

Financial supply chain management: A bibliometric analysis for 2006-2022**Ayman Abdalmajeed Alsmadi^{a*}, Anwar Al-Gasaymeh^b, Najed Alrawashdeh^c and Loai Naser Alhwamdeh^d**^a*Al Zaytoonah University of Jordan, Jordan*^b*Applied Science University, Jordan*^c*Isra University, Jordan*^d*Middle East University of Jordan, Jordan***ABSTRACT***Article history:*

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Supply Chain Finance (SCF) is playing an increasingly important role in operational and financial practices and attracted growing attention from academia and industry alike. However, researchers have not yet been totally able to reach a consensus on the definition of this phenomenon. The study presented in the paper provides an overview of the advancements present in research on Financial Supply Chain Management. Using a bibliometric analysis approach, the paper summarizes the trends of development and the status quo of the Financial Supply Chain Management. The aim is to provide the reader with guidance and a solid conceptual framework for future research.

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1. Introduction

Supply chain management is at the heart of the global economy and successful supply chain risk management is critical to corporate success. Supply chain management data is patchy, both for the individual companies in the supply chain management and for the links between multiple supply chains. Bank-sourced credit data can help to identify some of the weak links in supply chain networks. Moreover, supply chain management is a well-known management strategy which attempts to delight its customers by adding value to customer service, reducing cost and to enhance competitive advantage through integrating the main business process in supply chain. Since Supply chain management has been proposed in the 1980s, it is already three decades passed (Oliver & Webber 1982). Due to globalization and information technologies, Supply chain management has become more important and achievable (Cousins et al., 2006). From the past research, it is considered that organizations are no longer competing as individuals but rather as supply chains (Lambert & Cooper, 2000). The members of a supply chain include all companies with which the focal company interacts directly or indirectly through its suppliers or customers, from point of origin to the point of consumption. Thus, the analysis of the supply chain occurs from the focal firm.

Additionally, supply chain finance constitutes a critical part of supply chain management that connects buyers, sellers, and financial institutions. Supply chain finance (Chen & Hu, 2011; Baerentsen & Thorstenson, 2012) helps businesses reduce financial costs and improve business performance (Hofmann & Zumsteg, 2015). More importantly, supply chain finance helps to release working capital that is “stuck” in the supply chain. Another benefit of Supply chain finance is a solution to optimize working capital, and the development of the supply chain finance market needs to consider its characteristics and

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diversity so that all market participants can fully support the economy and small and medium enterprises. Moreover, supply chain finance is an effective facility to reduce financing costs and improve financial efficiency and effectiveness (Camerinelli, 2009), where supply chain finance does not have a unified concept and is viewed differently by the authors depending on the research approaches. Through the literature review, the author found that there are two main directions in research on supply chain finance: (i) financial-oriented perspective and (ii) supply chain-oriented perspective.

Under the first approach, Camerinelli's (2009) supply chain finance research focuses on financial aspects and supply chain finance as a set of solutions, products, and services provided by financial institutions. Under the latter, the supply chain finance approach is oriented towards improving cash flow management from the supply chain to help supply chain agents minimize credit risk and working capital in the supply chain. Cost-saving possibilities are created through improved trust, commitment to compliance, thereby increasing benefits for all stakeholders in the entire supply chain (Pfohl & Gomm, 2009; Wuttke et al., 2013a).

Bibliometric analysis was first introduced by Pritchard (1969), bibliometric analysis refers to the application of statistical methods to analyze and determine publication trends over time of research products. Bibliometric analysis helps to generalize comprehensive knowledge of a research area, establish links between research studies, the most influential authors, and cooperation between countries in the field of research, suggesting new research directions in the future.

Given such an important role and the recent expansion of the supply chain finance market, interest in supply chain finance is also growing among academia. The number of studies focusing on the topic of supply chain finance has increased in recent years, helping to form a more accurate and diverse conceptual framework to describe supply chain finance. The nature of research on supply chain management has been examined in many studies (Cooper et al., 1997; Mentzer et al., 2001; Tang et al., 2018), but very few researchers do bibliometric study. Although study of the intellectual structure was done using bibliometric methods by many researchers and provides a more objective scope of the study and development (Shiau & Dwivedi 2013). According to Giannakis (2012) intellectual structure of supply chain management has become an important research issue in recent years. Bibliometric method is a well-known method to describe the intellectual structure in any academic field (Shiau & Dwivedi, 2013). Others combined bibliometric analysis with keywords to explore the intellectual structure of supply chain management.

