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Published by the Faculty of Engineering, Khon Kaen University, Thailand

An overview of logistics network through bibliometric analysis using VOSviewer

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Received 30 March 2025
Revised 14 October 2025
Accepted 17 October 2025

Abstract

Logistics networks are essential frameworks that facilitate the efficient movement and management of goods within supply chains, particularly in the context of globalization and technological advancements. The objectives include: (i) conducting a large-scale bibliometric analysis of logistics network literature from 1980 to 2024, (ii) identifying leading authors, institutions, and countries, (iii) mapping thematic clusters and keyword co-occurrences, and (iv) clarifying research gaps to guide future studies. Using 3,686 Scopus-indexed documents, performance analysis and science mapping techniques (VOSviewer, MS Excel) were applied to analyze publication growth, citation metrics, co-authorship, co-citation, and keyword networks. Key findings show exponential growth in publications since 2004, with "China", "the United States", and "Germany" leading in both output and collaboration strength; "logistics" and "logistics network" are the most frequent keywords but have lower average citations compared to emerging terms such as "sustainability" and "circular economy"; and high-impact thematic clusters are shifting towards sustainable and technology-driven logistics. The novelty of this study lies in providing the first comprehensive, quantitative mapping of logistics network research, integrating structural collaboration patterns with thematic evolution to uncover actionable insights for advancing both theory and practice.

Keywords: Bibliometric analysis, Logistics network, Logistics, VOSviewer

1. Introduction

The logistics network is essential in coordinating, optimizing, and integrating various components of the supply chain to improve effectiveness and resilience [1]. It is instrumental in managing the flow of goods from suppliers to customers, especially during periods of high demand, while minimizing overall logistics costs, including construction, leasing, and operational expenses [2-4]. Gupta et al. [5] highlight that logistics networks facilitate the management of forward and reverse flows, as well as the storage of products, services, and related data, ensuring efficient and timely responses to customer demands. Luo et al. [6] emphasize the critical role of logistics networks in e-commerce by enabling efficient transportation, rapid responses to emergencies, and optimized resource allocation. Kramarz & Kmiecik [7] identify logistics networks as essential in coordinating flows within omni-channel models, utilizing various mechanisms such as market-based, social, hierarchical, and logistics coordination to improve efficiency and performance in managing network dynamics and resources among stakeholders. Moreover, logistics networks are pivotal in managing the distribution of supplies and emergency services during natural disasters and public health emergencies [8].

Perdana et al. [9] identify that effective logistics network governance brings several benefits, including cost savings (reduced logistics costs), ensuring high product quality, facilitating access to both domestic and international markets, and enhancing resilience and sustainability. Logistics network governance also aims to stabilize relationships among supply chain participants, such as enterprises, farmers, and intermediaries [10]. Farmer cooperatives enable farmers to gain greater control over the supply chain, which remains critical for resource coordination and maintaining market stability [11]. Governance plays a pivotal role in strengthening the resilience of agricultural logistics networks, especially when confronting issues like environmental shifts and global pandemics [12, 13]. Additionally, governance supports the establishment of fair trade practices in agricultural logistics, ensuring the equitable distribution of resources and benefits [14].

Bibliometric analysis is increasingly recognized as a widely adopted approach for examining emerging research trends [15]. Bibliometric analysis is a computer-assisted quantitative evaluation of bibliographic data, such as publications, citations, authors, and organizations, within a scientific field [16]. According to Lima and Bonetti [17], bibliometric analysis is a quantitative assessment method for scientific research that measures knowledge through scientific publications. While bibliometric analysis offers numerous advantages, it does have limitations, such as the fact that publication volume does not fully capture the significance of a research topic. Nonetheless, this method is highly effective in identifying research trends [18].

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https://doi.org/10.64960/easr.2026.261451

Bibliometric analyses related to logistics networks have been conducted from various aspects and perspectives. Fan et al. [19] conducted a study in the transportation sector to identify CO2 emissions. Habibullah and Pudjianto [20] employed bibliometric analysis to evaluate logistics research, utilizing 1,000 articles from Scopus. Salas-Navarro et al. [21] focused their study on inventory frameworks within environmentally conscious supply chains, highlighting trends, applications, and research opportunities. Additionally, Wang et al. [22] conducted an assessment of environmentally sustainable supply chain and logistics management, analyzing 2,809 publications. Their research emphasized trends, challenges, and opportunities in the field. Coşkun and Kazan [23], in their study on global supply chains, used bibliometric analysis to reveal trends such as greenhouse gas emissions and corporate social responsibility. Khan et al. [24] focused on humanitarian logistics and sustainable development, highlighting research trends and the increasing number of studies in this area in recent years. Similarly, Ittmann [25] utilized bibliometric analysis for the "Journal of Transport and Supply Chain Management", examining its impact, citations, authorship, and co-authorship relationships over a 13-year period.

