A Bibliometric analysis for knowledge advancement mapping in supply chain and firm performance

تحليل ببليومتري لرسم خريطة تقدم المعرفة في إدارة سلسلة التوريد وأداء الشركة

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Abstract:

Supply chain management is one of the most studied subjects in the field of management and business. This paper aims to map the advancement of knowledge in the field of supply chain and its impact on a firm's performance. Our study focuses on analyzing the literature published in the Scopus database using bibliometric analysis software. The results show a captivating evolution in the last decade in the quantity and quality of documents. Research in the supply chain management field is moving toward a new era, where advanced technologies such as artificial intelligence and machine learning heavily impact every domain in every aspect.

Keywords: *Supply Chain; Firm Performance; R language; Bibliometrix; VOSviewer*
Jel Classification Codes : *C88 ; L14 ; L25*

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Introduction:

Literature review is an important tool in academic research for gathering existing knowledge and examining the state of the art of a field(Dresch , Lacerda , & Antunes Júnior, 2014). Its importance manifests in being a robust mean for scholars to collect available evidence on a certain topic or issue, assessing the state of the already available evidence before proceeding new research (Linnenluecke, Marrone, & Singh, 2020). Literature review also serves in helping researchers to identify gaps in existing knowledge that require further investigation. It can also help establishing theoretical framework for studiesand provide a context for research questions or hypotheses.

Although literature review is usuallyapproached in a classical way for many papers, especially through original research, there exists many ways to do a literature review. Some of the most powerful methods used in the process of gathering existing knowledge essentially in recent years are systematic review and literature analysis. With the evolution witnessed in computer science both in hard and soft sides, performing mathematical and statistical analyses becomes more and more easy and accessible to researchers.Literature analysis consists of statistically analyzing and synthesizing previous research in a certain topic.There are three key concepts related to literature analysis which are Scientometric, Bibliometric and Informetric analyses.

Bibliometric analysis is a statistical technique used to measure, monitor and analyze a specific research area(de Oliveira, da Silva, Juliani, Barbosa, & Nunhes, 2019). It is applied to evaluate research, where it helps to locate the most relevant and reliable papers(Zupic & Čater, 2015). The use of bibliometric analysis or bibliometrics began back in 1896, however the expression bibliometric analysis or bibliometrics was only used since 1969. Bibliometrics is now widely used in different areas of scientific research, including in management and business topics such as supply chain management.

As the subject of Supply Chain Management witnesses a rapid growth in prominence across both practitioner and academic communities(Feng, Zhu, & Lai, 2017), a wide range of literature review papers using the bibliometric analysis technique have been published in different topics on most of the fanciest scientific journals. The subject of Supply Chain or Supply Chain Management have been widely exposed to literature review and bibliometric analysis. Several papers have been published in this scope. Scopus database for example shows more than 100 review papers with "Supply Chain Management" AND "Bibliometrics" keywords research results, with 46 of these papers published in 2022, and already a few papers published in the beginning of 2023. When reduced to only social sciences areas, the Scopus database displays 58 papers related to supply chain management and bibliometrics published between 2007 and 2023.

A quick analysis of these 58 papers shows that the number of publications about bibliometric analysis of the supply chain management area began to rise since only 2018. The quantity of publications remained very poor between 2007 and 2019 (for example there was no paper published between 2009 and 2012, and in 2014). The oldest study in this sample developed a computer-aided bibliometric system to automate the generation of core articles list (Guo, 2007). Based on four indicators, the paper considered seven subjects including supply chain with a total of 500 papers analyzed. The most cited document in our 58 papers sample provides a roadmap for green supply chain management using bibliometric and network analysis on over 1000 paper published on the subject (Fahimnia, Sarkis, & Davarzani, 2015). Looking into the latest papers published on supply chain management and bibliometric analysis, we notice that the researchers tend to focus on topics more related to information technologies, artificial intelligence and blockchain. For instance, (Bahoo, Cucculelli, & Qamar, 2023) identify innovative supply chain management as one of eight core fields that intersect with artificial intelligence. Another study explores technology research and processes development in the field of supply chain and logistics (Yalcin & Daim, 2022). The results show an emergence of some areas such as Internet of Things, Bitcoin and Smart Contracts as

research components open to development. It also spots USA, United Kingdom, China and India as the leading countries in the field. Blockchain is another technology enabling economic, social and environmental sustainability (Yang, Qu , Hua, & Wu, 2022).

Firm performance is a key concept in the supply chain management literature. Scholars have widely studied the two concepts, since they are closely related, where the literature draws on a wide range of theories and perspectives. From a firm's perspective, it is crucial to take the right decisions and act according to the changes that occur in its environment, in order to attain optimal performance.

