
| RESEARCH ARTICLE

Research Trend in Supply Chain Financing

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| ABSTRACT

Supply chain finance (SCF) is one of the effective methods to reduce costs for company financing and enhance the effectiveness of such financing. The purpose of this research is to highlight the gaps and insights in Supply Chain Financing (SCF) literature and to identify the development trends of supply chain financing (SCF) research through journals or articles published by leading journals. Data Processing Using Bibliometric Method through Bibliographic Information from Scopus for the Topic of Supply Chain Financing. The research adopts a quantitative approach. This quantitative approach is utilized to analyze journals or articles published from 2000 to 2022. Meanwhile, the mapping system uses VOS viewer and biblioshiny. Through this bibliometric analysis, data and visualization of research data trends are obtained. The process consists of four steps: (1) defining search keywords; (2) initializing search results; (3) refining search results; and (4) compiling initial statistical data and analyzing the data. The research findings are expected to provide a stronger roadmap for further research in this field. By utilizing bibliometric analysis, the following data and visualization of research trends are obtained: (1) SCF research within the timeframe of 2000 – 2020 experienced a significant increase starting from the year 2018; (2) Yan N is the most effective author in this topic; (3) China is the country that contributes the most to this research topic; (4) The International Journal of Supply Chain Management is the journal that publishes the most articles on the SCF theme. Furthermore, the research findings on the SCF topic reveal a depiction that this financing model (SCF) is also implemented by Sharia-based banks (MURABAHAH SCF). Thus, it can be ensured that competition will arise between the conventional bank SCF model and the SCF from Sharia banks. Potential topics in future research on supply chain performance or supply chain coordination will be more interesting to research.

| KEYWORDS

Supply chain, Supply chain financing, Supply Chain Management, Bibliometric analysis, VOS viewer

| ARTICLE INFORMATION

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1. Introduction

Supply chain financing is a form of working capital financing for business owners by purchasing goods or services from suppliers. Business owners sometimes feel burdened by borrowing money from banks to obtain capital, leading them to seek alternative financing methods. The advancement of financial technology (fintech) has resulted in the emergence of new methods in corporate funding systems that are more beneficial for business actors. The presence of financial technology is expected to enhance the performance of financial institutions, enabling them to provide services to customers more efficiently (Ranty Anindyastari et al., 2022). Top of Form

Business actors (both small and medium-scale) state that Supply chain financing is a type of funding that greatly assists them. In its implementation, there are three involved parties: Supplier, which is the entity that provides a product or goods. Suppliers can sell their invoices for the purchase of goods to banks or other financial institutions to obtain working capital more quickly. Next,

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the buyer is the party that utilizes the products from the supplier. Supply Chain Financing (SCF) has played a crucial role in operational and financial practices and has garnered attention among academics and industries (Yan et al., 2020). The definition of SCF was first proposed (Stemmler, 2002), stating that the main characteristic of supply chain financing is the integration of financial flows into the supply chain, which is an integral part of supply chain management. Hofmann & Kotzab stated that SCF is an approach to how a company manages funds (cash flow) between companies within a supply chain in the form of payments between vendors or buyers or in other financial forms involving external service providers (banks) (Hofmann et al., 2010).

There are several literature reviews with the same theme of SCF as examples (Chang et al., 2023). Chang's research provides an overview of the inventory lot sizing model under extended payment terms. Another example of research is (Yang & Birge, 2018), which discusses the interaction between operations and finance, where financial activities have significant potential to impact operations and operational considerations. Birge's research offers a new perspective on financial decisions. Research by (Zhao & Huchzermeier, 2019) proposes a risk management framework for integrating multidimensional models of the operational-finance interface. The term "bibliometric" was first used in 1969 by Pritchard in a paper titled "Statistical Bibliography or Bibliometrics" (Pritchard, 1969). Text analysis, citation analysis, content analysis, co-occurrence of keywords, co-citation, or co-authorship analysis are all part of the bibliometric approach (Dias G.P, 2019). Bibliometric analysis is almost synonymous with infometrics or scientometrics (a specific term) (Génova et al., 2016). Meanwhile, the term "webometrics" is used to analyze various aspects of the web (Ellegaard O & Wallin J.A, 2015).

Bibliometric analysis, initially known as scientometrics, mostly focuses on the scientific features of outputs measured by the number of publications produced and articles with a high number of citations (Van Eck N.J & Waltman L, 2010). Citation analysis, commonly known as publication impact evaluation, is a conventional bibliometric technique often used to analyze scientific quality indicators for individual researchers, institutional rankings, or universities (Ellegaard O & Wallin J.A, 2015). As bibliometric analysis methods continue to evolve, they are increasingly used to convey data about relationships between various authors, groups, fields of study, institutions, and more. Usually, parts of study materials or published articles will contain this information (Zhu et al., 2019). This information is crucial for researchers to collaborate with others, conduct joint research, and stay informed about emerging research trends. This research was conducted to determine the trend of Supply chain financing that developed between 2000 to 2022. The purpose of this study is to highlight the topic of supply chain financing generated by scientific literature taken from Scopus data and highlight gaps and recommendations for future research (Purwoto L, 2020). Specifically, the aim of this research is to address the following questions related to the topic of "Supply chain financing": (1) What are the trends in Supply chain financing research based on the number of publications per year? (2) Which journals have published the most papers on Supply chain financing? (3) How is the level of networking and centrality in authorship? (4) What are the top potential topics for future research? (5) From which country do the most contributions come from authors? (6) Which articles are the most influential based on citation metrics in Vos Viewer?