There is still a large lack of thorough study focused solely on logistics networks, despite the expanding corpus of work using bibliometric techniques in the supply chain and logistics sectors [20, 21]. A comprehensive mapping of publishing performance, author collaboration, citations, co-authorship, and interconnections is typically absent from existing research, which frequently concentrates on certain subdomains like transportation emissions, humanitarian logistics, or green supply chains. For instance, some studies have examined risk propagation in emergency response logistics [8], governance in agricultural product logistics [9], or blockchain-based supply chain governance [10], yet none have comprehensively mapped the logistics network field as a whole. Understanding the field's development patterns, significant contributors, and new research areas is hampered by the lack of comprehensive analysis. Thus, comprehensive investigations are urgently needed to give a wide view of the state of logistics network research, enhancing the body of knowledge and promoting international scientific advancement. By using extensive Scopus data (1980–2024) to do a comprehensive bibliometric analysis, this study fills this vacuum by providing a performance review and a structural representation of the logistics network landscape, including journals, authors, and topic evolution.

The objective of this study is to present a comprehensive summary of the existing literature related to logistics networks. Additionally, the study analyzes the contributions of authors, citation counts, and geographic distribution. Furthermore, it aims to identify the authors with the most significant contributions and influence based on citations and collaborative relationships with other scholars. The study also highlights the development of the logistics network field in the current period. To achieve these objectives, the paper employs bibliometric analysis techniques as a foundation to explore issues. This study has analyzed 3,686 articles based on data from Scopus, covering the period from 1980 to 2024. The bibliographic links in this study were compiled and analyzed using Microsoft Excel and VOSviewer to visualize the data. Bibliometric analysis has supported the creation of a comprehensive database on logistics networks and related fields while processing a large volume of articles to uncover connections and structural patterns in this domain. This method surpasses traditional review approaches such as critical, narrative, or meta-analysis reviews by efficiently synthesizing large-scale data. This study addresses the following research questions: (1) What are the structural and collaborative patterns among scholars, institutions, and countries in logistics network research? (2) Which thematic areas, emerging trends, and underexplored topics characterize the field? (3) How have publication and citation patterns evolved over time?

The remainder of this article is structured as follows. Section 2 provides an overview of the existing literature on logistics network research. Section 3 presents the data sources and the bibliometric methodology using VOSviewer. Section 4 discusses the results and visualizations obtained from the analysis. Section 5 concludes the study.

2. Literature review

Zhuang et al. [26] suggest that logistics networks (LN) refer to the connected systems responsible for transporting and distributing goods or services from suppliers to consumers. These networks comprise various components, including suppliers, transportation modes, distribution centers, and consumers, all working together to ensure efficient movement and distribution of products. Orjuela-Castro et al. [27] state that logistics networks refer to the configuration of agents and facilities involved in the production, transformation, commercialization, and distribution of goods within the supply chain. Ezaki et al. [28] define logistics networks as a system of interconnected transportation hubs that facilitate the movement of goods between nodes through various links. They involve the integration of transportation activities, increasing complexity and affecting the system's predictability in the face of disruptions. Vijaiprabhu et al. [29] identify logistics networks as a collection of activities associated with the transfer of goods between locations, encompassing the creation, production, and distribution of products. They include processes necessary to ensure goods are delivered efficiently, often involving various transportation modes and routes. Kailaku et al. [30] state that logistics networks refer to an interconnected system of facilities, transportation modes, and processes that facilitate the movement and storage of goods from production centers to consumers.

A logistics network constitutes a systematic arrangement of transportation pathways that interlink various logistical sites. It plays an important role in the efficiency and stability of the supply chain, particularly in modern e-commerce [31]. In the study by Zhao et al. [32], the importance of an efficient logistics network was emphasized for improving accuracy in forecasting and adaptability in complex scenarios, utilizing various innovative methods for optimization. Ren [33] highlighted the significance of supply chain management in optimizing logistics networks to increase revenue and facilitate resource sharing among businesses. A logistics network typically represents a structured framework of organizations, individuals, activities, information, and assets that facilitate the transfer of goods between suppliers and consumers, enabling efficient operations and competitive advantages in the market.