The present paper has for purpose to highlight the most important studies published in supply chain management and firm performance research field so far, trying to respond to the following research question:

- How did literature in the field of supply chain and firm performance and what is research tending to focus on?

To do so, we opted for a bibliometric analysis using two powerful programs on a Scopus dataset. More details of the analysis are discussed in the next section. The rest of this paper is divided into three main sections: First, we begin with the methods used in our research where we explain in detail how we extracted and analyzed the data. Then,the second section where we highlight the most important results obtained in our analysis, and finally a conclusion of our work.

I-Methodology:

In this section,we will explain in detail how we extracted our dataset from the Scopus database, and what analysis tools did we use.

I-1- Data extraction:

Usually, studies that are published using bibliometric techniques use several international databases like Web of Science and Scopus. As for this study the Scopus database is used as a fundamental resource to our bibliographic research. We conducted our research on Scopus database with ("Supply Chain" AND "Firm Performance") tittles, keywords and abstracts, which displayed 1125 total results until the end of 2022. We limited our research to "Business, Management and Accounting", "Decision Sciences", "Social Sciences" and "Economics, Econometrics and Finance" subject areas, which gave us 967 results. Then we excluded all document types except Articles, Conference papers and Reviews, which eliminated 40 results. After that we limited our search to only English written papers. The final 922 refined results were exported with all Citation information, Bibliographical information and Abstract & keywords content as a CSV/Excel file.

I-2- Software analysis:

Several software programs are used to perform bibliometric analysis i.g., the R programming language via Bibliometrix package (Aria & Cuccurullo, 2017), VOSviewer (van Eck & Waltman, 2010), CiteSpace and BibExcel. We opted for the Bibliometrix package to perform our analysis. The bibliometrix package is an open-source software that has a wide variety of powerful tools to conduct a bibliometric analysis. As for VOSviewer, we will use it to perform keywords co-citation analyses.

The main results shown in the next section indicate a captivating evolution in matter of publications in the topic studied.

II-Results and Discussion:

This section highlights the main results obtained by performing the bibliometric analysis on the Scopus database using Bibliometrix package and VOSviewer. Our results are divided into two subsections. In the first subsection, we analyze the scientific production in the field of supply chain and firm performance to see how did it evolve over the years. Then, in the second subsection, a

content analysis is performed to identify the most relevant topics related to our subject of research and how literature tends to evolve in the area, which will allow us to answer our research question.

II-1-Scientific production analysis:

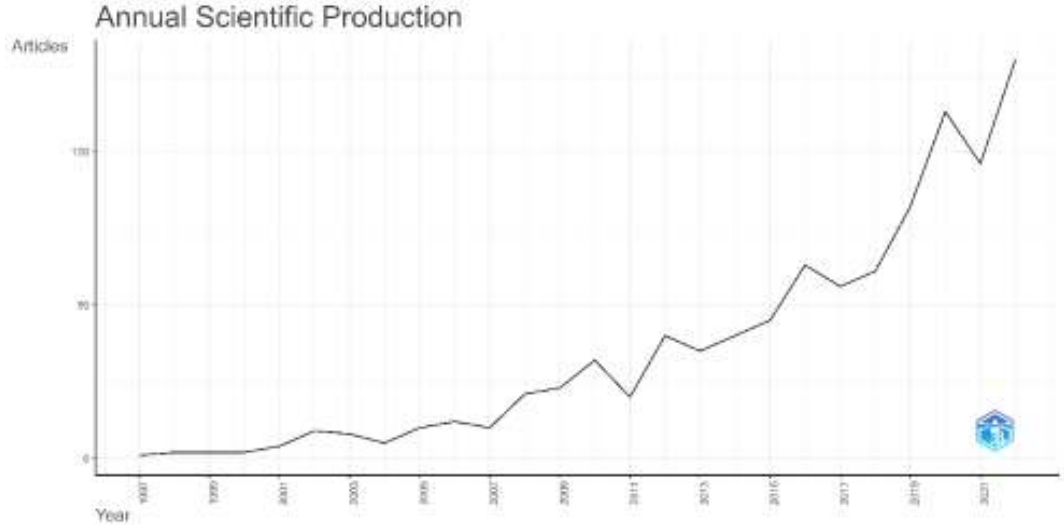
One of the goals of a bibliometric analysis is to picture the scientific development process over time(Qiu, Zhao, Yang, & Dong, 2017). Describing research in terms of growth, interrelationship and productivity is important to map the direction of future research in a given field. The main indicators used in this context are: (i) Annual scientific output; (ii) Research output of sources; (iii) research origin by country, and several other indicators. In the following sections we will discuss some of these indicators and the results obtained.