Based on the descriptions above, a bibliometric analysis research titled "Supply chain financing bibliometric analysis" was conducted.

2. Literature Review

2.1 Supply Chain Management (SCM)

Supply Chain Management (SCM) is a system that regulates the flow of products from manufacturers to warehouses with the aim of cost efficiency. Several experts define the supply chain with various explanations. According to (Heizer et al., 2009), supply chain management is the integration of activities involving the procurement of materials and services, their conversion into semi-finished and finished products, and their delivery to customers. These activities require a close relationship between suppliers of goods or services in product transformation and distribution to customers. Martin & Hofmann argue that supply chain management is a network of organizations involving upstream and downstream relationships in various processes and activities that add value in the form of products and services to customers (Martin J & Hofmaan E, 2019). Meanwhile, according to Kalakota, supply chain management is a process where products are created and delivered to consumers (Kalakota et al., 2001)

Another definition is proposed by Ling Li, who argues that SCM is a set of interrelated activities and decisions to efficiently integrate suppliers, manufacturers, warehouses, transportation services, retailers, and consumers. As a result, the produced products can be distributed in the right quantity, time, and location to minimize costs and meet consumer needs (Ling Li, 2007). This supply chain encompasses all its components, including suppliers, manufacturers, distributors, and customers, both directly and indirectly. This supply chain not only involves manufacturers and suppliers but also includes transportation, warehousing, retailers, and even extends to the end customers (Chopra et al., 2007).

2.2 Supply Chain Financing (SCF)

The formal definition of Supply chain financing is expressed by the Aberdeen Group (Aberdeen, n.d.)

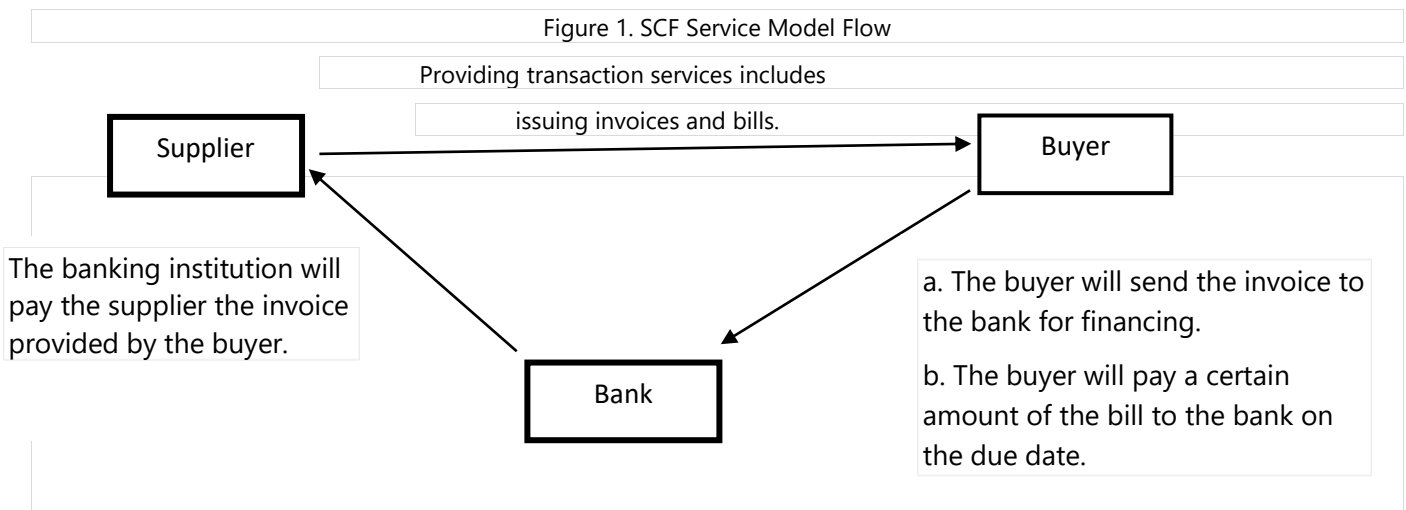
Supply chain financing (SCF) is "a combination of Trade Financing provided by a financial institution, a third-party vendor, or a corporation itself, and a technology platform that unites trading partners and financial institutions electronically and provides the financing triggers based on the occurrence of one or several supply chain events."