In the study of transportation network design in logistics, Khezeli et al. [34] identified that designing logistics networks has a significant impact on strategic decisions in supply chain management. In the context of perishable food supply chains, logistics network design (LND) significantly affects performance measures, response capabilities, and food security, particularly in environments characterized by seasonality and fluctuating supply and demand [27]. Logistics networks facilitate the flow of goods and information, allowing for efficient resource planning and forecasting throughput across different nodes. Forecasting cooperation regarding logistics network throughput requires integrating all nodes as a comprehensive research object to optimize performance and enhance operational efficiency within the logistics framework [35].

In addition, logistics networks play an important role in coordinating flows in a multichannel context. They facilitate the integration of various coordination mechanisms, market-oriented, social, hierarchical, and logistical, adjusted to improve efficiency [7]. Logistics

networks are crucial for enhancing customer service by enabling efficient, fast, and reliable operations [36]. Recently, Duan et al. [37] noted that logistics networks serve as the foundation of supply chains, performing the task of transporting goods and materials between suppliers, manufacturers, and distributors. This is a complex system structured by nodes and the relationships between them, facilitating the flow of goods and ensuring uninterrupted production and distribution operations. Li et al. [38] stated that logistics networks play a central role in meeting customer demand in the e-commerce sector, contributing to reducing operational costs and improving efficiency. Li [39] identified logistics networks as an essential component in cross-border e-commerce, ensuring that international delivery takes place efficiently and on time. This not only meets customer needs but also maintains companies' competitive advantages.

Logistics network study can be situated in the nexus of technological integration, governance processes, and structural design, according to the studied literature. Few research have integrated these elements in a thorough bibliometric mapping; most have only examined them separately. This research uses a dual-lens approach:

(1) Performance Analysis Lens: to measure production, impact of citations, and level of collaboration.

(2) Science Mapping Lens: to find upcoming research fronts, term co-occurrence, and theme clusters.

Combining these perspectives offers a methodical technique to record both the dynamic (evolutionary) and static (structural) facets of LN research, making it possible to identify important players, important discussions, and potential future directions. The methodological design is supported by this framework, which also directs how the bibliometric results are interpreted in the parts that follow.

3. Methodology

Bibliometric analysis represents a methodological framework employed to investigate and assess extensive quantities of scientific data, utilizing a range of approaches, methodologies, and indicators to illustrate the progression and intricacies of research, thus facilitating the identification of trends and nascent domains within a defined field [40]. The bibliometric indicators used in this study include: Total number of documents; Total citations; Average citations per document; H-index; Total Link Strength (TLS); Degree centrality; Betweenness centrality. The research is conducted using performance analysis techniques (based on the quantity of published academic articles, publishing countries, authors, publishing organizations, connections, and trends in publications over the years). Simultaneously, the study employs scientific mapping analysis techniques to explore the structure of publications, relationships between publications, and research fields developed over the years. The primary authors and key authors in the research field are also analyzed through co-citation analysis, based on the total number of citations and the total number of articles. Scholars perform evolutionary analyses to examine the progression of a research field over time and to identify emerging trends that may shape its future direction [41].

The research uses data from the Scopus database collected on October 16, 2024. Scopus is one of the important and reliable databases widely used. Research on logistics networks has been expanded across many aspects and various fields such as agriculture, transportation, inventory, supply chain, and others. The keyword “Logistics network” was used to search for relevant articles in the title, regardless of language. The first publications that appeared after the search were from 1980, marking the initial period in the research field. Hallock and Bennett [42] argue that the title of a paper is the first opportunity to capture the reader’s attention. However, to cover all data relevant to the topic, the research expanded the scope of the search beyond just titles to include abstracts and related keywords in the Scopus database search. The research customized publications from 1980 to 2024 to identify studies on logistics networks relevant to the topic.

The topic is carried out in 5 steps as follows (Figure 1):

Step 1: Formulate the research design and objectives. In order to examine the thematic trends, research clusters, and intellectual structure in logistics network governance, the study used bibliometrics. A survey of the pertinent literature served as the foundation for the definition of the research questions and objectives.

Step 2: Identification of the data source. Because of its broad coverage of scholarly papers of the highest caliber, the Scopus database was chosen. The term "logistics network" was created with the help of preliminary literature reviews and professional advice.

Step 3: Gathering information. Scopus was searched using a structured query that covered the years 1980–2024. Only peer-reviewed journal papers written in English were filtered using inclusion and exclusion criteria.

