

Sustainable Practices in Global Supply Chains of Chinese Enterprises: Bibliometric Approach

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Abstract

Chinese enterprises have indeed recognized the importance of sustainable practices in their global supply chains, with one key practice being the enhancement of supply chain transparency. These enterprises are implementing measures to trace and track raw materials and components, ensuring compliance with sustainability standards and ethical sourcing practices. This transparency is crucial in identifying and mitigating environmental and social risks within the supply chain. However, it is important to note that there is still a lack of extensive research in the context of China regarding sustainable practices in global supply chains. While some studies and initiatives have been conducted, there is a need for more comprehensive research to understand the specific challenges and opportunities faced by Chinese enterprises in adopting and implementing sustainable practices throughout their supply chains. The objective of this study is investigating the research progress on issue related Sustainable Practices in Global Supply Chains of Chinese Enterprises. In doing so, systematic literature research was implemented on the supply chains of Chinese enterprises' foreign direct investment (FDI) to provides insights into the penetration and significance of sustainable concepts in this topic. This paper utilizes advanced data visualization techniques and an in-depth literature review to comprehensively summarize and review previous research extracted from the Web of Science database. The study included 518 articles and analyzed them through RStudio and VOSviewer software. Research analysis reveals that most of the past research articles on this topic primarily come from China, followed by large economies such as the United States and the United Kingdom. However, when ranked by influence, the order is Canada, the UK, and the US. Around 2020, collaborations between countries mainly occurred in Asian nations. China, enterprises, and FDI are currently the most popular keywords. The importance of sustainability in the research on FDI in Chinese enterprises has been verified through data analysis and theoretical review. Key terms related to sustainability, such as "carbon dioxide emissions, economic growth, and energy consumption", are expected to play a vital role in future research. Current theoretical studies confirm that integrating environmental, social, and economic goals (ESG) into supply chain operations can implement a sustainable philosophy for the entire product lifecycle in Chinese outward foreign direct investment (OFDI) enterprises. Disseminating sustainable management principles in supply chains among Chinese OFDI companies can contribute to ESG sustainability goals, while also enhancing the long-term profitability of the companies themselves.

Keywords: Foreign Direct Investment (FDI), Chinese Enterprises, Supply Chain, and Logistics

JEL: F23, M11, Q01, Q56

Introduction

Sustainability in Supply Chain Management (SCM) is an evolving paradigm that has received support and high attention in recent years due to its potential to deliver both environmental and business advantages (Balon, 2020; Zekhnini et al., 2022). It focuses the incorporation of environmental,

social, and economic (ESG) goals into supply chain operations, balancing short-term profitability with long-term sustainability (Muñoz-Torres et al., 2019; Alkaraan et al., 2022; Baid and Jayaraman, 2022; Saini et al., 2022). This notion is becoming more relevant for Chinese firms engaging in FDI, particularly in view of the growing worldwide focus on sustainability and corporate responsibility (Daú et al., 2019; Tarofder et al., 2019, 2019; Shete, Ansari and Kant, 2020). among others, have documented the significance of sustainable SCM within the context of FDI. These works illuminate how businesses can integrate sustainability into their SCM practices, thereby positively impacting their overall FDI strategies. In recent years, Chinese companies have significantly increased their overseas direct investment (ODI) activities (Wang, 2019). Effective administration of cross-border supply chains becomes a crucial success factor as Chinese companies increase their global footprint (Ali et al., 2021). The globalization of supply chains has provided Chinese businesses with new opportunities to increase their competitiveness and enter foreign markets. Chinese companies can explore new markets, gain access to resources, and gain a competitive edge by establishing global production networks and optimizing supply chain operations (Duan, Zhu and Lai, 2020; Thüerer et al., 2020). There are many obstacles to managing transnational supply chains, such as coordination and integration in geographically dispersed places, cultural differences, regulatory complexity, and logistics and transportation disruptions (Chang, Iakovou and Shi, 2020; Choi et al., 2021; Rejeb et al., 2021; Raj et al., 2022; Spieske et al., 2022). Huawei's green supply chain (Berning, 2019; Wu, Fan and Su, 2021; Kowalczyk, 2022) and Alibaba's sustainable supply chain (Zhu, Lan and Zhang, 2021) efforts are two case studies proving the usefulness of sustainable SCM. These Chinese multinational firms have successfully integrated sustainability into their supply chain management (SCM), improving operational efficiency, risk management, and stakeholder interactions, as well as contributing to their long-term FDI goals.

