jen-Hung; Liao, Yen-Chih; Chong,
2017	The FinTech Revolution and Financial Regulation: The Case of Online Supply-Chain Financing	Tsai, Chang-Hsien; Peng, Kuan-Jung
2017	Analysis of the Competitive Strategy of Supply Chain Finance-A Case Study of Chinese Supply Chain Financial Enterprises	Tsai, Sang-Bing

It can be observed that most literature concerning fintech is focused on innovation in systems. This indicates how traditional financing options will

gradually erode if fintech is supported with further research. The congruence of supply chain finance and technology can be viewed in figure 2.

Figure 2 Citation trend of technology in supply chain finance
(Source: Author's compilation)



There are 766 journals and proceedings included in the publications on supply chain finance. Table 2 demonstrates the top 20 journals in supply chain

finance. The results show that top 5 journals account for more than 10% of total research on this subject.

Table 3 Top 20 journals and proceedings in the field of supply chain finance
(Source: Author's compilation)

Sr. No.	Field: Source Titles	Record Count	% of total
1	International Journal Of Production Economics	58	4.27%
2	Sustainability	39	2.88%
3	International Journal Of Production Research	28	2.07%
4	Computers Industrial Engineering	24	1.77%
5	European Journal Of Operational Research	22	1.62%
6	Journal Of Cleaner Production	20	1.48%

7	Industrial Management Data Systems	19	1.40%
8	Advances In Social Science Education And Humanities Research	16	1.18%
9	Omega International Journal Of Management Science	16	1.18%
10	Mathematical Problems In Engineering	15	1.11%
11	International Journal Of Physical Distribution Logistics Management	14	1.03%
12	International Transactions In Operational Research	14	1.03%
13	Manufacturing Service Operations Management	14	1.03%
14	Advances In Economics Business And Management Research	13	0.96%
15	IEEE Access	12	0.89%
16	Production And Operations Management	12	0.89%
17	Journal Of Purchasing And Supply Management	11	0.81%
18	Advances In Education Research	10	0.74%
19	Management Science	10	0.74%
20	Vaccine	10	0.74%

An author analysis based only on the number of publications will not be adequate in order to present the contribution of authors. Hence, Price's Law is adopted to analyze this data. An author analysis based only on the number of publications may not be an effective method to reveal the contributions of authors. According to Price's Law (Price 1965), around 75% of scholars published only one publication, and half of these publications were generated by 10% of scholars. Therefore, it is important to identify the core authors who not only have good publication abilities but also ones who have greater contributions on promoting the development of the discipline. In this study, Price's Law is employed to calculate the minimum number of publications published by one scholar, and the equation of the threshold number of publications is as follows:

$$TP_n = 0.749\sqrt{N_{max}}$$

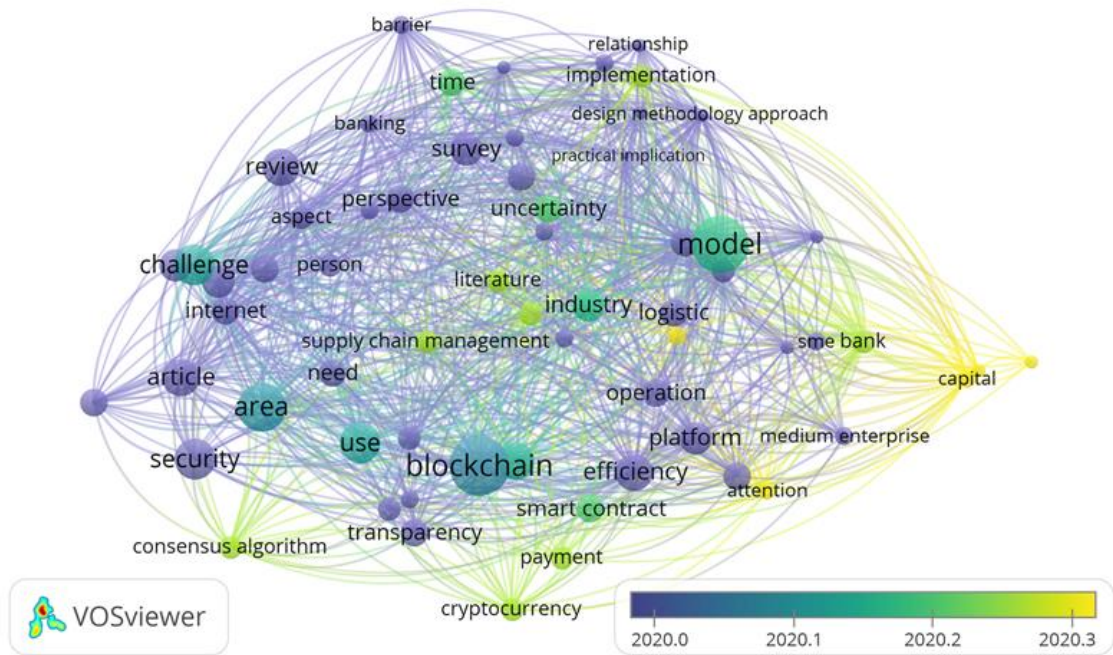
Where, N_{max} denotes the number of publications of the most prolific author in this field.