Step 4: Data cleaning and preparation. Duplicate records, incomplete entries, and non-relevant documents were removed. The bibliographic data were exported in CSV format for analysis. The study will exclude publications based on the following criteria: incomplete entries lacking essential bibliographic information (e.g., missing author or source data); publications where the term “Logistics network” appears only peripherally, without substantive relevance to the main research scope; and duplicate records. After screening, a total of 3,686 documents were collected. Among the total collected data from published articles, the primary types of documents include: Journal articles (2,009 articles, accounting for 54.5%); Conference papers (1,339 articles, accounting for 36.33%); Book chapters (178 articles, accounting for 4.83%). Additionally, there are Conference reviews, Reviews, Books, Notes, Editorials, Short surveys, and Letters

Step 5: Data analysis was conducted after screening and included statistical analysis, co-citation analysis, and keyword analysis to achieve the objectives of the study. VOSviewer, a software program created especially for building and viewing bibliometric networks, was used in the study. In order to find linkages between authors, institutions, keywords, and citation patterns, VOSviewer provides sophisticated visualization tools and makes it possible to create maps based on network data. Large dataset handling, a variety of visualization modes (network, overlay, and density), and the ability to perform in-depth analyses of co-authorship, co-occurrence, co-citation, and bibliographic coupling are among its strong points. VOSviewer is especially well-suited for this study because of these qualities, which make it easier to explore the logistics network domain's structural patterns, research clusters, and theme trends. Studies like Habibullah and Pudjianto [20], who tracked global trends in logistics research; Wang et al. [22], who looked at sustainable logistics and supply chains; and Coşkun and Kazan [23], who evaluated the global supply chain, have shown its efficacy in comparable circumstances. Together with Microsoft Excel, VOSviewer enabled the study of quantitative data and the production of comprehensible visual representations, guaranteeing that the results are both aesthetically pleasing and analytically sound.

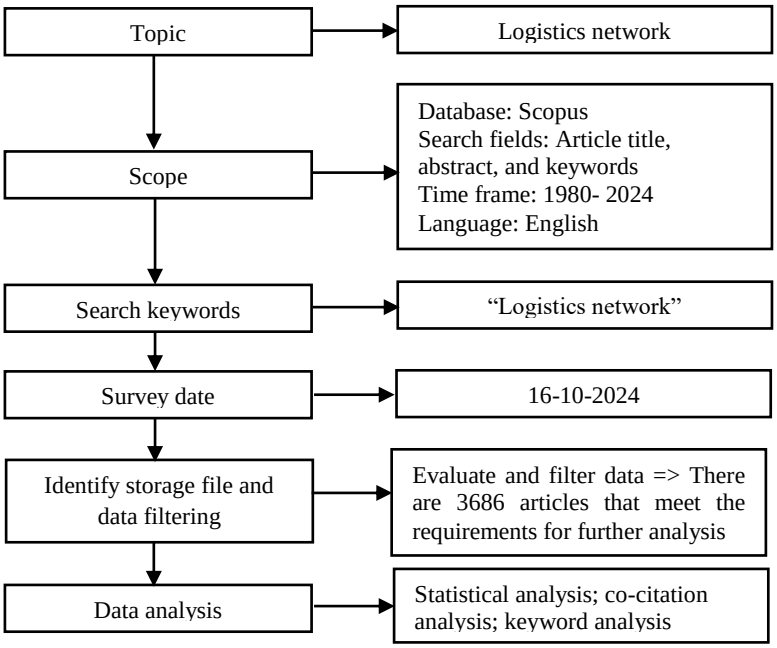


Figure 1 Research Implementation Process

4. Results

4.1 Descriptive statistics

Figure 2 shows that the number of annual publications has significantly developed in the research field. Since the emergence of research related to logistics networks in 1980, the annual volume of scholarly publications has experienced remarkable growth. Specifically, during the 1980s and 1990s, the number of publications was very limited. However, the number of articles began to grow rapidly from 2004 (37 publications). This number continued to increase significantly in the following years, reaching a peak of 303 publications in 2023. This indicates that researchers have shown a growing interest in the field of logistics networks in recent years. The rapid increase in the number of publications aligns with the period of e-commerce boom, deeper integration into global supply chains, and the emergence of advanced logistics management technologies.