This study provides a comprehensive analysis of the literature on sustainable supply chain management (SCM) in Chinese enterprises' foreign direct investment (FDI), highlighting its significance and significant contribution to academic knowledge and practical implementations. The analysis of 518 articles using Bibliometrix (with RStudio) and VOSviewer provides an objective picture of the current state of the literature. This study investigates sustainability issues throughout the supply chain, concentrating on supplier selection, green logistics, circular economy initiatives, and stakeholder participation. The findings will benefit researchers, practitioners, and policymakers by enhancing their understanding of SCM practises in Chinese companies with international operations.

Regardless, this paper provides a systematic summary of the research on supply chain management for China's FDI on the international stage. When Chinese enterprises undertake FDI investments, they need to pay attention to the factors influencing supply chain management, avoiding risks related to demand, exchange rates, society, and politics, especially in areas of working capital, financing strategies, and control over retailers. During the implementation of the SCM concept, Chinese FDI enterprises need to particularly focus on whether the enterprise has environmental social and governance (ESG) elements into its SCM.

Material and method

This study aims to analyze and summarize the areas of Chinese firms, foreign direct investment (FDI), and supply chain management. The objective is to comprehend and conquer the current state of research on this topic. In addition, this research examines and discusses the prevalence of

sustainable concepts in supply chain studies, with an emphasis on the impact of these two themes on Chinese FDI firms. This work also concludes a summary of previous research on this topic. The study used Web of Science database for extracting the necessary documents for the study. Web of Science database is one of the primary databases used in literature analysis (AlRyalat, Malkawi and Momani, 2019; Singh et al., 2021). With Chinese FDI attracting considerable attention in today's society, the choice of the Web of Science database ensures coverage of core articles related to this topic. The relative keywords used to extract the documents are ((("China" OR "Chines*") AND ("company*" OR "firm*" OR "Enterpr*" OR "Entrep*") AND ("Overseas" OR "Abroad" or "FDI" OR "foreign direct investment" or "working capital") AND (Sustainable*) AND ("suppl*" OR "supply chain management*" OR "SCM "OR "logistics*")). The study used a total 518 documents extracted from the Web of Science database, as shown in Figure 1.

The documents included in this review encompass a range of scholarly materials, In addition to this, the article filters the search results by time, selecting data from before 2022 for analysis. All other content will continue to adopt the search results from the Web of Science database. The search results of the above keywords are visualized using the Bibliometrix software package (Bibliometrix version: 4.0), the RStudio system (version used for this analysis: RMe1 4.2.2 for Windows), and VOSviewer software. The two literature analysis software, Bibliometrix and VOSviewer, have gained widespread use and attention in recent literature research methods (Meng et al., 2020; Ejaz et al., 2022; Brahim and Haneya, 2023). Bibliometrix presents clear and distinct charts in the summary and analysis of all data, particularly the WordCloud and Thematic Map functions, which researchers very much favor. On the other hand, VOSviewer can directly filter keywords in keyword analysis (Aktürk, 2021), compensating for the lack of this feature in Bibliometrix.

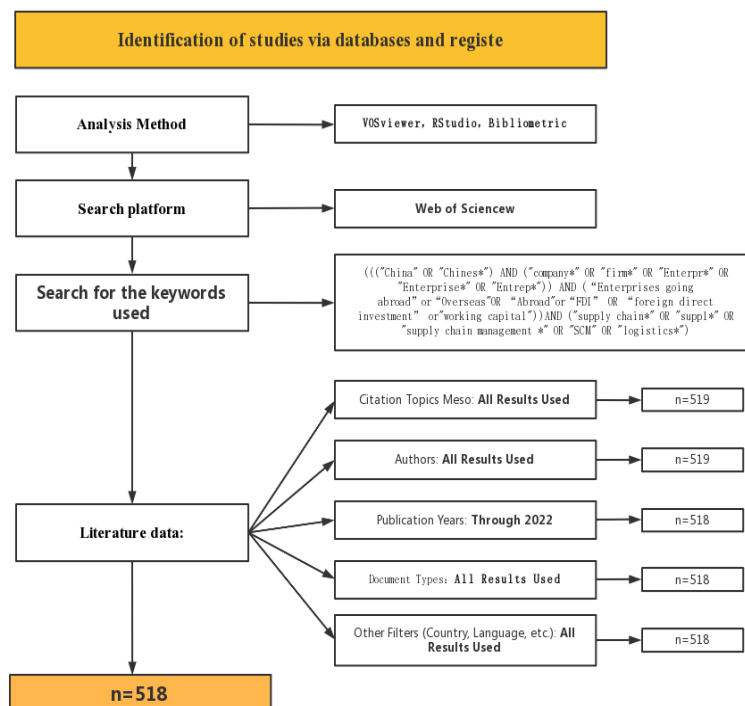


Figure 1. The study flow diagram chart

Source: created by author

Results of Research

Overall data summary – Basic data / Annual productivity and influence

The literature included in this study spans a period from 1994 to 2022, encompassing a total of 518 articles. These articles were published across 325 different journals, indicating a diverse range of sources contributing to the research field. The authors involved in this body of work amounted to 1721 individuals, who either collaborated with others or conducted their research independently. Notably, 71 articles were authored solely by a single individual, showcasing independent contributions.