II-1-1- Annual scientific production:

The first plot displays the annual scientific production of papers treating the subject of supply chain and firm performance, showing a mean annual growth rate of 21.49% between 1997 and 2022. The results show that the average year production of papers treating supply chain and firm performance on Scopus database is 32 papers, however the yearly production was remarkably poor until the late years of the 2000s. The number exceeded 100 paper per year for the first time in 2020. This plot makes an important illustration of the development of the number of yearly published papers in the field of supply chain management based on the Scopus database. According to these findings there is an important evolution in the last 4 to 5 years in the number of published papers that treat supply chain and firm performance, despite the decline between 2020 and 2021, and the peek was attained in 2022 with 130 documents indexed in the Scopus database. This has a clear significance that researchers are more and more interested in writing about the subject of supply chain and firm performance. Many of them are motivated by the rapid changes that areoccurring in the socio-economic environment and their effects on the different sub concepts of the supply chain management

The sample was subject to a simple linear regression analysis. The results showed that it is likely that the number of papers published will increase in the future, and that there is a 95% chance that the number of published papers on supply chain and firm performance will increase from 3 to 5 papers every year. For example, the model predicts the number of publications to be between 133 and 135 in 2023, and between 136 and 140 papers in 2024 on the Scopus database.

Figure n°1: Annual scientific production in Supply chain and firm performance.

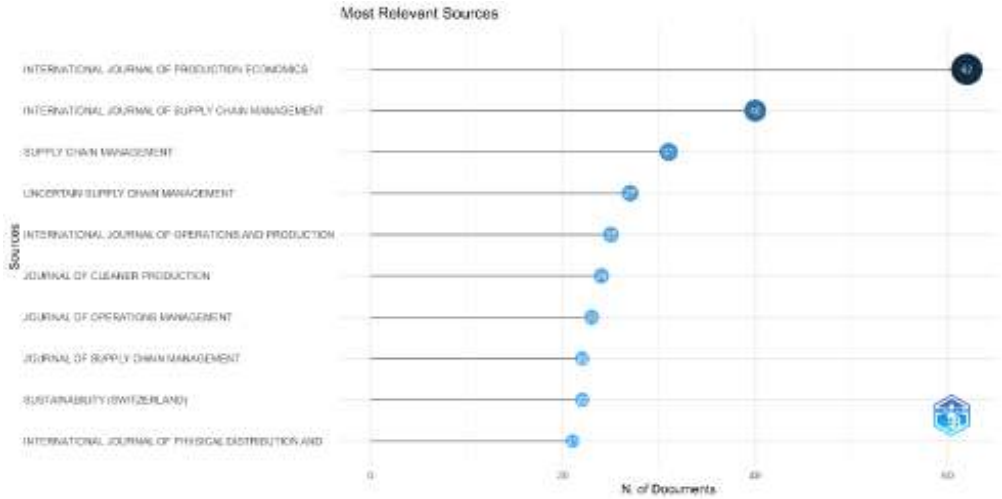


Source: Illustrated by the authors using Bibliometrix

II-1-2- Most relevant sources:

The second figure shows the most relevant sources which we limited its number to 10 journals and/or conferences. The results show that the International Journal of Production Economics is by far the most relevant scientific magazine with 62 papers that treat the subject of Supply Chain and Firm performance, followed by the International Journal of Supply Chain Management and the Supply Chain Management journal with 40 and 32 papers respectively. The international journal of production economics mainly focuses on topics treating the interface between engineering and management. The journal covers subjects in relation to manufacturing and process industries. The second journal in this list as indicated by its title, covers topics related to the field of supply chain management and aims to develop generalizable theory, typically through the identification, analysis, and theorization of real supply chain management problems. The importance of showing the most relevant sources is to guide readers to the most publishing journals in a given subject.

Figure n°2: Most relevant sources in Supply chain and firm performance.