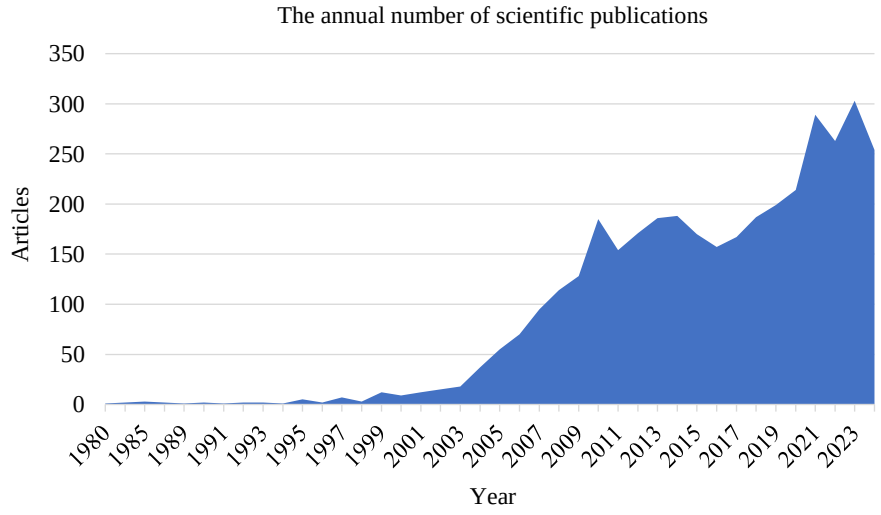


Figure 2 Annual number of publications (with 303 publications in 2023)

The summary results from Figure 3 show that a total of 3,686 documents were collected from the Scopus database based on the research field. The types of documents include: Article; Conference paper; Book chapter; Conference review; Review; Book; Note; Editorial; Short survey, and Letter. Among these, Articles account for a total of 2,009 published documents (54.5%), followed by Conference papers with 1,339 publications (36.33%), and Book chapters with 178 publications (4.83%). Additionally, Conference reviews and Reviews have 60 publications (1.63%) and 58 publications (1.57%), respectively. Other types of publications account for very low proportions, such as: Book (25 publications, 0.68%); Note (7 publications, 0.19%); Editorial (5 publications, 0.14%); Short survey (4 publications, 0.11%), and Letter (1 publication, 0.03%). These results indicate that the field of logistics networks is primarily focused on research in the categories of Articles and Conference papers.

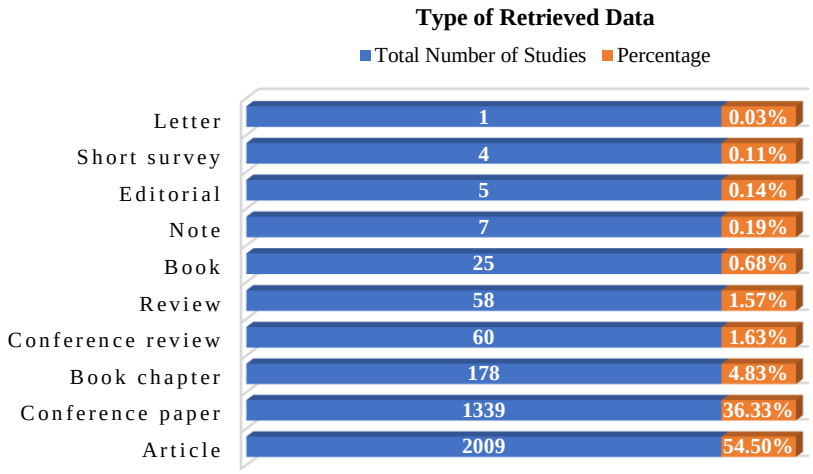


Figure 3 Data retrieved during the period from 1980 to 2024

The summary results from Figure 4 show that the majority of publications are published in English, with a total of 3,442 publications. Following that is Chinese, with 190 publications. Additionally, German has 22 publications; Portuguese has 10 publications; and both Spanish and Japanese have 9 publications each. Furthermore, the number of publications in other languages is very small, such as Turkish (4 publications), Russian (4 publications), French (4 publications), and Korean (2 publications). The study incorporates language diversity in publications to reflect regional research activities and local scholarly networks. Publications in the same non-English language often document collaborations among institutions and authors within the same linguistic and cultural context. At the same time, considering multilingual factors allows for a more accurate and comprehensive interpretation of global collaboration trends.