International cooperation was a significant aspect of the literature, with articles on this topic constituting approximately 33.13% of the total number of articles included in the study. This highlights the global perspective and collaborative nature of the research.

Additionally, the average number of citations received by the articles is approximately 16.86. This metric reflects the level of influence and recognition garnered by the included literature within the academic community. A higher number of citations suggests that the research has had a greater impact and has been referenced by other scholars in their own work. Overall, these statistics provide insights into the characteristics of the literature selected for the study, including the publication period, journal distribution, authorship patterns, international cooperation, average article age, and citation impact. They contribute to understanding the scope and significance of the research field under investigation.

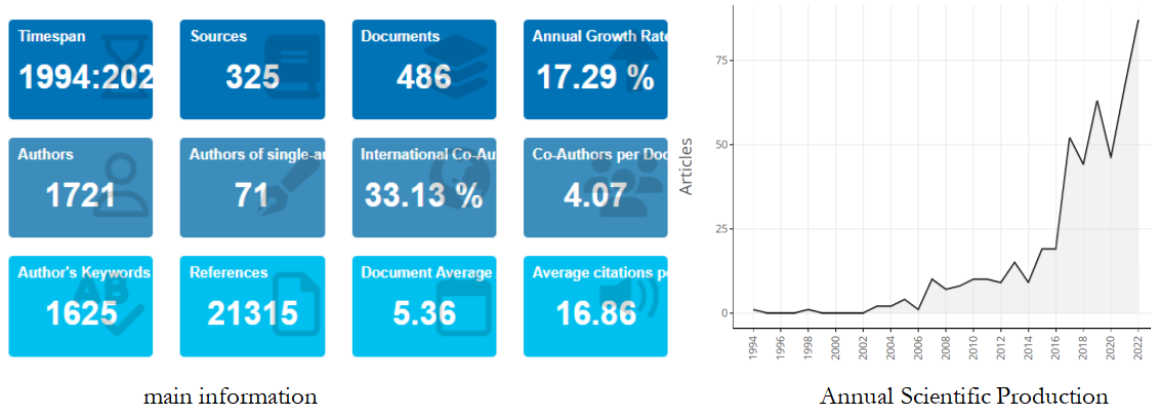


Figure 2. visualizes the annual productivity and influence of the articles.

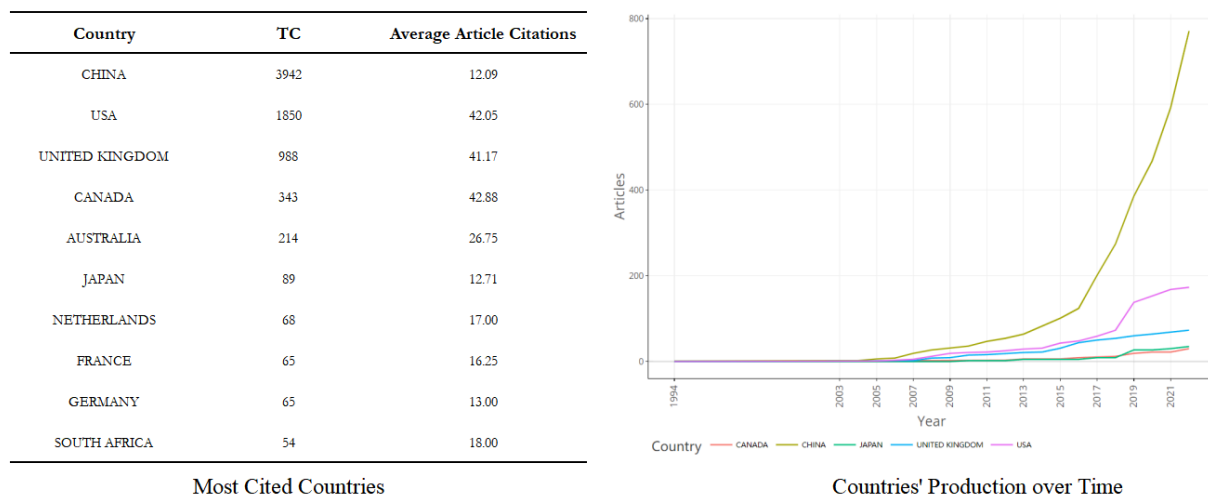
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The scientific productivity related to this topic has exhibited three distinct stages of growth. The diagram on the right in Figure 2 provides a visual representation of these stages. The first stage began in 1994, marking the initial exploration and publication of research in this field. The second stage, which can be further divided into the period from 2002 onwards, witnessed fluctuations in scientific productivity. Following the fluctuating period, the third stage experienced a significant surge in scientific productivity from 2016 to 2022. The delineation of these three stages provides valuable insights into the trajectory of scientific productivity within the chosen topic. It demonstrates the evolution of research interest over time, highlighting the initial exploratory phase, the subsequent fluctuating period, and finally, the phase of accelerated growth and increased scholarly output.