The purpose of this study is to provide an overview of bibliometric analysis for the publication trends worldwide on the topic of supply chain finance to answer the following questions: In the Scopus database, what is the historical trend of scientific products and the numbers of Financial Supply Chain Management research? How is the trend of scientific production of Financial Supply Chain Management researchers in terms of subjects/fields? What are the critical intellectual and influential aspects of Financial Supply Chain Management literature? What is the future research direction of Financial Supply Chain Management? The findings of this paper could provide some future study directions for the interested authors and to fill the literature gap which is presented in the literature reviews of the Financial Supply Chain Management.

The remaining sections of the article are organized as follows: Section 2 describes the theoretical overview and bibliometric methods used in this study; Section 3 presents the research results and discusses key findings; Section 4 presents the conclusions and suggests potential future research directions in the field of supply chain finance.

This paper aims at contributing the existing literature by addressing the following questions

- In the Scopus database, what is the historical trend of scientific products and the numbers of Financial Supply Chain Management research?
- How is the trend of scientific production of Financial Supply Chain Management researchers in terms of subjects/fields?
- What are the critical intellectual and influential aspects of Financial Supply Chain Management literature?
- What is the future research direction of Financial Supply Chain Management?

The findings of this paper could provide some future study directions for the interested authors. Moreover, the following table represents the literature reviews of the Financial Supply Chain Management.

2. Literature review

SCF aims to optimize financial flows through solutions implemented by financial institutions (Camerinelli, 2009) or technology providers (Lamoureux & Evans, 2011). The ultimate objective is to align financial flows with product and information flows within the supply chain, improving cash flow management from a supply chain perspective (Wuttke et al., 2013b). The benefits of the SCF approach rely on cooperation among stakeholders within the supply chain and typically result in lower debt costs, new opportunities to obtain loans (especially for weak supply chain players) or reduced working capital within the supply chain (Claassen et al., 2008; Gelsomino et al., 2016; Caniato et al., 2016).

Financial Supply Chain Management may mean differently from various viewpoints in supply chain including: logistic services provider (LSP), information services providers (ISP) and financial services providers (FSP). This concept commences from a simple definition “cash flow management (including financial payment or short-term financial supply) among members of a supply chain”, and in some other definitions, it emphasizes on management of investment expenses or financial supply for the whole supply chain and method of such expenses. FSCM contains a number of approaches and services to accelerate financial and information resources flow among commercial partners in supply chains (Hausman, 2005). Based on another definition, FSCM concept includes facilitating financial supply tools for supply chains by banks and institutes of third party financial services providers through introducing processes and modern payment conditions by these financial institutes for the partners of supply chain. Another viewpoint to “Financial Supply Chain Management” shall be expressed after calculating all the expenses of financial activities, which occur in a supply chain and among its members and also determining methods of decreasing those expenses without imposing risk on weaker members of the supply chain. Another approach to “Financial Supply Chain Management” defines it as a series of processes which include cash exchange, inventories and information management in the supply chain. In this concept, FSCM is a series of cross-functional processes which manage key processes related to risk, working capital and information management. Based on another definition, financial supply chain management is detecting methods of effective management and optimizing working capital of a company; not only from an internal viewpoint of organization but from an external view of organization (i.e. from standpoint of other members of a chain). This optimization can be implemented through collaboration in payable accounts, receivable accounts, liquidity and risk. The final goal of financial supply chain management is to obtain clarity and demonstration of purchase processes up to payment and ordering till receiving cash. This cash-to-cash cycle is one of the most important factors effective in the success of the supply chain. This may lead to efficiency and profitability besides saving expenses in one supply chain. Better optimization of financial processes and flows by companies, less working capital will be required, thus less financial credits will be demanded from banks. This approach will result in saving in expenses and therefore in creating more investment opportunities for all members of the supply chain. Companies usually focus on financial supply chain management when the following issues seem to be so significant (Fujimori et al., 2005; Al-Omouh et al., 2022).