From the information above, we can conclude that Supply chain financing is a combination of trade financing by financial institutions, a tri-party collaboration among vendors or companies themselves, and a technological platform that electronically connects trading partners and financial institutions, providing financing based on the involvement of one or multiple points in the supply chain.

Supply chain financing runs parallel to the physical or material supply chain and represents all transactional activities related to cash flow from the initial customer order through reconciliation and payment to the seller (Killen & Association, 2002). Finance Supply Chain Management (FSCM) is a holistic and comprehensive financial planning and control of all relevant processes within a company and for communication with other companies. The goal of FSCM is to enhance transparency and the level of automation in financial business processes along the financial value chain, aiming to save processing costs and reduce working capital for the company. This is in line with the goal of a company that is established, which is to seek the highest possible profit or to increase profits for the following year (Suhastiningsih & Wiyadi, 2012).

The main characteristic of supply chain financing is the integration of financial flows into the supply chain, which is an integral part of supply chain management (Stemmler, 2002). Hofmann & Kotzab argue that supply chain financing is at the intersection of logistics, supply chain management, and financing. SCF is an approach for an organization or multiple organizations within the supply chain, including external service providers, to collectively create value by planning, driving, and controlling the flow of financial resources at the organizational or inter-organizational level (Hofmann et al., 2010).

SCF is the optimization of financing between companies and the integration of financing processes with customers, suppliers, and service providers to enhance the value of all participating companies (Pfohl H.C & Gomm M, 2010). According to (Gomm, 2010), the goal of SCF is to optimize cross-border financing between companies to reduce the cost of capital and accelerate cash flow. SCF also aims to optimize financial flows through solutions implemented by financial institutions (Cammerinelli E, 2009). or technology providers (Lamoureux J.F & Evans, 2011). In addition, its primary objective is to align financial flows with product and information flows in the supply chain, thus improving cash flow management from a supply chain perspective (Wuttke D.A et al., 2013). In Islamic Economics, this SCF model is known as Islamic Supply Chain Finance - Pembiayaan Murabahah (Muhammad Sholahuddin & Hakim, 2020)



The benefits of having a supply chain financing system are as follows: For buyers: maintaining cash flow, ensuring capital security, and increasing sales. For suppliers: ease in working capital and improvement in cash flow.

For banks: The bank will receive fees for providing services to suppliers and buyers. In this three-party collaboration, the bank will certainly consider the risks involved. This means that even though the parties enter into a collaboration, the bank will not immediately approve it but will first analyze the level of risk involved (e.g., the type of business, the type of product, and others)

(Imronudin & Hussain J.G, 2020). The creative industry is one of the sectors expected to become a new economic force in the future, in line with the diminishing natural resources each year (Mangifera, 2018). Therefore, this creative industry needs to be supported with funding through the use of the SCF model (Fershie D. Yap & Artates, 2023).

3. Research Methodology

Bibliometric analysis is the application of statistical and quantitative approaches to research publications (Thomson Reuters, 2008). This analysis has been used for different purposes, fields, and topics (Ariwibowo E.K, 2019) or in specific journals (Abdi A. et al., 2018). Bibliometric analysis often uses data (metadata) sourced from Web of Science (WoS) or Scopus. Both databases are used because they have a vast amount of data and cover a wide range of research fields. Bibliometric, when used in academic research, can be defined as a set of methods to provide quantitative analysis of written publications (Pugnetti C & Elmer S, 2019). Common metrics frequently used in bibliometric analysis include publications, number of citations, average citations per article, h-index, and co-authorship (Dias G.P, 2019). However, bibliometric data analysis should still be done with caution. In fact, most criticism of bibliometrics is based on the fact that impact, as measured by citation indicators, does not always reflect quality. Additionally, different fields tend to have vastly different publication and citation patterns. Therefore, direct evaluation of publication and citation metrics for different subjects should be applied with caution (Adi A.N, 2015)

This research utilizes a descriptive bibliometric research method based on literature databases. Bibliometric analysis is an approach that provides valuable insights from a vast amount of scientific literature produced each year by researchers from various countries around the world. The data search is conducted using journals available in Scopus, a prominent journal publisher. The data collection technique involves downloading journal data from Scopus based on the specified theme. Then, the data is filtered according to predetermined criteria, including the type of journals and other publications, as well as the desired range of years.

There are two aspects of bibliometric analysis that can be distinguished, namely the construction aspect of bibliometric maps and the graphical representation aspect of the maps (Rusydia A & Tubastuvi N, 2021). In bibliometric literature analysis, the greatest attention is given to the construction aspect of bibliometric maps (Zainal N et al., 2021), while the graphical representation aspect receives less attention. However, currently, some researchers are seriously studying issues related to graphical representation. This research uses publication data from various scientific journals and other sources related to Supply Chain Financing (SCF). The analysis tools used are Biblioshiny and Vos Viewer software to analyze the visualization of research trends.