Results of analysis of countries and organizations

Most Cited Countries/ Countries' Production over Time: Figure 3 presents the table of Most Cited Countries and the graph of Countries' Production over Time, It is evident that the scientific productivity of each country began to increase around 2006, marking the onset of the first stage of growth.

Subsequently, a second stage of scientific productivity growth emerged around 2018 in four countries. These countries experienced a significant boost in research output during this period, signifying a further consolidation of their scientific contributions. Notably, China, which occupies the top position in terms of scientific productivity, initiated its second phase of growth ahead of schedule in 2016. The observation of these temporal patterns in scientific productivity provides valuable insights into the trajectory and dynamics of research output in different countries. It demonstrates how productivity has evolved over time, highlighting the emergence of distinct growth phases. Understanding these trends helps us assess the development and influence of countries in the field of scientific research.



Most Cited Countries

Countries' Production over Time

Figure 3. Most Cited Countries/Countries' Production over Time

Source: created by author

In "Most Cited Countries", the column labeled "TC" represents the total number of documents cited by each respective country. This provides an indication of the overall impact and influence of the scientific research produced by each country. Additionally, the "Average Article Citations" column provides insight into the average number of citations received per article. In comparison, China falls behind the first-place position in terms of average article citations. These findings demonstrate that while China leads in terms of overall scientific productivity and the total number of citations across all documents, other countries such as Canada and the United Kingdom exhibit higher average article citations. This suggests that, on average, research publications from these countries tend to have a greater impact and receive more frequent citations per article.

Co-authorship-country: The co-authorship collaboration between countries can be effectively visualized using VOSviewer. Figure 4 provides a comprehensive representation of the time of co-operation between countries. China's cooperation with other countries primarily intensified around 2018, indicating a significant increase in collaborative research efforts during that period. On the other hand, the United States shows the highest frequency of cooperation with other countries

around 2015. The visualization generated by VOSviewer allows for a clear understanding of the temporal patterns and intensity of cooperation between countries. It reveals the dynamics of collaboration, highlighting the periods when cooperation between specific countries was most prevalent. By examining these patterns, researchers can gain insights into the evolving nature of scientific collaboration and identify key periods of heightened cooperation between countries.

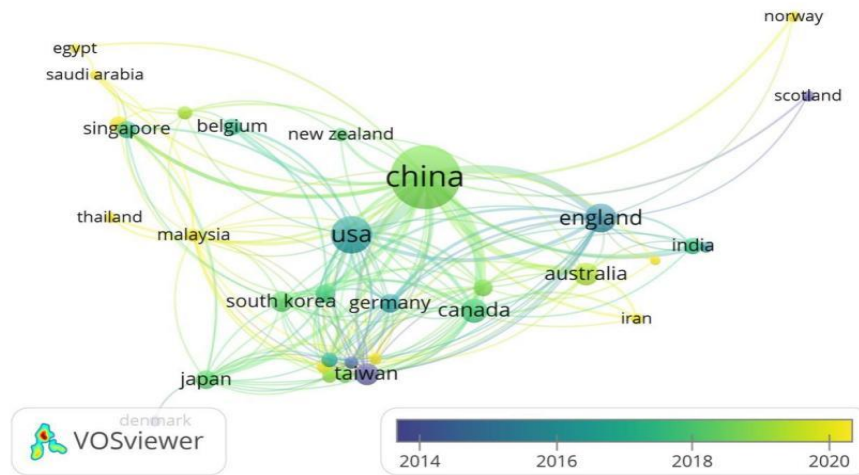


Figure 4. VOSviewer-Co-authorship-overlay visualization-country

Source: created by author

Results of analysis of journals

Most Relevant Sources: Table 1 shows the list of journals from which the 518 articles are searched, and shows the first 10 journals according to their relevance.