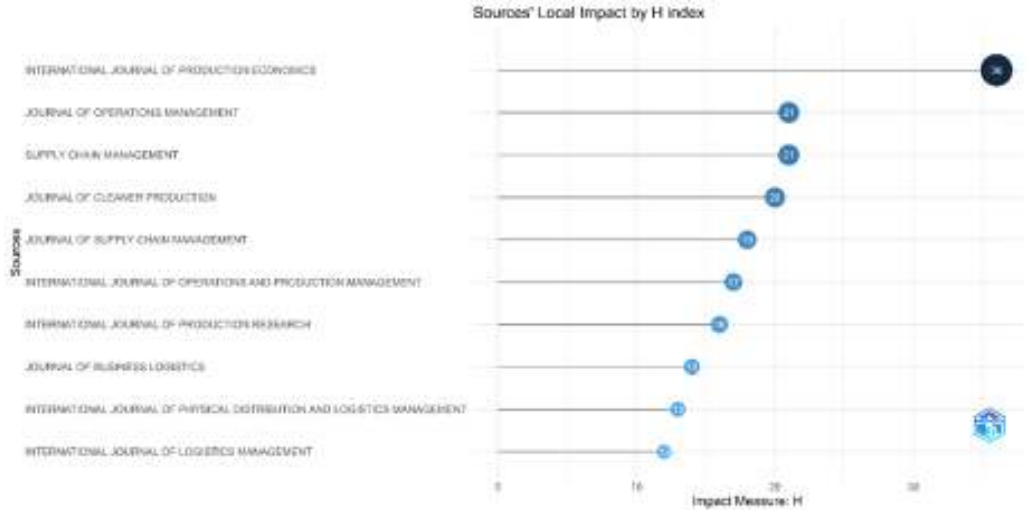


Source: Illustrated by the authors using Bibliometrix

II-1-3- Sources impact:

The thirdfigure provides insights on the most impactful sources by the H-Index. The plot shows also that the International Journal of Production Economics has a significantly higher impact than its peers, followed by the Journal of Operations Management and the Supply Chain Management journal. According to figure 3, Bibliometrix package provides us with the most impactful sources indexed in the Scopus database (We limited the number to 10 most impactful sources). Although the number of published articles in a given journal does not necessarily mean that the journal is impactful, i.e., the quantity of published papers is not positively correlated with their quality, we notice that the International Journal of Production Economics is the leader in both quantity (62 papers) and quality (36 H-index), indicating its significant contributions to the field of supply chain management.

Figure n°3: Most impactful sources in Supply chain and firm performance.

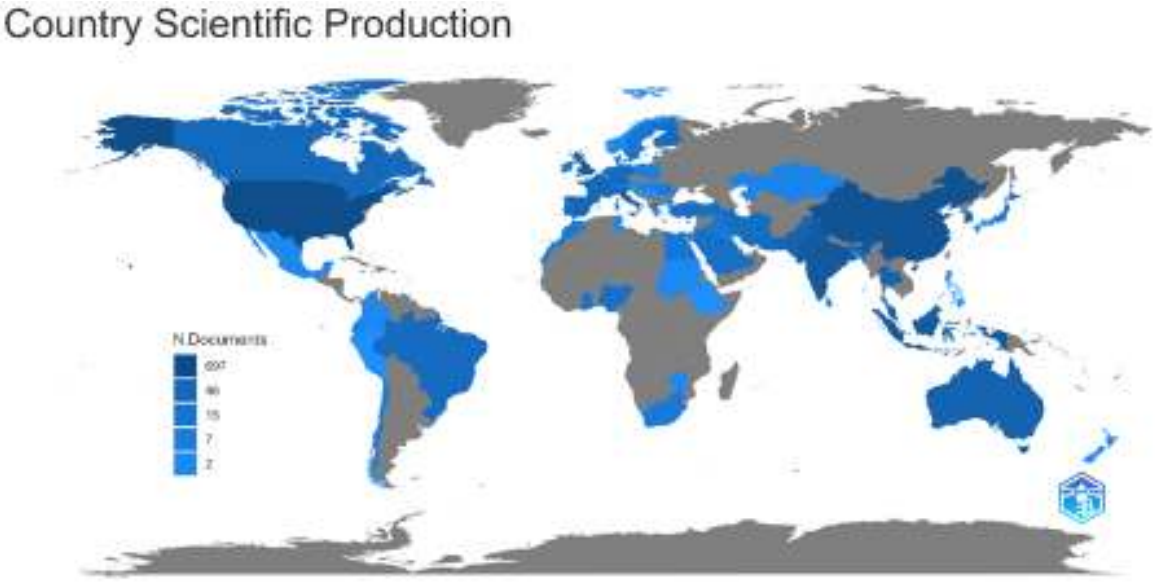


Source: Illustrated by the authors using Bibliometrix

II-1-4- Countries' scientific production:

In this subsection, the aim is to identify the most productive countries in the field of supply chain management and Firm Performance. The results indicate that there is a total of 56 countries which contributed to the subjectup until the end of 2022.The USA leading this list with 636 papers, followed by China with 308 documents then India with 178 publications. Countries such as Belgium, Kuwait, Lebanon, New Zealand, Philippines and Sri Lanka are on the bottom of the table with one document published for each. Interestingly, Zimbabwe has entered the ranking with two papers published in the early 2022, whereas Algeria has no contribution to the supply chain and firm performance field in the Scopus database. The analysis provides valuable insights into the global distribution of research activity in the field and sheds light on the trends and contributions of various countries.

Figure n°4: Countries scientific production in Supply chain and firm performance.