The steps in data processing are as follows: The first step is to determine the keywords that will be used as the focus of the research. The second step is to finalize these keywords by searching for articles in the Scopus database. Data search is limited to journal articles and conference papers authored by researchers from various countries. The third step is to refine the initial results, which involves identifying relevant documents from the last 8 years. The final step is the data analysis process using bibliometric tools (biblioshiny R) and Vos Viewer for visualizing research trends.

In brief, the research methodology can be depicted in the following scheme:

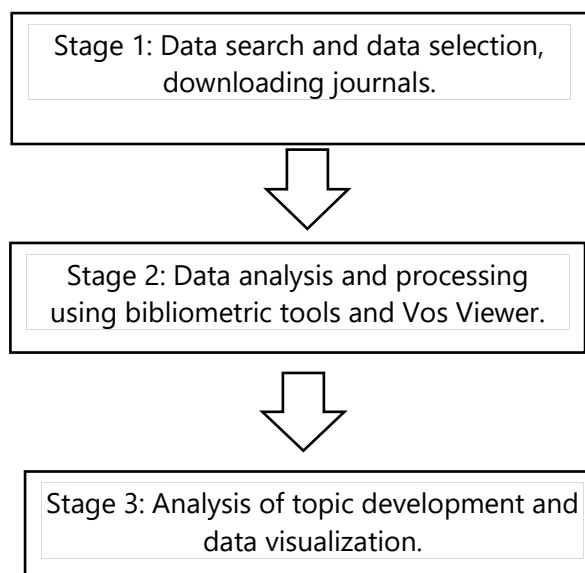


Figure 2: Research methodology for analyzing research trends in supply chain finance.

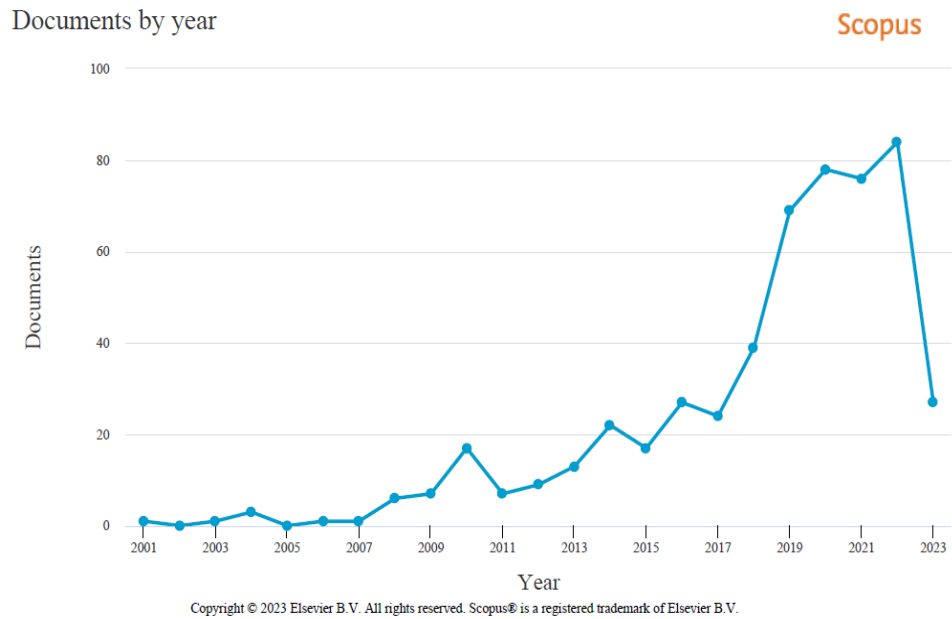


Figure 3

4. Bibliometric Analysis Results

4.1 Research Trends in Supply Chain Financing Policies Worldwide Research Trends in Supply Chain Financing based on the number of publications per year.

Figure 3 shows the research trends in supply chain financing based on the number of articles published per year. Generally, research in supply chain financing began to develop in 2001 with 2 published documents, and currently, the research trend is growing in terms of the number of publications. Overall, the research trend in supply chain financing started to develop in 2020 with 78 published documents. In understanding the research trend, data analysis shows the highest peak occurred in 2022 with 84 published documents. Going forward, the number of research in this area is expected to become a trend and will continue to grow.