As it was mentioned before, working capital is one of the major indicators in expressing supply chain efficiency, and the existing organizations in the chain intend to optimize it. This indicator is usually calculated as follows:

Working Capital = Current assets – Current debts,

where current assets include inventories, receivable accounts, banking accounts, cash and negotiable papers, and current debts include payable accounts, current liabilities etc. Hence, institutions have tried to obtain an optimized amount of working capital to develop their business by equalizing the said components. It should be mentioned that attention to moderating working capital is the relation of this subject with two factors of profitability and credit risk of business. On the other hand, it was intended in financial supply chain management theory to manage working capital of one-by-one institutions which are members of the chain besides emphasizing on management of working capital of all the chain totally in order to optimize the entire working capital (Hatfield et al., 2007).

Dong et al. (2014) develop a framework of service supply chain performance measurement. Based on the strategic, tactical and operational level performance in a service supply chain, measures and metrics are discussed. The emphasis is on performance measures dealing with service supply chain processes such as demand management, customer relationship management, supplier relationship management, capacity and resource management, service performance, information and technology management and service supply chain finance. Wuttke et al. (2016) provides a definition of SCF reflect two major perspectives: the ‘finance oriented’ perspective - focused on short-term solutions provided by financial institutions, addressing accounts payable and receivable - and the ‘supply chain oriented’ perspective - which might not involve a financial institution, and is focused on working capital optimization in terms of accounts payable, receivable, inventories, and sometimes even on fixed asset financing. Hans and Moritz (2009) aimed to review the state-of-the-art of research regarding financial flows in supply chains. Thus, it becomes apparent that an explicit examination and optimization of the cost of capital has been missing so far. To close this gap, a conceptual framework and a mathematical model of “Supply Chain Finance” is proposed. Moritz (2010) proposes a framework for investigating the financial issues in logistics and SCM and shows that taking a supply chain perspective on financial issues offers great opportunities for SCM professionals. SCM can not only contribute to improvements in sales, cost of sales, and the invested capital, but also has the potential to improve the capital cost rate as a long neglected supply chain driver of shareholder value (Hohenstein et al., 2015; Irshad & Hussain, 2021).

Fig. 1 shows the importance of Financial Supply Chain Management as reflected in the various discussions by researchers and scientists.

This paper started by providing a summary of literature from recent publications, intending to prove a broader picture of relevant research conducted in this field. The following parts are Section 2, that is an overview of the research database and methodology, including the data collection strategies used and filtered data. Section 3 provides further discussions. Section 4 includes the conclusion of the paper and the future directions.

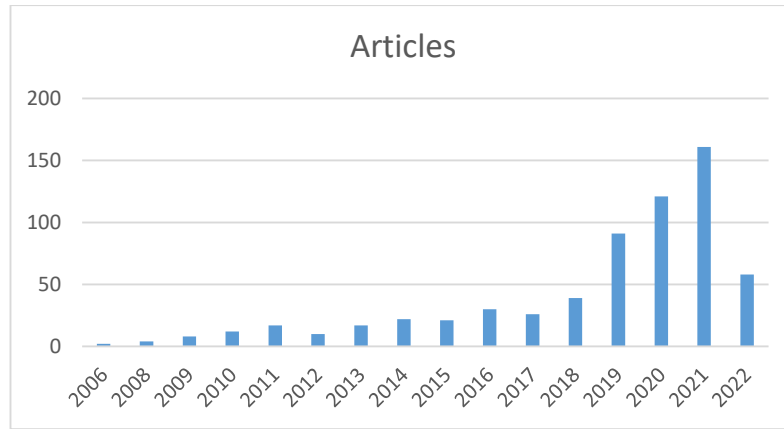


Fig. 1. The number of relevant publications.

2. Methodology and Procedures

A bibliometric analysis approach has been used in this paper. Pritchard (1969) was among the first researchers to utilize it. The approach has acquired more recognition as an effective tool to conduct a quantitative analysis to gain a deeper understanding of the literature.

Since articles from the Scopus database are more reputable, it was utilized as a source for analyzing publications focused on the Financial Supply Chain Management. Since the first article based on the Financial Supply Chain Management is the Journal of Cleaner Production in 2006, the bibliometric analysis will utilize publications from 2006 to 2022. All journal publications from 2006 to 2022 are exported in Comma-Separated Values (CSV) and plain text format, containing keywords, citations, and bibliographic information. A total of 639 publications are retrieved and used for the analysis for providing representative and informative perspectives of the information on the topic.