According to the data collected, there are 3,094 authors published in SCF domain. The most

prolific author was Hofmann E with over 23 publications. Thus the threshold number in this case will be 3.59. Thus, 98 authors qualify as core authors including Chen XF (14), Chung KJ (14) and Wang Y (14). The result indicates that Hofmann E makes greatest contributions to the domain knowledge diffusion and dissemination from the field of SCF to other domains.

The network analysis was then performed by taking into account every keyword in the title and abstract fields and ignoring structured abstract labels and copyright statements. This was done by VOSviewer by binary counting using the threshold occurrences of a term as 4. This counting resulted in 1838 terms, 83 met threshold. The number of terms selected for network mapping is capped at 64. As seen in figure 3, most literature is towards blockchain, model creation, smart contracts and security. It can be observed how banking has emerged as a notable cluster in the periphery. On the right-hand side of the figure, there is also an active discussion regarding SME bank, capital and in the bottom crypto currency and payments.

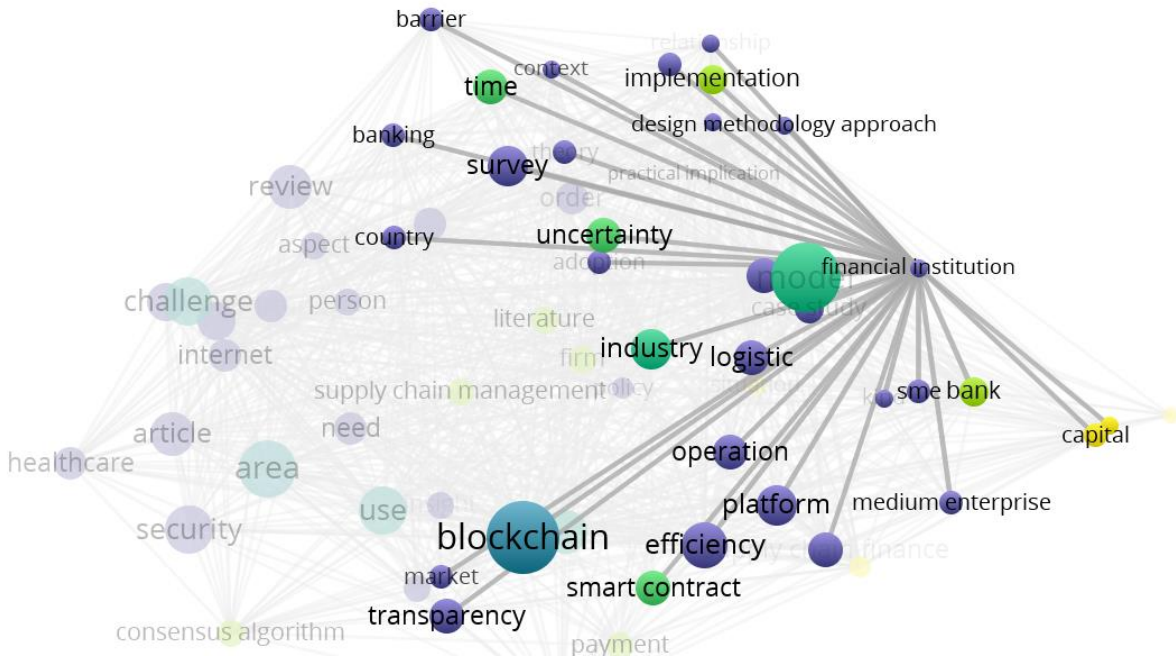
Figure 3 Density visualization of literature in supply chain and technology
(Source: Author’s compilation)



indicating that financial institution is a promising area of research in this domain.