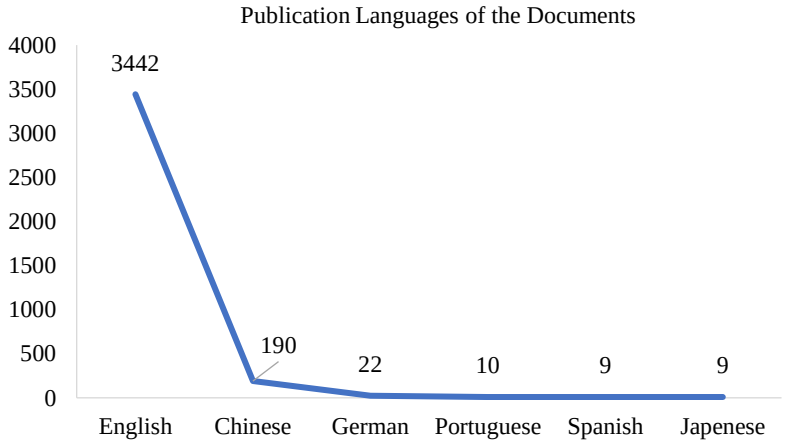


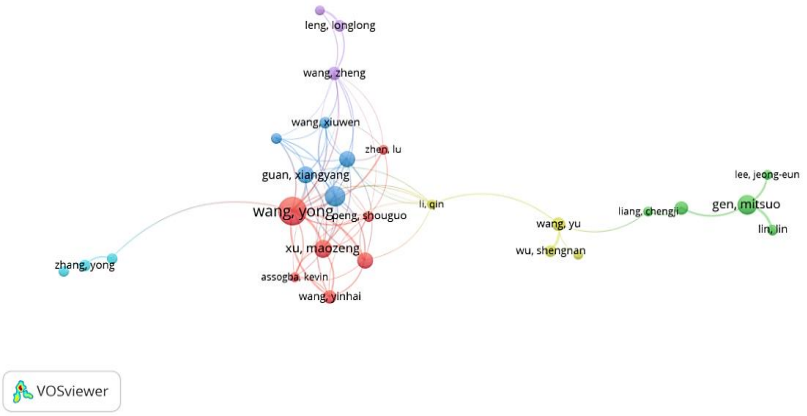
Figure 4 Number of Primary Languages Used for Publishing the Documents

4.2 Co-author analysis

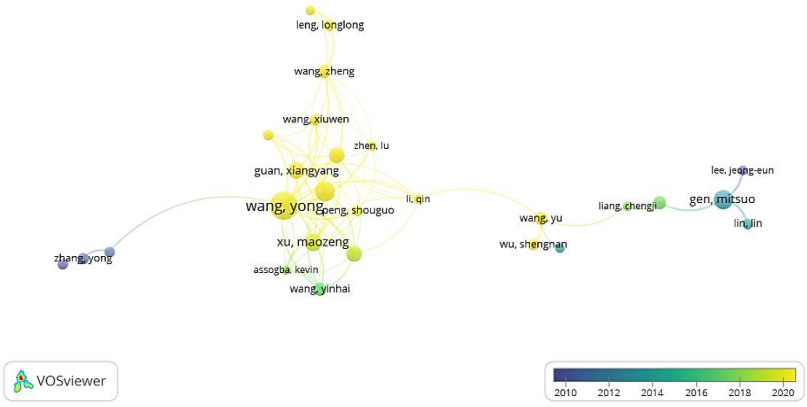
Unit as Author: When conducting the analysis with the unit of analysis as the author, the study used the fractional counting method. This method allocates credit across contributions proportionally. For example, if a paper has four authors, each author will receive 1/4 of the credit. Similarly, credit is distributed equally among the associated institutions or countries. This provides a fairer reflection of the individual, keyword, or organizational contribution, and it is particularly useful in studies focusing on analyzing equity in contributions or the actual roles of stakeholders [43]. At the same time, the study excluded articles with numerous authors (up to 15 authors) and set the minimum number of documents per author to 5. This is intended to avoid data distortion in network analysis caused by abnormal increases in link strength and centrality measures, thereby helping maintain the balance of the analysis. While some large-scale studies may be omitted, most are not central to the logistics network domain, so the impact is minimal. A total of 164 authors met the requirements out of the 8,187 authors associated with 3,686 publications.

The analysis results in Figure 5 show that a total of 6 clusters are interconnected, with cooperation among authors represented by 79 links and a total strength of 118.50 across all clusters. The formation of these clusters reflects the prominent relationships among researchers and is based on the average number of years of publications within the network. Specifically, Figure 5a shows strong links, such as those of author groups “Wang, Yong”, “Xu, Maozeng”, and “Liu, Yong”, who are grouped within the same cluster. The results also indicate several prominent researchers within the network, such as “Wang, Yong”, “Xu, Maozeng”, “Liu, Yong”, “Wang, Haizhong”, “Guan, Xiangiang”, and “Gen, Mitsuo”. The study of these author clusters primarily focuses on optimizing logistics networks. Figure 5b shows that the size of the circles represents the weight of the author's links, while the color changes from blue to yellow indicate the average years of publications from the period 2010 - 2020. It is evident that certain recently published documents, such as those by “Wang, Yong”, “Wang, Haizhong”, and “Guan, Xiangiang”, have high author link weights. Additionally, Figure 5c illustrates the density of the yellow circles, representing the clusters with the strongest author links within the network. This shows that