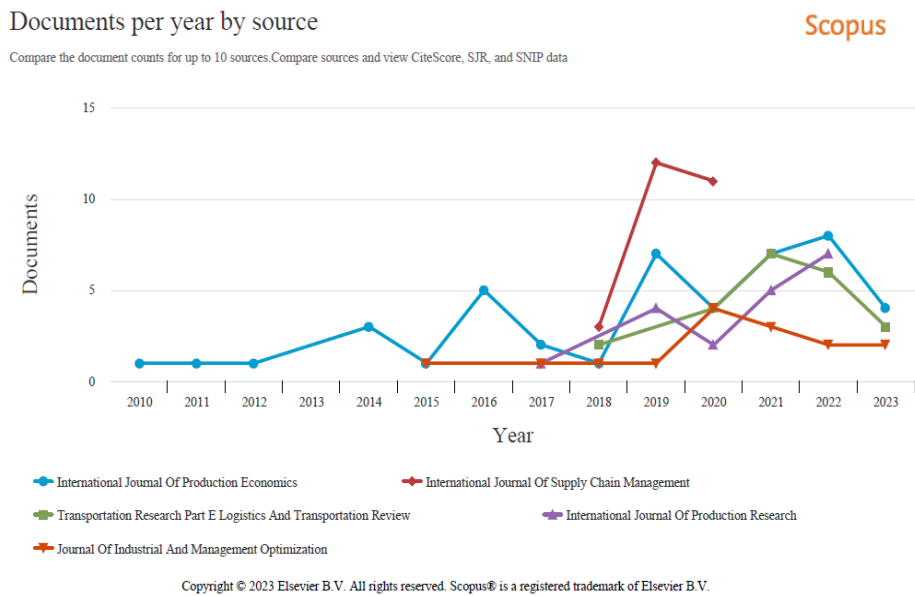


Figure 4

4.2 Shows the top ten peer-reviewed journals with the highest number of publications in supply chain financing research.

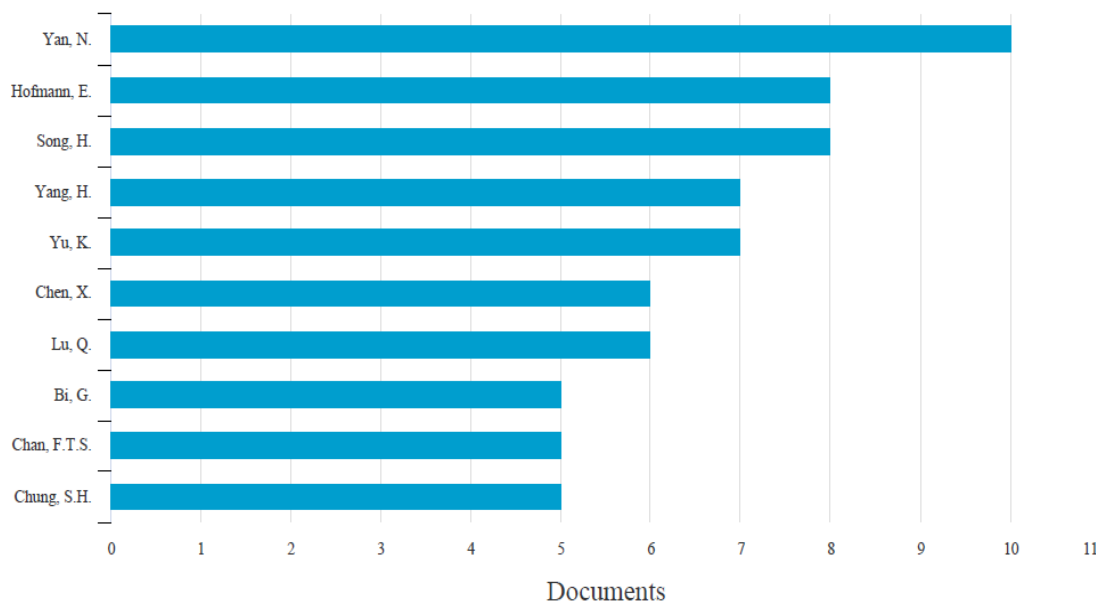
Journals with the most published articles in the field of supply chain financing research.

Image 4 depicts documents based on the source of documents per year, starting from the year 2010 until 2022, illustrating the top 5 sources in supply chain financing research. When observing the trend over time, it is evident that the documents per year from the first source originate from the International Journal of Production Economics, with a total of 8 publications in the year 2022. And secondly, the International Journal of Supply Chain Management with a total of 12 document publications from 2018 to 2020. The third source is the Transportation Research Part E-Logistics And Transportation Review, with a total of 7 documents from the year 2018 to 2022. The fourth source is the International Journal of Production Research, with 7 documents in the year 2022. Lastly, the Journal of Industrial and Management Optimization has published a total of 4 documents in the year 2020.

Documents by author

Scopus

Compare the document counts for up to 15 authors.



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Figure 5

4.3. The top ten authors contributing to supply chain financing research worldwide.

The most productive author in the publication of supply chain financing research.

Figure 5 shows the top ten authors contributing to supply chain financing research. Firstly, Yan N is the author with the highest number of publications, totaling 20 documents. Secondly, Hoffmann E and Song H have 8 publications each. Thirdly, Yang, H. and Yu, K. have 7 publications each. Fourthly, Chen, X and Lu, Q have 6 publications each. Lastly, Bi, G., Chan, F.T.S, and Chung, S.H are authors with 5 publications each.