Identification of essential parts of the scientific publications was done through clustering techniques. For data analysis, the software VOS viewer and Excel software were used in the study. VOS viewer software facilitates bibliometric analysis by creating co- occurrences maps, co-authorship and co-citation. Other features such as searching, magnification, and navigating found in the software made it a necessary tool in the study (Van Eck et al., 2010; Carter & Easton, 2011; Carter et al., 2015). Fig. 2 summarizes the applied methodology in this paper.

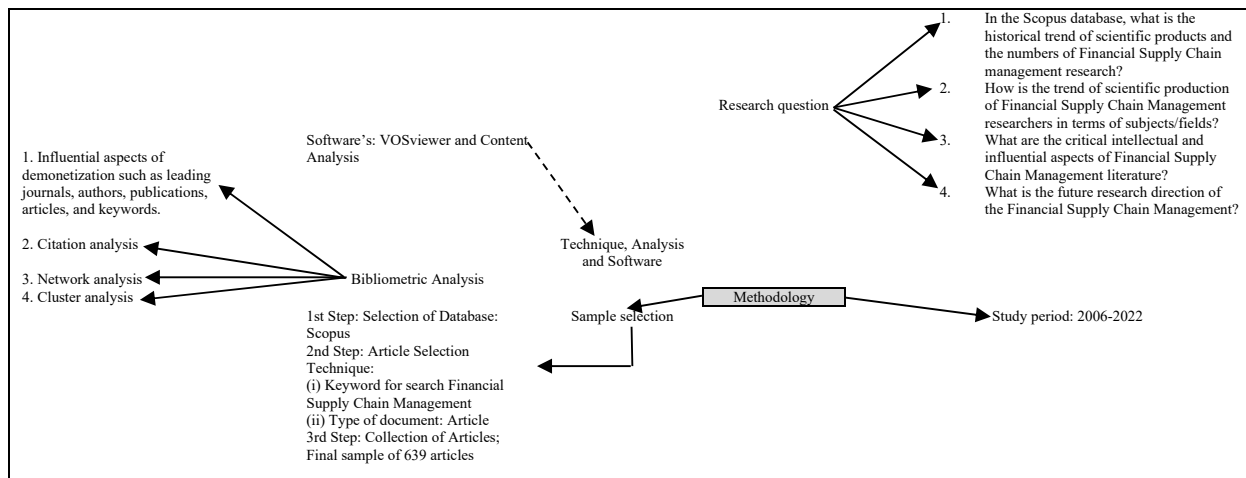


Fig. 2. The summary of the methodology used for the survey analysis

3. Key Results

The bibliometric analysis addresses the questions like the names of the journals published articles, the country of the origin, the fundamental interest and the number of citations.

journals shows the literature is comprehensive. Although this area is labeled supply chain finance, the studies are not mainly found in prominent stream finance journals. This shows the unavailability of models and techniques in mainstream finance research to gain a more profound understanding of issues relating to finance.

Table 4
Top cited articles

| Author and Year | Journal | Citations | Documents Title |
|------------------------|---|-----------|--|
| Hans & Moritz, 2009 | Logistics Research | 209 | Supply chain finance: optimizing financial flows in supply chains |
| Dong et al., 2012 | Computers & Industrial Engineering | 201 | A framework for measuring the performance of service supply chain management |
| Gelsomino et al., 2016 | International Journal of Physical Distribution & Logistics Management | 184 | Supply chain finance: a literature review |
| Xu et al., 2018 | Business Process Management Journal | 171 | Supply chain finance: A systematic literature review and bibliometric analysis |
| Yan et al., 2016 | International Journal of Production Economics | 147 | A partial credit guarantee contract in a capital-constrained supply chain: Financing equilibrium and coordinating strategy |
| Wuttke et al., 2013a | International Journal of Logistics Research and Applications | 118 | Supply chain finance: applying finance theory to supply chain management to enhance finance in supply chains |
| Wuttke et al. 2013b | Journal of Business Logistics | 115 | Managing the Innovation Adoption of Supply Chain Finance— Empirical Evidence From Six European Case Studies |
| Caniato et al. 2016 | Supply Chain Management | 111 | Does finance solve the supply chain financing problem? |
| Tang et al., 2018 | Journal Of Cleaner Production | 107 | Sourcing from Suppliers with Financial Constraints and |
| Wuttke et al., 2016 | International Journal of Production Economics | 107 | Supply chain finance: Optimal introduction and adoption decisions |