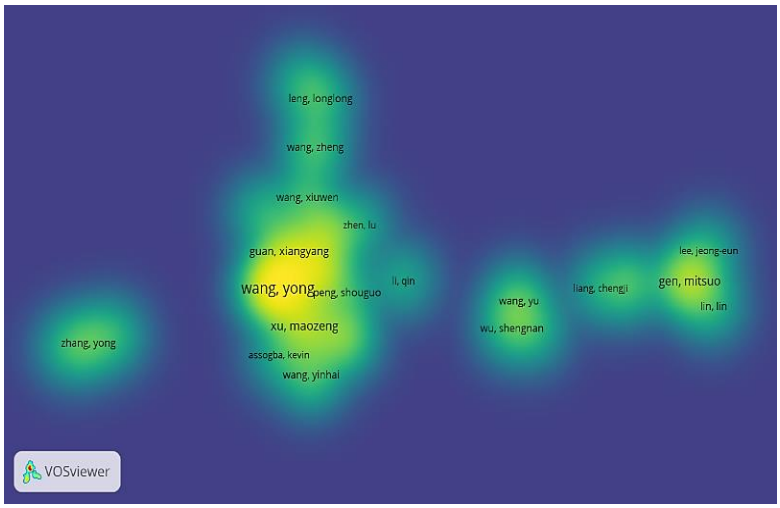
some authors, such as “Wang, Yong”, “Wang, Haizhong”, and “Guan, Xiangiang”, have strong connections in recent years. The visualizations also highlight that the related research fields are undergoing significant development. For example, topics such as optimizing collaborative logistics pickup and delivery problems with eco-friendly packages based on time-space networks; Research on planning multi-tier, multi-depot logistics networks. The results show that LN research is forming strong research groups. The prominence of author groups from China reflects the country's systematic investment in logistics R&D, along with close collaboration between universities and businesses. However, some clusters remain regional, not fully tapping into the potential for intercontinental connectivity, this presents opportunities to promote cross-border LN projects.



(a) Visualization of networks grounded in the weighted attributes of documents.



(b) An overlay visualization that incorporates both document weights and the mean year of publication, constrained by a lower threshold of 2010 and an upper threshold of 2020.



(c) Density visualization illustrating 6 clusters, 79 links and total strength of 118.50.

Figure 5 Network Representing Authors' Collaboration

Table 1 Listing top 10 contributing authors, affiliating institutions, sources titles and keywords

Authors	F	Affiliations	F	Sources	F	Keyword	F
Wang, Y.	39	Beijing Jiaotong University	87	Journal of Cleaner Production	65	Logistics	1363
Wang, H.	21	Southwest Jiaotong University	80	Computers and Industrial Engineering	61	Logistics Network	1002
Gen, M.	20	Southeast University	58	Sustainability Switzerland	56	Optimization	488
Ballot, E.	19	Shanghai Maritime University	52	Transportation Research Part E Logistics and Transportation Review	45	Supply Chains	469
Tavakkoli-Moghaddam, R.	18	Universität Bremen	51	International Journal of Production Economics	37	Reverse Logistics	443
Shimizu, Y.	18	University of Tehran	48	Expert Systems with Applications	36	Integer Programming	415
Xu, M.	17	Chongqing Jiaotong University	39	International Journal of Production Research	35	Genetic Algorithms	305
Ignaciuk, P.	17	Central South University	38	Jisuanji Jicheng Zhizao Xitong Computer Integrated Manufacturing Systems CIMS	33	Decision Making	298
Manzini, R.	16	Shanghai Jiao Tong University	38	ACM International Conference Proceeding Series	33	Supply Chain Management	293
Zhang, J.	15	Chongqing University	37	European Journal of Operational Research	32	Transportation	285