To illustrate this further, figure 4 shows the cluster formed in supply chain and technology clearly

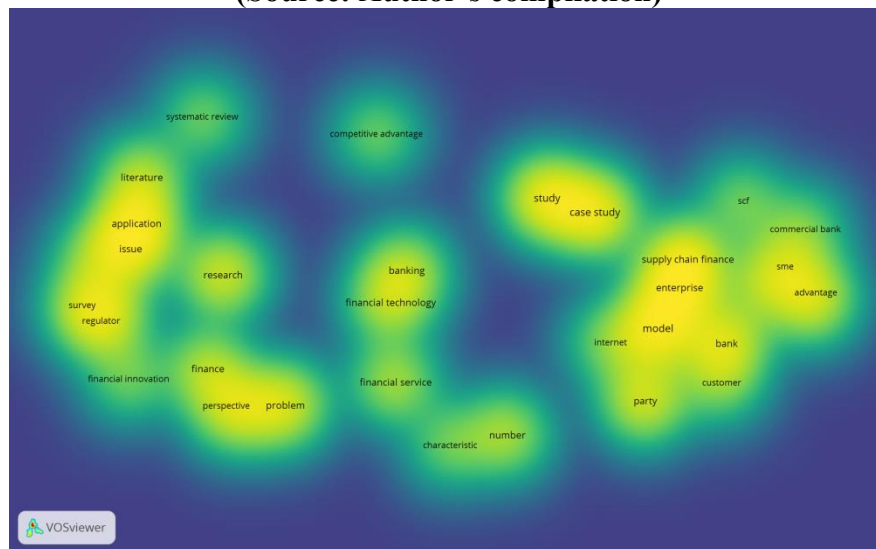
Figure 4 Citation trend of technology in supply chain finance
(Source: Author’s compilation)



As can be seen from Figure 5, areas like regulatory aspects of supply chain finance, commercial banks, fintech as competitive

advantage appear subtly in the auxiliary literature discussion. The literature is dense on supply chain finance however the aspects of fintech in this space remain undiscovered.

Figure 5 Density visualization of literature in supply chain and fintech
(Source: Author's compilation)



Combining the review, network mapping, and heat map analysis comprehensive results are achieved on the evolution of fintech in supply chain.

5. Limitations and Conclusion

5.1. Limitations

The study had to be conducted in a multidisciplinary environment which led to limitation in covering all available literature on both fintech and supply chain. However, it is ensured that all overlapping aspects are covered in the form of supply chain finance and the advent of technology therein. The lack of open access literature in all sources limited the study to a singular database. In future, this can be exploited to commit better literature for fintech in supply chain.

5.2. Conclusion

In this paper, an attempt was made to present the development path of the field of supply chain finance as well as the research hotspots and potential research directions based on the bibliometric method. The literature data was collected from the core collection of WoS, and 1,310 related publications were obtained after cleaning the data. The yearly research output regarding SCF shows that it steadily increased from 1980 to 2020. Furthermore, other measures of the current status were conducted, including publication types, top journals, and co-occurrence network of categories. Moreover, to discover additional meaningful results, bibliometric

analysis, author analysis, and citation analysis were conducted. The main contributions of this paper can be concluded as follows: First, an overview of the knowledge structure and a development path of the field of SCF are presented to help the researchers capture new research opportunities and build new perspectives. Specifically, the contributions of leading journals, publications, authors, institutions, and keywords regarding fintech and supply chain were identified. Second, it has concluded the potential research opportunities for the field of SCF. All in all, this article has brought into view a quite extensive research base in for supply chain that can embrace fintech in a variety of ways.

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