Table 1: Most Relevant Sources

Sources	Articles
SUSTAINABILITY	14
INTERNATIONAL JOURNAL OF PRODUCTION ECONOMICS	10
MATHEMATICAL PROBLEMS IN ENGINEERING	9
INTERNATIONAL JOURNAL OF EMERGING MARKETS	7
CHINESE MANAGEMENT STUDIES	6
EUROPEAN JOURNAL OF OPERATIONAL RESEARCH	6
AGRO FOOD INDUSTRY HI-TECH	5
EMERGING MARKET'S FINANCE AND TRADE	5
FRONTIERS IN PSYCHOLOGY	5
JOURNAL OF DEVELOPMENT ECONOMICS	5

Source: created by author

Among the journals considered in the study, the journal "SUSTAINABILITY" stands out as the most relevant with a total of 14 articles. This indicates that a significant body of research related to

the topic under investigation has been published in this journal. The high number of articles suggests that "SUSTAINABILITY" is a prominent publication venue for scholars working in this field. These statistics reveal the journals that have made significant contributions to the study's topic, indicating their influence and relevance within the research field. Researchers and readers interested in exploring more on the subject can refer to these journals to access a substantial amount of literature and gain valuable insights into the topic of sustainability and production economics.

Authors citation analysis: Figure 5 provides an overview of the global citation count for the articles included in the study. Among these articles, the most highly cited publication is attributed to Akiyama et al. (2019). This article has garnered significant attention and recognition within the academic community, as evidenced by its high citation count. Following closely behind in the second position is the work by Alfaro et al. (2010). This article has also received considerable citations, indicating its impact and influence in the field.

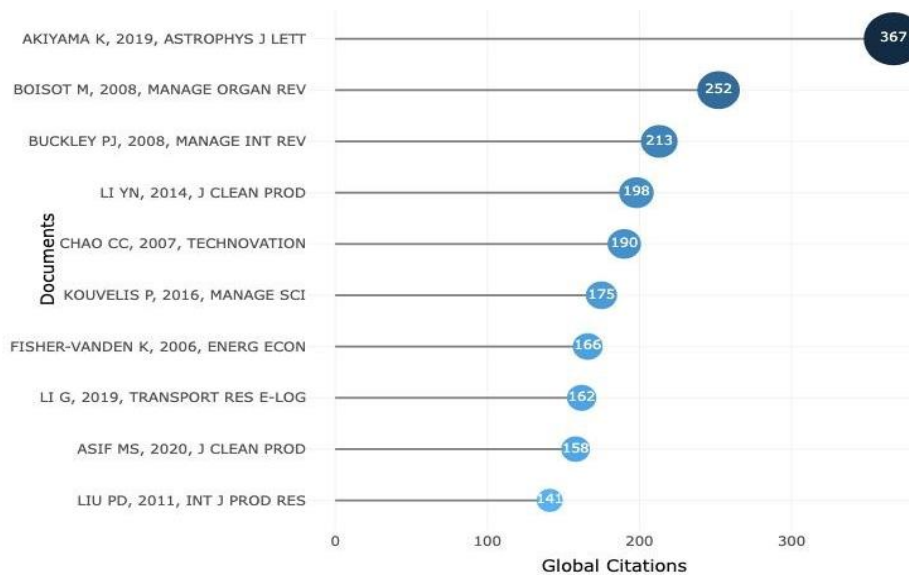


Figure 5. Most Global Cited Documents.

Source: created by author

These highly cited articles, as illustrated in Figure 5, serve as notable contributions to the literature and have attracted considerable attention from other researchers in the field. Their inclusion and citation count highlight their significance and the potential influence they have had on subsequent research and scholarly discussions.

Analysis results of keywords

Core keywords/ Thematic Map: The WordCloud in Figure 6 presents the current most popular keywords in this study, while the Thematic Map in Figure 10 provides a statistical and predictive analysis of the core keywords for the past, present, and future.

Additionally, Figure 6 not only illustrates the popularity of these keywords in the field but also analyzes the importance of the keywords in this domain.