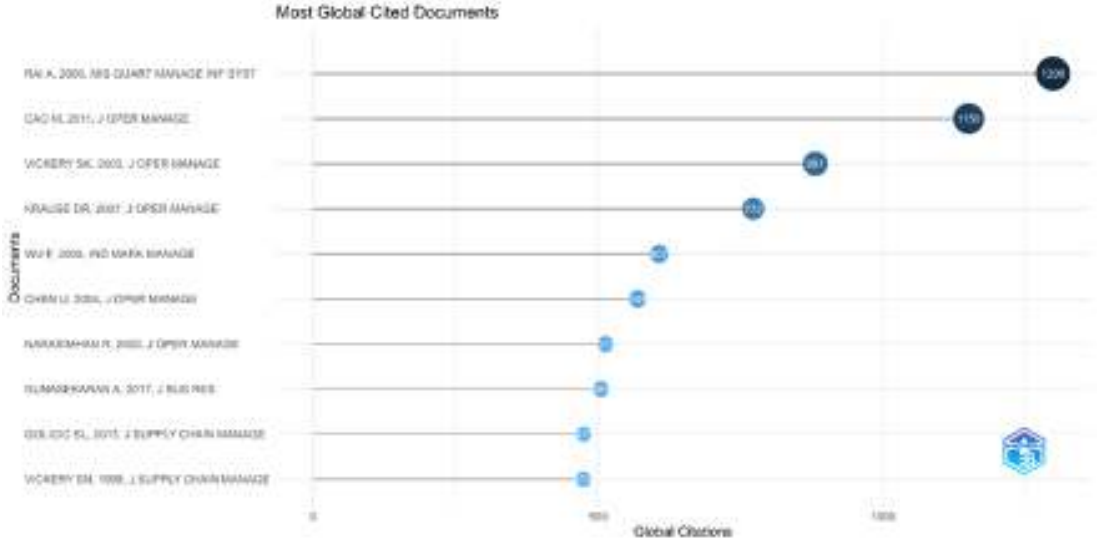


Source: Illustrated by the authors Bibliometrix

II-1-5- Documents citations:

One of the most important information given by a bibliometric analysis is the most cited documents, which its importance is to make it easy for researchers to reach the most relevant papers dealing with the studied topic. In figure n°5 we see that (Rai, Patnayakuni, & Seth, 2006) is the most cited document until the end of 2022 with about 1298 citation, followed by (Cao & Zhang, 2011) with 1150 times cited. The results show that the 10 most cited documents count at least 474 citations for each document. For instance, (Rai, Patnayakuni, & Seth, 2006) studied the creation of performance gains by information technology in a supply chain management context. The paper suggests that higher-order capabilities of SCM are developed by IT infrastructures integration. Among these documents, two papers were published in the last decade. The oldest one studies the linking between firm performance and environmentally sustainable supply chain by performing a meta-analysis which is one of the literature review techniques (Golicic & Smith, 2013). The second paper investigates the effects of big data and predictive analytics on supply chain and organizational performance (Gunasekaran, et al., 2017). These findings highlight the growing interest in sustainability and environmental challenges, as well as the integration of artificial intelligence and IT-related topics in supply chain management research.

Figure n°5: Most global cited documents in Supply chain and firm performance.



Source: Illustrated by the authors Bibliometrix

II-2- Content Analysis:

In this section we will discuss the results of performing the analysis of the concepts and keywords existing in our dataset. We will highlight the most important topics that researchers tend to focus on over time and their interrelationship. This part consists of two subsections. The first one discusses the different topics related to supply chain and firm performance and their relevance. The second subsection discusses the keywords co-occurrence network. This part has for goal to explain the scientific development related to our main subject over time.

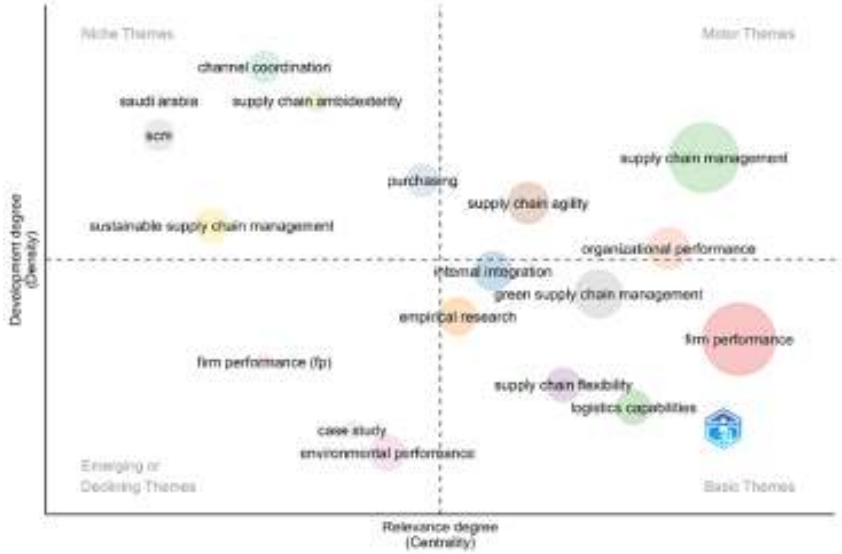
II-2-1- Thematic map:

Thematic mapping is a useful technique to locate the keywords related to a topic studied. This technique uses several clustering algorithms to create clusters out of keywords analysis. The Bibliometrix package proposes a variety of cluster analysis techniques and algorithms.Out of 2187 total author's keywords, the plot below highlights the results of 250 author's keywords analysis

(Ended up being only 187 author's keywords) based on the Walktrap algorithm, as we could not choose the first option, which is "keywords plus" since it is a Web Of Science feature and 62.8% of the total "keywords plus"are missing. The 16 clusters are grouped into four theme types: Emerging or Declining themes, Basic themes, Niche themes and Motor themes. The most important results to focus on are the motor themes, which have high centrality and density. We notice that the cluster labeled supply chain management is the most important cluster in this category, followed by supply chain agility cluster.

Basic themes represent the topics that are highly central but with less density. Firm performance is the most important cluster in this category, followed by green supply chain management, supply chain flexibility, and logistics capabilities clusters.

Figure n°6: Most global cited documents in Supply chain and firm performance.



Source: Illustrated by the authors using Bibliometrix

In order to comprehensively grasp the interconnectedness of various concepts and their placement in the thematic map, the subsequent paragraphs provide an in-depth analysis of each individual theme.

- Basic Themes:

Basic themes are highly central themes with low density, i.e., they are recognized as important topics but with low interconnection. Basic themes are broad and general, they represent fundamental concepts of a research area.

The most weighting cluster is firm performance. As a basic theme, this cluster gathers 64 keywords that occur 919 times. The most important keywords are related to some basic supply chain topics such as firm performance, supply chain performance, supply chain collaboration and competitive advantage. These keywords represent the foundation of the supply chain and firm performance literature.

The second most weighting cluster in the same category assembles some topics related to green supply chain management. The cluster gathers some keywords related to the concept of sustainable supply chain, such as environmental management, environmental collaboration and green supply chain. We note four other clusters with lower density in this category that are labeled internal integration, empirical research, supply chain flexibility and logistics capabilities.

- Motor Themes:

This category of topics is related to the most weighting clusters in both centrality and density, which means that a motor theme is a topic widely studied and strongly linked to other important topics in the field. This category is critical to understanding what research is focused on at the current time, and concepts and ideas that drive research in a field, leading to its growth and progress.

The results obtained in this analysis gave us three clusters. The first cluster labeled supply chain management is the most weighing in this category, assembling 57 keywords that occur 718 times. The cluster is linked to 253 papers published between 2001 and 2022 with a mean publishing year that equals 2016. The cluster gathers the most important keywords related to the field of supply chain management such as supply chain, performance, sustainability, information technology, business performance and corporate social responsibility.

- Niche themes:

These themes are highly developed ones with low centrality, which means they are highly specialized topics with extensive studies, but with a low connection to the central research topic. Sustainable supply chain management represents the most frequent cluster in this category. However, the cannel coordination cluster is the cluster with highest densityin the niche themes category, which means that topics underlaythis cluster are not directly connected to the core topic of supply chain and firm performance. The channel coordination cluster contains some keywords such as retailing, game theory and relationship quality.

- Emerging or declining themes:

This category assembles topics that are either old and starting to decline or new and emerging. Emerging themes represent emerging trends in a particular subject and declining themes are topics that are no longer relevant to the subject. In figure n°6 above, we note that the cluster environmental performance is the most weighting emerging cluster.The cluster gathers five keywords that are sustainable development, environmental performance, economic performance, environmental orientation and green supply chain integration. This can indicate the motivation of researchers to investigate more about the ability of supply chains be more sustainable with regards to the integration of green practices that mightaffect the environmental and economic performance.

II-2-2- Co-Occurrence network:

VOSviewer software is a powerful tool to perform network analyzes. In order to perform the co-occurrence network analysis, we firstly uploaded our dataset to the VOSviewer software. Secondly, we choose the co-occurrence analysis of all the existing keywords in the dataset (Authors and indexed keywords). Then in the third step, we limited our analysis to the 107 keywords that appear at least ten times in the dataset. This choice was motivated by the fact that the more keywords we take into account, the less the network is readable and the less information taken from the network is relevant.