5. Data Analysis

In this bibliometric analysis, the data obtained from Scopus is stored in RIS or CSV format, which is then visualized using VOS viewer software. According to Hudha (Hudha M.N et al., 2020), VOS Viewer can be applied for data analysis and can be graphically represented in the form of bibliometric maps. VOS Viewer application is widely used due to its ability to work with large datasets and display reasonably large bibliometric maps in an easy-to-interpret and understandable manner. Based on the research findings of (Van Eck N.J & Waltman L., 2010), it is evident that VOS Viewer is capable of handling large-sized maps and displaying citation maps from major scientific journals. Moreover, the VOS Viewer application can create maps of publications, authors, journals, or countries based on co-citation networks, as well as generate keyword maps for topic modeling. Besides being a free application, VOS Viewer remains widely used in research related to data mining.

5.4 Density visualization of the Scopus database using Vos Viewer Potential topics in the field of Supply Chain Financing for future studies.

Figure 8 shows potential topics in the field of Supply Chain Financing that require further investigation in the future. Therefore, the image above (Figure 8) provides an opportunity for other researchers to identify potential topics as new contributions to research in the field of Supply Chain Financing. In terms of related research, we can also see that, for example, the keyword "Supply chain financing" has not been studied with "supply chain" at the same time because they are in different clusters. This topic is a relatively new trend for researchers to conduct research that combines Supply Chain Financing with the broader concept of supply chain.

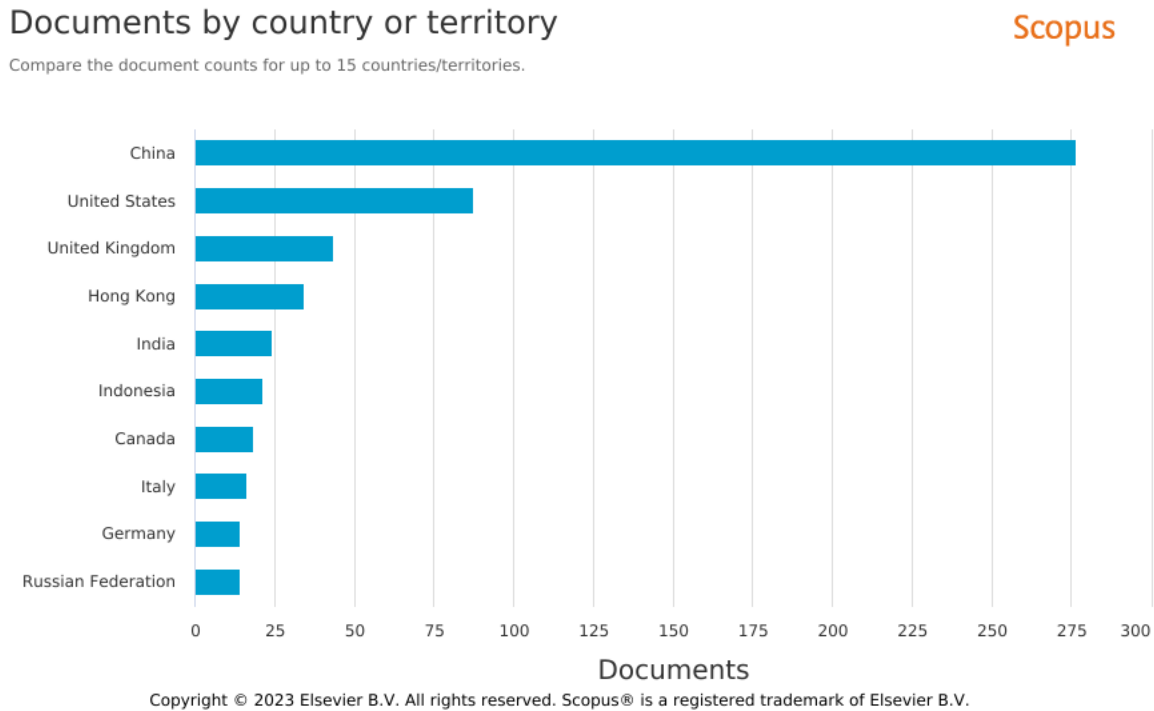


Figure 9

5.5 Shows the top ten countries of authors and collaborations based on the number of publications. The visualization of the countries of authors and collaborations using VOS Viewer.

In this section, bibliometric analysis is conducted to analyze and visualize the countries of authors contributing to the field of Supply Chain Financing research. The default minimum number of documents set for a country is one document. The top ten authors above indicate that they have the highest number of publications.

The countries of authors contributing the most publications to Supply Chain Financing research and their collaborations are shown in Figure 9.

The figure indicates that China is the country with the highest number of research publications on the topic of Supply Chain Financing, with a total of 276 documents. The United States (US) ranks second with 87 documents, followed by the United Kingdom (UK) with 43 documents. Hong Kong ranks fourth with 34 documents, while India ranks fifth with 24 documents. Indonesia holds the sixth position with 22 documents, Canada ranks seventh with 28 documents, followed by Italy in the eighth position with 26 documents. Germany and Russia each have 24 documents.