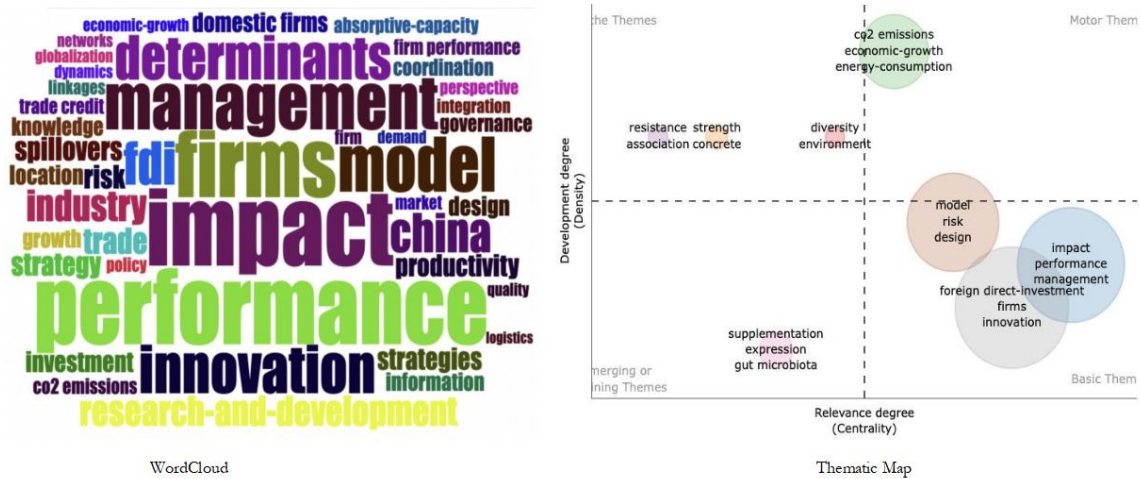


Figure 6. WordCloud/Thematic Map.

Source: created by author

Using the 50 hottest keywords to generate WordCloud through bibliometrix, the hottest and core keywords can be clearly presented in Figure 6.

The Thematic Map of keywords represents the current situation of keywords in the research field, this paper uses Keywords Plus for analysis, and selects 250 keywords. They are scattered in four different regions, centrality represents Abscissa, density represents ordinate, As shown in the thematic map in Figure 6, the four regions represent motor themes, referring to the key phrases that are good and important in today's development. Niche themes refers to a key phrase that is not important in the current field but has been developed. Emerging or declining themes, some key phrases that have just appeared or are disappearing, have no key phrases that are not developed or important. Basic themes, on the other hand, refers to keywords that have not been developed but are very important to the corresponding field.

Co-occurrence Network-keywords: Figure 7 shows 58 keywords that appear more than or equal to 10 times in all articles. After filtering and deleting keywords that have nothing to do with the topic, 40 keywords are finally obtained for analysis and display.

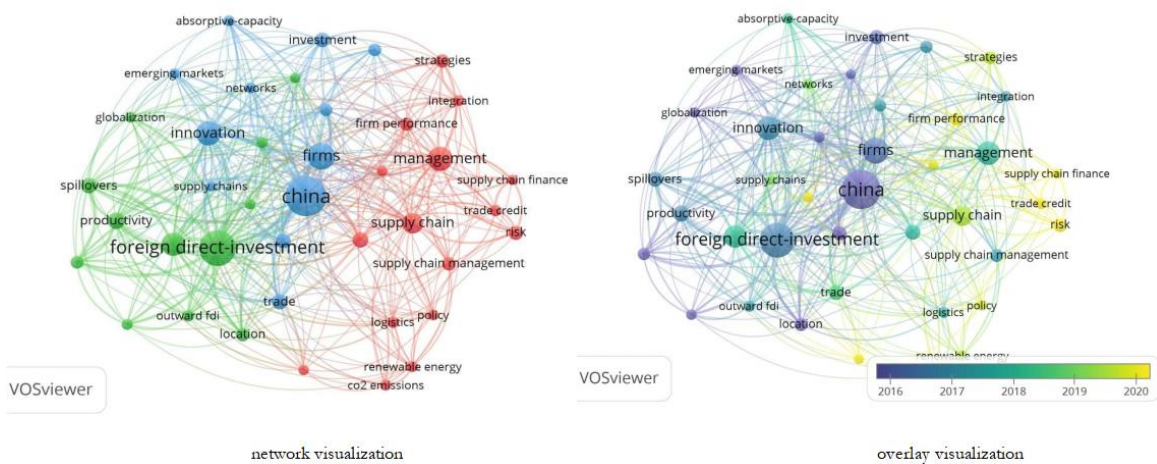


Figure 7. VOSviewer - (network visualization / overlay visualization) - keywords

Source: created by author

The refined “network visualization” provides further insights into the topic by displaying keywords such as “foreign direct investment, China, firms, and supply chain” and their co-occurrence network with other related keywords.