- Network visualization:

The results reveal the formation of six keywords' clusters which are formed in six colors. The first cluster indicated by red color gathers 26 items related to the thematic of sustainability such as corporate social responsibility, environmental performance, green supply chain, industrial and operational performance. China and India also appear in this cluster, which means that most of the empirical context of the papers published in supply chain and firm performance related to sustainability were focused on China and India. The second cluster in green color is more about supply chain strategies. It contains 20 items, such as business performance, collaboration, competitive advantage, internal integration, outsourcing, and supplier integration.

Clusters three, four and five, representedby blue, yellow and purple colors respectively, contain 19, 18 and 17 items. While the third cluster aggregates items related to costs, marketing,

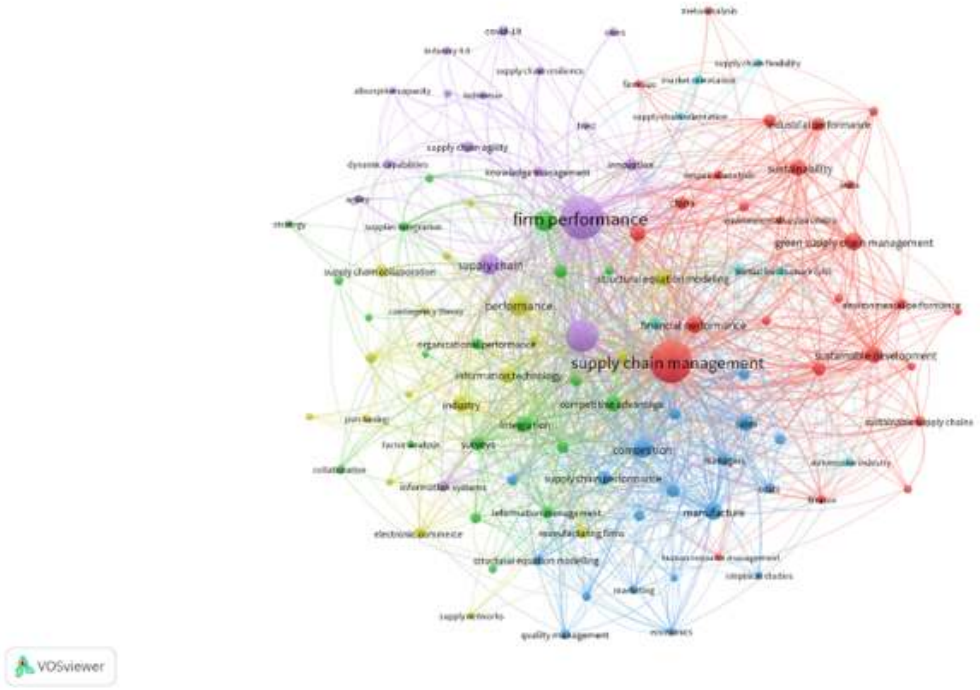
sales and profitability, the fourth and the fifth ones are related to contingency theory and supply chain risks and agility respectively.Finally, the least weighing cluster colored in cyan, assembles only 7 items such as market orientation, supply chain flexibility and supply chain orientation.

The results suggest that supply chain management and firm performance are studied through various lenses and themes, as illustrated by the six clusters identified in the analysis. The first cluster indicates that research is heavily focused on the environmental and economic impacts of the supply chain management on firms' performance. The fact that China and India are in this cluster means that there is a significant amount of research on these concepts in these two countries.

The second cluster related to supply chain strategies, indicates that there is also a focus on the strategies used by companies to manage their supply chains effectively, including topics such as collaboration, competitive advantage and outsourcing.

The remaining four clusters indicate that there is also an interest by researchers in other areas related to supply chain management and firm's performance, such as sales, costumer satisfaction, supply chain agility, covid-19 and industry 4.0.

Figure n°7: Keywords co-occurrence networkof Supply chain and firm performance.



Source: Illustrated by the authors using VOSviewer

- Overlay visualization:

The last network showedin figure n°8 displays the same network in figure n°7, but with respect to years of publication. This illustration provides insightsinto the trends and evolution of research focus over time. Notably, concepts related to sustainability, green supply chain management, and industry 4.0 emerge as trending topics. In contrast, topics such as customer satisfaction, marketing and quality management are old topics. These results suggests that researchers have increasingly emphasized sustainable development and green supply chain management in recent years, highlighting the growing importance of these areas in the field.