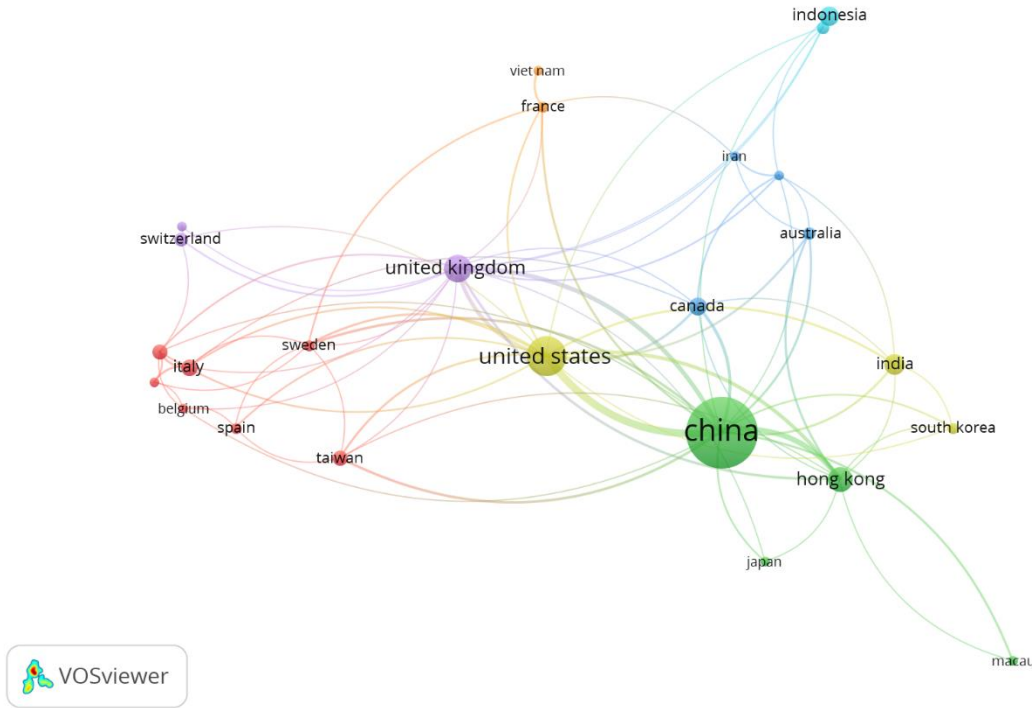


Figure 10

5.6 Shows the collaboration between countries in the visualization of authors

Figure 10 shows the collaboration between countries in Supply Chain Financing research. The circles above are interconnected, representing the collaboration between different countries. The size of the circles indicates the number of publications from each country. The largest circle belongs to China, indicating its dominance in this research area. China serves as a central hub for Supply Chain Financing studies, and other countries conducting research in this field have collaborations with China. The network of country/region collaboration can be obtained using the VOS Viewer application. In the provided figure, the most extensive connection items are shown among 20 countries/regions. The size of the nodes in this figure represents the number of publications from each country/region. Each country/region is connected through links, indicating collaboration relationships among them. Different color codes represent different groups, and all parameters and collaboration networks have the same meaning.

The article which has the most influence based on citation size in the VOS Viewer literature is shown in Table 2 as the most cited article.

Table 2 is the most cited article.

No	Title	Year	Source	Citation
1.	financing the news vendor: supplier vs. bank, and the structure of optimal trade credit contracts.	2022	Operation Research	37
2.	Focusing the financial flow of supply chains: an empirical investigation of financial supply chain management	2022	International journal of production economics	22
3.	coordinating contracts for a financially constrained supply chain	2019	International journal of supply chain management	22

This study shows that Scopus journals have a significant impact on citation-related metrics. Table 3 displays the most cited articles in the field of Supply Chain Financing, and the results are limited to the top three articles with the highest number of citations among others. The total number of citations is used to determine the most influential articles, as shown in Table 4. The article titled "Financing the News Vendor: Supplier vs. Bank, and the Structure of Optimal Trade Credit Contracts" has been cited 284 times and is the most cited article overall in this field. Next, the article titled "Focusing the Financial Flow of Supply Chains: An Empirical Investigation of Financial Supply Chain Management" has been cited 22 times and is the second most cited article in this field. Finally, the article titled "Coordinating contracts for a financially constrained supply chain" has also been cited 22 times and is the third most cited article in this field.

6. Results and discussion

Bibliometric analysis is a quantitative approach to studying trends and patterns in scientific literature, using data and metrics related to publications, authors, citations, and journals. Based on the data provided, Figure 2 shows the research trends in Supply Chain Financing based on the number of articles published per year, indicating that research on this topic is still continuously growing. Bibliometric analysis can be used to analyze research trends, patterns, and relationships in scientific literature based on quantitative data and metrics related to publications, authors, and sources.

Figure 4 shows the documents based on their sources, illustrating the top five sources in Supply Chain Financing research from 2010 to 2022. The data indicates that the International Journal of Supply Chain Management has the highest number of publications, with 12 documents occurring in 2020. However, it is important to note that the quality and impact of these publications can vary and may not necessarily reflect or represent the most influential or prestigious sources in the field. Figure 5 displays the top ten authors contributing to Supply Chain Financing research.