On the other hand, “overlay visualization” analyzes the temporal co-occurrence of keywords. China, enterprises, foreign direct investment, etc. have become popular keywords in the past, but in recent years, the keywords are gathered in a cluster related to sustainability, supply chain, etc. Thus, the keyword filtering feature of VOSviewer plays a significant role in data visualization, offering valuable insights in the field.

Discussion

On the concept of Sustainability and supply chain Management: As can be seen from the above Bibliometric analysis, the number of relevant literature has continued to increase significantly since 2016, with the keyword “supply chain” accounting for 2% of the total number of keywords, “China” accounting for 3%, and foreign direct investment accounting for the highest proportion (8%). In the current field, the hottest and most important keywords focus on “carbon dioxide emissions, economic growth and energy consumption”, while OFDI-related keywords are shown in “not well developed but very important” areas.

After the keywords are screened and visualized by VOSviewer software, it is concluded that the emergence density of “supply chain” is second only to “China, foreign direct investment, innovation, and enterprise and management”, are more researched topics.

Meanwhile, the concept of sustainability not only holds a significant position in the aforementioned data analysis but also constitutes the central theme of the core articles in the theoretical review.

(Lu et al., 2018) delve into the realm of sustainable supply chain management (SSCM). Business sustainability encompasses long-term, social, stakeholder, environmental, volunteer, resilience, and economic considerations. Supply chain management, on the other hand, focuses on flow, coordination, relationship, value, stakeholder engagement, efficiency, and performance. From this, it becomes evident that SSCM involves a wide range of content areas, signifying the complexity of its management tasks. While sustainability and green initiatives share a close relationship, it is essential to differentiate between green supply chain management (GSCM), which emphasizes environmental aspects within the supply chain, and sustainable supply chain management, which encompasses sustainable practices across various fields within enterprises. In China, previous studies predominantly focused on economic and environmental benefits in sustainable supply chain management. However, (Lu et al., 2018) expanded the research scope by incorporating economic, environmental, and social benefits. Their findings indicate that institutional pressures positively influence sustainable supply chain management. Specifically, sustainable supply chain procurement significantly impacts environmental and economic performance but not social performance. Sustainable supply chain distribution, in contrast, exhibits a considerable positive impact on environmental and social performance, with a favorable influence on economic performance, although the precise relevance remains unclear. Lastly, sustainable supply chain design enhances economic, social, and environmental performance (Lu et al., 2018).

The concept of sustainable supply chain management is gaining prominence as organizations recognize the need to align their supply chain practices with the principles of sustainable development. Feng Wei and Zhihui Xiong emphasize that sustainable supply chain management is not only a necessity but also a reflection of the current societal trend (Wei and Xiong, 2020). Traditional

economic models based on resource-intensive industries have proven detrimental to the environment and society, underscoring the urgency to shift towards sustainable practices (Ageron, Gunasekaran and Spalanzani, 2012).

Integrating environmental, Social, and Economic objectives (ESG) into the key business processes of supply chain organizations is essential for long-term profitability and competitive advantage. This entails managing logistics, information flow, and capital flow, as well as coordinating procurement, production, and distribution activities to meet stakeholder needs (Ahi and Searcy, 2013). Sustainable supply chain management recognizes the importance of addressing environmental concerns throughout the product lifecycle, including design, raw material selection, production, delivery, and end-of-life management (Centobelli, Cerchione and Esposito, 2018).

Moreover, achieving economic profit and meeting customer demands are closely tied to factors such as flexibility, reliability, transportation cost, and route selection. Organizations need to consider these elements in their supply chain operations to drive sustainable development (Sandeepa and Chand, 2018). Eco-environmental sustainability plays a crucial role in addressing environmental concerns within the sustainable supply chain framework.

To achieve ecological sustainability, organizations should focus on strategies such as waste emission reduction, the adoption of energy-saving products and services, utilization of renewable and recycled energy sources, maximization of recyclable components and raw materials, and the implementation of sustainability performance evaluation standards (Das, 2018).

By embracing the concept of sustainable supply chain management and implementing strategies that encompass environmental, social, and economic dimensions, organizations can contribute to a more sustainable future while enhancing their own long-term profitability.