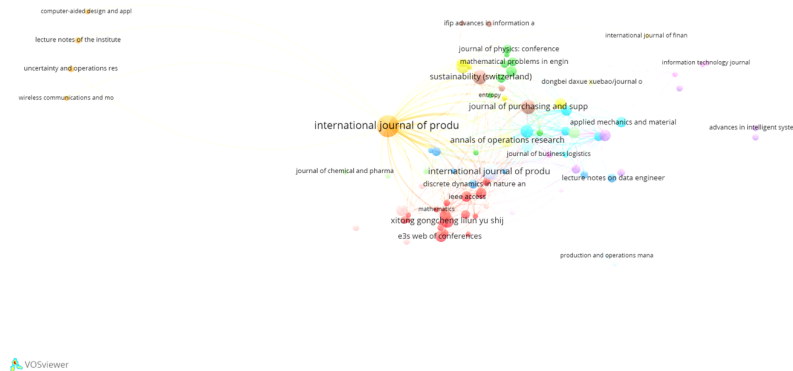


Fig. 6. Citation analysis from reference lists

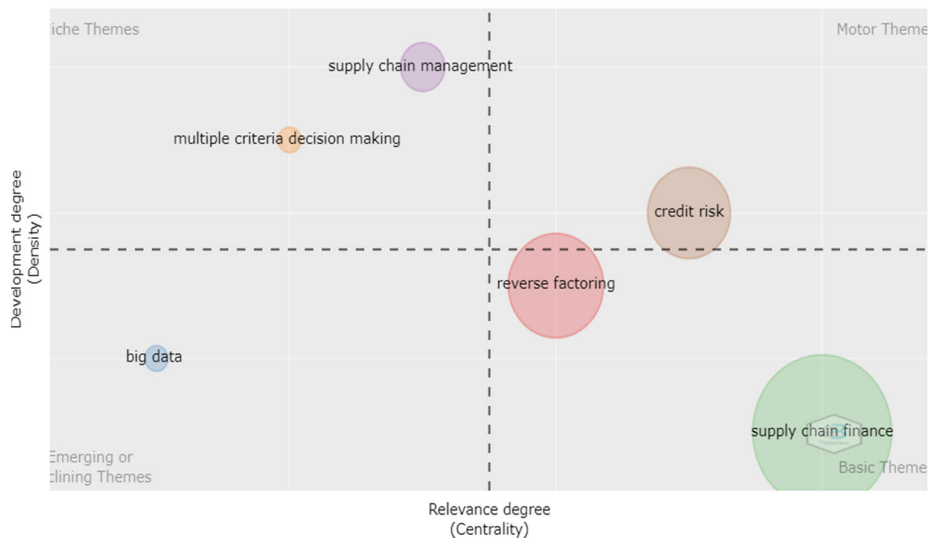


Fig. 6. Thematic evolution

4. Research Streams and Future Research Questions

Stream 1: Supply Chain Management- Multiple Criteria Decision Making

Stream 1 discusses the impact of multiple criteria decisions on supply chain management because decisions in supply chain management are subject to various conflicting criteria and multiple objectives must be considered in the decision process. Furthermore, a group, rather than a single decision maker, is often involved in the process. For such decisions, methods in multiple criteria decision making are certainly appropriate. However, an overview concerning applications of multiple criteria decision-making methods in supply chain management is not yet available. This paper conducts a literature survey to fill this gap and give an overview of multiple criteria decision-making applications in supply chain management; a research map is developed to guide researchers interested in this field.

As the importance of certain management areas increases, the need for suitable decision support in these areas also rises. Decision problems in supply chain management range from single quantitative criterion analyses to multiple criteria and/or objectives problems, where quantitative as well as qualitative criteria must be incorporated. A very common decision problem in supply chain management is the single-criterion, purely quantitative consideration of inventory control. For such problems, classical methods only consider costs and minimize them under certain constraints, like customer service. However, even in such cases, authors tend to state that conflicting goals are balanced (cf. Axsäter 2006).