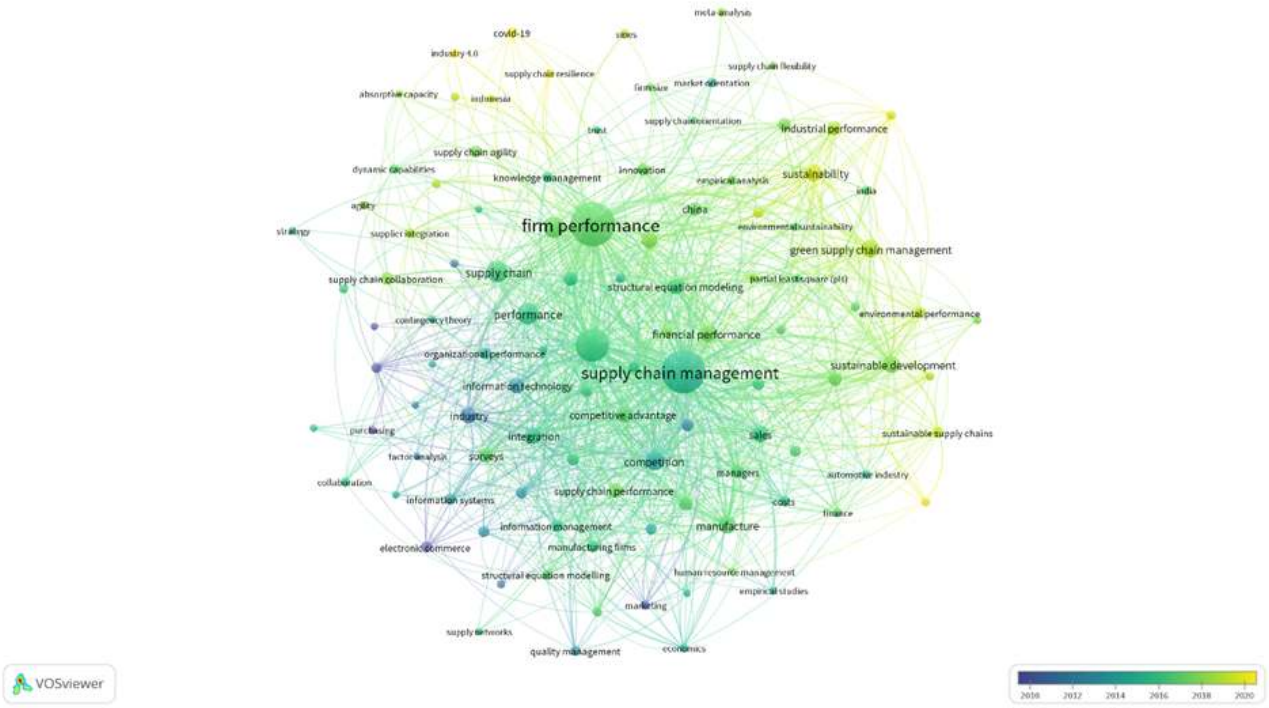
This trend is significant in the way that it reflects a growing recognition among scholars of the importance of sustainable practices in supply chains and how they have a potential impact on firm's performance. Sustainable development refers to the ability to meet the needs of the present without

compromising the ability of future generations to meet their own needs((WCED), 1987).In the context of supply chain management, this involves implementing practices that minimize negative environmental impacts, promote social responsibility, and maintain economic viability.

Researchers are also increasingly interested in exploring the impact of COVID-19 pandemic, which has significantly impacted global supply chains leading to disruptions and challenges.

Industry 4.0, on the other hand, refers to the integration of advanced technologies such as artificial intelligence, the internet of thing and machine learning into manufacturing and supply chain processes(Majiwala & Kant, 2023). Researchers are more and more focusing on these topics and studying their impact on supply chains and companies' performance.

Figure n°8: Keywords overlay network of Supply chain and firm performance.



Source: Illustrated by the authors using VOSviewer

Conclusion:

In the last decade, research in the field of supply chain management has expanded rapidly encompassing a variety of topics. Among these topics, subjects related to innovation, IT, blockchain, artificial intelligence … etc., have earned researchers'attention. In parallel with that, multiple studies have been published in the aim of mapping and reviewing what have been published in the subject of supply chain with respect to these multiple topics.

The present study was conducted to assess the advancement of research in the subject of supply chain management and the impact on firms' performance. Although plural studies have been published about supply chain literature analysis, the primary focus of this study was to analyze the existing literature specifically related to firm performance in the supply chain domain.

The results showed an important evolution in both quantity and quality of published papers. It also highlighted the most referenced papers, the different concepts leading the research in supply chain nowadays. To answer our research question, we can say that research in this area is tending to focus on the impact of advanced technologies such as artificial intelligence (Riahi, Saikouk, Gunasekaran, & Badraoui, 2021), sustainability and environmental and social changes that occur due to unexpected events such as COVID-19 on the supply chain management.

Appendices:

Figure n°A1: Main information on the data extracted from Scopus using Bibliometrix.

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