Comprehensive discussion of the literature: Managing transnational supply chains presents greater challenges compared to domestic supply chain management due to the complex operating environment (Busse et al., 2016). This complexity is influenced by multiple factors that affect the establishment and operation of transnational supply chains. One important factor is the innovation of supplier clusters, which is influenced by global supply chain relationships, local market competition, and innovation spillovers (Ding, Atallah and Sun, 2021). Furthermore, the successful interaction between e-commerce and e-logistics will promote the global sustainable chain management (Torcsvary, 2015). These relationships play a significant role in shaping the innovation and profitability of local clusters within the global supply chain context. Additionally, transnational supply chains are more exposed to uncertainty and uncontrolled factors, which affects their risk tolerance compared to local supply chains (Zeng and Yen, 2017). Common risks include demand risk, exchange rate risk, social risk, and political risk (Cruz, 2013; Lei et al., 2021). Yan Xiaoli and Yu Hui's research emphasizes the significance of channel choices in the transnational supply chain. They identify three options: direct sales in two markets, domestic sales through distributors, and sales in two markets via distributors. The channel choice plays a crucial role for multinational enterprises in reaching international target markets and connecting with final consumers (Yan and Yu, 2022). Macroeconomic factors, including exchange rate fluctuations and sales prices in foreign markets, also influence the decision to establish a new channel in the transnational supply chain for domestic sales (Yan and Yu, 2022).

On the topic of supply chain management (SCM) and working capital management (WCM), limited research exists examining how to manage working capital from a supply chain perspective (Peng and Zhou, 2019). Erik Hofmann and Herbert Kotzab emphasize the importance of considering supply chain reactions when determining payment amounts and timing. The monetary aspect of working capital, such as accounts receivable (A/R), accounts payable (A/P), and cash, is tied to "how much to pay," while the time-based aspect, related to the accounts payable period, accounts

receivable period, and cash-to-cash (C2C) cycle, addresses the question of "when to pay" (Hofmann and Kotzab, 2010).

Insufficient working capital can lead to supply chain instability or failure for node enterprises. Supply chain financing techniques have been adapted to accommodate node enterprise working capital, with two financing methods being external financing and internal financing. However, the exploration of a mixed financing plan that integrates both internal and external financing is still limited (Zhang and Cui, 2021). Capital-constrained node firms can seek external finance from financial institutions outside the supply chain system, such as banks, while self-financing options like early payment discounts or buyer-backed purchase order finance can assist suppliers (Lin and Xiao, 2018; Jin, Zhang and Luo, 2019; Lu, Gu and Huang, 2019; Yang, Miao and Zhao, 2019).

Songtao Zhang and Yi Cui propose three financing strategies: internal financing, hybrid financing, and external financing. Their research indicates that the optimal financing strategy outperforms external financing, internal financing, and hybrid financing in lowering the total cost (Zhang and Cui, 2021). Andrés Polo and Numar Peña introduce the concept of a robust switching strategy that considers the uncertainty of final product demand, and Zhang and Cui integrate financing strategies and the robust switching strategy into a robust financing strategy to ensure the stable operation of the uncertain supply chain financing system at a lower cost (Polo et al., 2019; Zhang and Cui, 2021). Research by Juan Penga and Zhili Zhou suggests that the equilibrium solutions recommend maximizing the payment period when the retailer's.

Conclusion

The analysis of Bibliometrix and VOSviewer reveals a significant increase in the number of relevant publications since 2016. China dominates in terms of article origin, while the United States has shown explosive growth in scientific productivity since 2017. China is the most cited country, but Canada and the United Kingdom have the highest average citation count. Cooperation density between China and neighboring countries is the highest, indicating China as the most collaborative country since 2018. Key research topics focus on "carbon emissions, economic growth, and energy consumption." These findings highlight a significant research gap in the supply chain management of overseas Chinese enterprises, particularly when compared to the attention received by "overseas Chinese enterprises" as a topic. Supply chain management is critical for enterprise operations, and integrating environmental, social, and economic objectives (ESG) into supply chain operations can enable sustainability throughout the product lifecycle. By adopting sustainable supply chain management, organizations can contribute to a more sustainable future while enhancing long-term profitability. To understand the success of overseas Chinese enterprises and achieve sustainable development, it is essential to study their operational management and promote the widespread adoption of sustainable supply chain management concepts across the product lifecycle. Regardless, this document provides a comprehensive summary of the research on supply chain management for China's FDI on the global stage. When Chinese enterprises make FDI investments, they must consider the factors that influence supply chain management, avoiding risks related to demand, exchange rates, society, and politics, particularly in the areas of working capital, financing strategies, and retailer control. During the implementation of SCM, Chinese FDI enterprises must pay special attention to whether they have ESG elements into their SCM.

In conclusion, the literature analysis highlights the recent growth and international collaboration in the research field. It identifies the importance of supply chain management in transnational op-

erations and the significance of working capital management and financing strategies. Understanding these findings contributes to a comprehensive understanding of the research field and provides insights for future studies and practical applications in supply chain management,

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