Multiple criteria decision-making offers support for such strategic decisions (cf. Montibeller/Franco 2011), allowing for the consideration of conflicting and qualitative objectives (cf. Ram et al. 2011). Wallenius et al. (2008) state that the most crucial support delivered by Multiple criteria decision-making approaches to decision makers is probably the structured examination of the decision problem as part of the process. While many applications

of such methods to supply chain management already exist, a literature survey of Multiple criteria decision-making methods, allowing the consideration of qualitative information in supply chain management, is not available yet.

Stream 2: Supply Chain Management and Big Data

According to Beyer and Laney (2012), Big Data is defined as “High-volume, high-velocity and/or high-variety information assets that demand cost-effective, innovative forms of information processing that enable enhanced insight, decision making, and process automation.” In addition to this, Big Data has been defined with the ‘3V’s’ concept by (Laney, 2001). With the technological advancements across the entities of Supply Chain, data generated is increasing at a fast rate. Firican, (2017) information flow was documented in terms of physical documents until the use of Information Technology in Supply Chain. Most of the information flow linked to the material flow is being documented in the form of digital structured data. As the scope of Supply Chain is currently worldwide, the volume of data collected from its numerous processes and the velocity at which it is being generated can be qualified as Big Data (Awwad et al., 2018, Nguyen et al., 2017). In addition to this, entities such as marketing and sales are now relying on analysis of the unstructured data along with the structured data to gain better insights on customer needs and improve upon the cost aspects of Supply Chain processes. The use of Big Data can offer a significant value in areas such as product development, market demand predictions, supplying decisions, distribution optimization and customer feedback (Arunachalam, et al., 2017; Laney, 2001; Miguel & Gómez, 2016). According to a study by Accenture (2014), companies with a disciplined strategy of utilizing Big Data Analytics have had bigger returns for their respective investments in Big Data Analytics as shown in Figure above. As it is evident that a clear and systematic strategy towards Big Data Analytics can provide a good Return on Investment, the areas in Supply Chain such as Marketing, Procurement, Transportation, Warehousing can be tapped by Big Data and Big Data Analytics (Benabdellah et al., 2016). By utilizing big data, a supply chain should function with goals of improving in areas such as prediction of customer needs, assessment of supply chain, efficiency of the overall supply chain, reaction time, risk assessment and improving predictions on customer needs: improving efficiency of supply chain, improving risk assessment in supply chain, improving the reaction time (ComputerWorld, 2018). Given the high infrastructure costs for Big Data Analytics, dedicated research on making Big Data Analytics more cost effective is possible by reducing the infrastructure costs for storing Big Data. To increase the volume and accuracy of the data generated from various processes such as manufacturing and logistics, improving the sensor accuracy in physical systems along with enhancements in the data integration technology amongst various business processes is necessary and can be a potential field of study for further research.

Stream 3: Supply Chain Management and Credit Risk

Credit risk is a hot topic for research and academics as the change in the credit risk of upstream and downstream enterprises in the supply chain management has a direct impact on the business status and future development trends. According to the characteristics of management, Liu and Cui (2016) used the structural equation model (Supply chain management) and the grey relation analysis models to evaluate the credit risk of Supply chain management. With the development of the Internet, the combination of Supply chain management and the Internet has gradually developed online, and its credit risk challenges have become more complicated. Fan et al. (2017) combined the thinking and data mining direction of financial big data on the Internet to screen the financial risk evaluation indicators of the supply chain and established a credit risk evaluation system and a three-party game model. It used qualitative and quantitative methods to analyze the principle of risk-sharing

among the participants of Supply chain management and evaluated the credit risk of SMEs. Under the innovative mode of combining online and traditional Supply chain management, He (2016) extracted the influencing factors of risks, constructed a risk evaluation system for online Supply chain management, and evaluated these risks through the analytic hierarchy process and fuzzy comprehensive evaluation method. Li and Zhao (2020) analyzed the influence factors of supply chain finance credit risk based on the systems science perspective. They built a structural equation model to explore the basic path of supply chain financial credit risk formation and established a system dynamics model to study the mechanism of system elements in the evolution of supply chain financial credit risk. Tian et al. (2021) constructed a credit risk assessment model for supply chain management in the supply chain financing model. The empirical results show that the model is more accurate in predicting the financing risks of supply chain management in the automobile manufacturing industry and provides suggestions for commercial banks, core supply chain enterprises, and supply chain management to improve the supply chain financing dilemma. However, with the absence of data and inaccurate information, traditional risk assessment methods frequently failed to assess the credit risk in supply chain management, especially for small- and medium-sized enterprises (SMEs).