Figure 5 shows that Yan, N is the author with the highest number of publications, with 20 publications. This indicates that they are a productive or influential researcher in the field. However, it is essential to examine the quality and impact of these publications to assess whether the research can contribute to the business world in practice. Additionally, it is worth noting that some authors have only one or two publications, which may indicate a more fragmented or diverse research community that can also have an impact on the field, particularly in the business world.

Figure 6 shows the most frequently used keywords related to this topic. The words "Supply chain," "supply chain management," and "supply chain finance" are the most commonly used (appear frequently). This indicates that researchers in this field focus on studying the concepts of Supply chain financing and its management. Additionally, other frequently used keywords include "profitability," "investment," and "financial strategy."

Figure 7 shows the visualization of the research clusters in the field of Supply chain financing. The clusters are color-coded based on the year of publication, with the most recent research in yellow. These clusters represent the most popular research topics in this field, with "profitability," "investment," and "financial strategy" being the most commonly occurring keywords. This visualization also highlights other potential areas for future research, such as the relationship between Supply chain financing and the banking sector.

Figure 8 presents potential research topics that require further investigation in the future. These topics include "Supply chain financing with manufacturing and distribution companies," "Supply chain financing with government policies," and "Supply chain financing in the banking sector." These topics offer opportunities for researchers to explore new areas and are expected to contribute to further research in the field of Supply chain financing.

Image 8 presents potential research topics that require further investigation in the future. These topics include "Supply chain financing with manufacturing and distribution companies," "Supply chain financing involving government policies," and "Supply chain financing in the banking sector." These topics offer opportunities for researchers to explore new areas and are expected to provide fresh contributions to future research in supply chain financing

Figure 9 shows the distribution of research publications based on countries. China is the country that contributes the most in terms of publications. Meanwhile, other countries such as the United States (US), the United Kingdom (UK), Hong Kong, India, and Indonesia also have significant contributions in this field. This indicates that research in Supply chain financing is a global phenomenon and not limited to specific regions.

In summary, it can be said that bibliometric analysis provides valuable insights into trends, authors, sources, and subject areas related to Supply chain financing research. However, it is important to note that bibliometric analysis also has limitations and biases, such as the quality and impact of publications, relevance of search terms and the database used, as well as data

interpretation and representation. Therefore, it is advisable to complement bibliometric analysis with other qualitative and quantitative methods to provide a more comprehensive and accurate understanding of the research field.

In conclusion, bibliometric analysis serves as a useful tool to analyze trends, patterns, and gaps in existing research on Supply chain financing. It is expected to assist researchers in identifying potential research areas and making new contributions to the field.

7. Conclusion

The results of the research conducted to understand the trends in the development of research on the topic of Supply Chain Financing during the period from 2000 to 2022 can be summarized as follows: The keywords used in this search were supply chain, supply chain management, and supply chain financing. The research outcomes on the topic of Supply Chain Financing exhibit a stable growth trend since 2020, with an increasing number of published articles each year. The International Journal of Supply Chain Management is the most prolific publisher in this field (publishing 12 documents in 2020), and Yan N is the most prolific author with 20 documents published during 2000 – 2022. The results also showed that the words Supply Chain Financing and Supply Chain are words that often appear (the frequency of occurrence is higher). This means that research on this topic (supply chain financing) has been researched a lot. Supply Chain Financing and Supply Chain are central terms in research within this field. Potential topics in future research on supply chain performance or supply chain coordination will be more interesting to research. Because it will be very useful for the activities of an organization, both profit and non-profit organizations

China is the country with the highest number of articles contributing to the literature on Supply Chain Financing. Meanwhile, the primary research focus in this field is on supply chain, with the most frequent keywords being supply chain management and supply chain financing. The research results indicate that the most influential article based on citations originates from the Journal of Operations Research with the title "Financing the News Vendor: Supplier versus Bank and Structure of Optimal Trade Credit Contracts," which has been cited 37 times. This study provides valuable insights for the general public, entrepreneurs, and banking practitioners and highlights the need for further research to validate existing findings. Overall, this research helps bridge gaps in the literature and enriches our understanding of Supply Chain Financing.

8. Limitations

Bibliometric research on the theme of Supply Chain Financing is not exempt from limitations. The keyword search was conducted using general keywords, potentially causing some relevant articles to be missed. Thus, future research could expand the types of units to be analyzed, include more detailed keywords, and broaden the scope of databases by incorporating other analyses such as Web of Science (WOS), Springer, and others. To mitigate author bias, the results of the bibliometric study should also be compared with other approaches such as Hits Cite and Bib Excel. Despite the limitations of using bibliometric analysis with VOS viewer on Supply Chain Financing literature, the successful application of VOS viewer to map and visualize bibliometric data has been demonstrated. The fact that this study only utilized data from the Scopus database is a weakness.

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