Stream 4: Supply Chain Management with Reverse Factoring

Stream 4 focuses on the role of reverse factoring, specifically, in a financial solution where the vendor (who is ordering) contacts its bank to arrange for early payments to its supplier to finance their accounts receivables (from purchases) at interest rates lower than the market (Van Der Vliet et al. 2015). The vendor is assumed to have a better financial position (liquidity and solvency) than its suppliers. Reverse factoring is an innovative technique in supply chain financing. Among the buyer-based financing mechanisms, Reverse Factoring is one that has received considerable attention from both the business and research communities (Wu et al., 2019; Lekakos et al., 2017; Jaber & Goyal, 2008; Chang et al., 2008). This interest is because it allows for the reduction of both the net operating working capital and the cash-to-cash cycle of a company and to improve supplier financial rating. Many firms use this scheme to induce their strategic suppliers, who usually are difficult to replace, to grant them flexible, mostly lenient, payment terms. Recent advancements in technology allowed firms to offer reverse factoring and to effectively manage it despite the challenging economic conditions (Hurtrez & Salvadori 2010; Caridi et al., 2010)

Reverse factoring aims to reduce working capital in supply chain management and promote the stability of cash flows. Advanced reverse factoring makes full and better use of the exchange of information between an entity closer to the market in supply chain management and a financial institution to improve suppliers' access to credit. Most innovative solutions have great potential and exciting opportunities for growth in the future; however, currently, they are still far from widespread adoption. Reverse factoring is one of the most addressed financing schemes in the literature (Hurtrez & Salvadori, 2010; Seifert & Seifert, 2011; Wuttke et al., 2019; Ramezani et al., 2014). Several qualitative studies have highlighted the relevance of reverse factoring for suppliers driven by high working capital requirements and, contextually, have high costs or difficulties accessing other forms of working capital financing, such as direct factoring (Gelsomino et al., 2016). Tanrisever et al. (2015) investigated how reverse factoring can influence operational decisions. They found that reverse factoring generates value and is acted by the spread in external financing costs, the extension of the payment period, the operational characteristics of SMEs (i.e., volatility in their cash flows and working capital policy), and the risk-free interest rate.

A reverse factoring agreement has the potential of success and to bring additional benefits to a supply chain, especially when financially weak suppliers face increases in demand. Start-ups are a reality of modern markets. They, for instance, could be suppliers for vendors in supply chains that struggle initially because of slow demand, which could be due to limited production capacity that usually grows with time and experience (learning). Such companies have weak financial positions and critical economic performance that restrict them from accessing cash at low rates as banks consider them risky investments. A possible extension of this study is to consider the maximization of the annuity stream instead of the total annual profit, which helps in identifying the revenues and costs arising from time shifts between payments. Other future research may deal with different supply chain settings and acting on the financial flow of the companies.

5. Conclusions and Future research directions

The study used the bibliometric approach to provide an analysis of the ongoing trends and status of the development of supply chain finance. Using a rank analysis and illustration of critical factors of the publications, we identified vital data that assisted in forming an accurate subject matter description. After analyzing the keywords in Financial Supply Chain Management literature, it shows it is important to consider it as an interdisciplinary research phenomenon that covers policies and investments in management and financing. An analysis of the authors' country of origin shows that developed countries dominate most research on Financial Supply Chain Management. The Financial Supply Chain Management is seen as an essential topic that is gaining more recognition in the academic sphere. Recent literature shows an increased focus on the Financial Supply Chain Management, but less interest is paid from finance journals and mainstream economics. This creates a vacuum that allows researchers to investigate the following direction in their research. Since the Financial Supply Chain Management is a topic based on finance and management, this creates a need to look into issues using more financial solutions and finance perspectives. Also, more developed theories needed and more focusing.

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