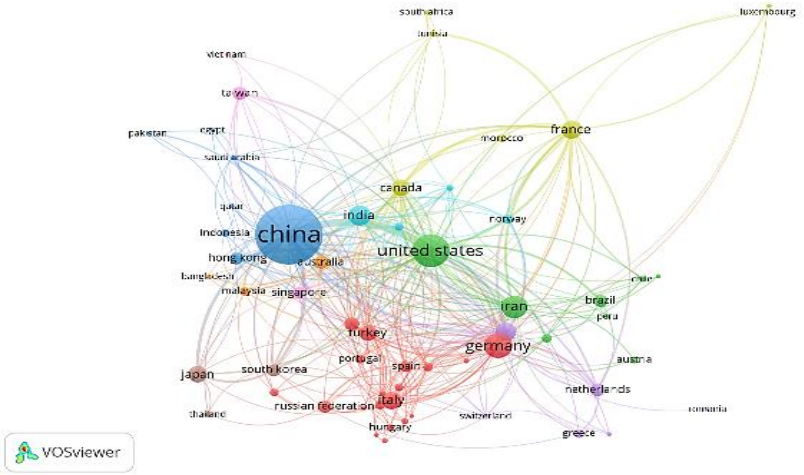
Note: F = Frequency

The summary results (Table 1) indicate that the top 10 authors have made significant contributions to the research field. Notably, “Wang, Yong” has 39 publications; followed by “Wang, Haizhong” with 21 publications, “Gen, Mitsuo” with 20 publications, and “Ballot, Eric” with 19 publications. Regarding affiliating institutions, there are two organizations with a substantial number of research works related to logistics network, specifically “Beijing Jiaotong University (87 publications)” and “Southwest Jiaotong University (80 publications)”. Additionally, in terms of source titles, the most prominent are the journals “Journal of Cleaner Production (65 publications)” and “Computers and Industrial Engineering (61 publications)”. These are the two journals with the highest number of publications related to the topic. This study also highlights that the most frequently used keywords are “logistics (1363 times)” and “logistics network (1002 times)”. The summarized results suggest that these authors, institutions, and source journals have made important contributions to the logistics network field. These findings reflect the significant development of the research area, and future research can refer to and build upon the work of these authors and institutions. Furthermore, the study underscores the importance of keywords such as “logistics” and “logistics network” in in-depth research aimed at addressing the challenges within the logistics industry.

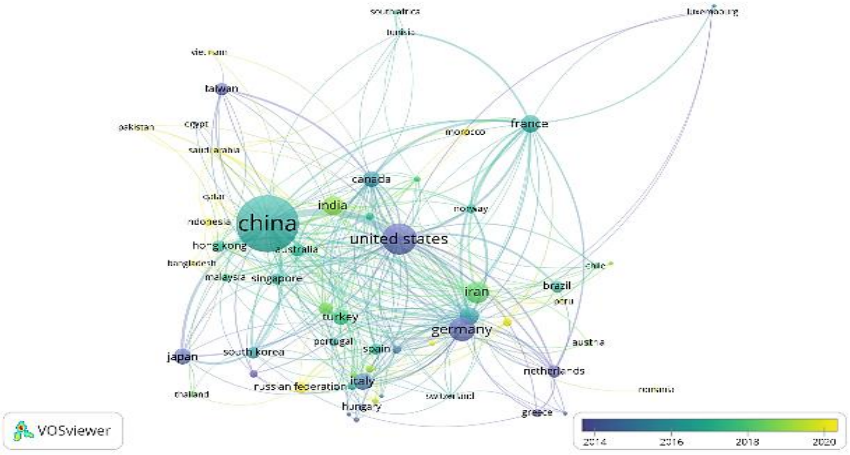
Unit as country: A total of 130 countries from 3,686 publications published on the Scopus database are related to the topic from 1980 to 2024. The study set a minimum threshold of five official documents established for a country. This criterion aims to enhance statistical reliability and clarity in analysis, minimizing noise from countries with minimal output; ensuring collaboration patterns reflect meaningful and consistent research activity, aligned with common bibliometric analysis practices. Thus, 60 countries met this criterion.

Figure 6 shows a total of 9 clusters linked together, representing this collaboration with 346 links, and all clusters generate a total link strength value of 961. The formation of these clusters helps to highlight the collaborative relationships between the countries of the authors, based on the weights of the documents and the average number of publication years of the articles with a minimum threshold. The results from Figure 6a show that the country with the strongest link is “China”. Following this are several other countries with strong connections, such as the “United States”, “United Kingdom”, “Germany”, “Iran”, “India”, and “France”. Additionally, other countries also exhibit certain levels of collaboration, such as “Italy”, “Japan”, “Netherlands”, “Canada”, and many others. In Figure 6b, the circle dimensions indicate the link weight of the countries, while the color shifts ranging from blue to yellow hues, reflecting the mean publication timeframe of the articles in the 2014–2020 period. The results show that publications from the early years (2014–2016, blue) reflect strong connections between countries such as the “United States”, “Germany”, and “Japan”. Over time, as it progresses to later years (2016–2020, yellow), these connections appear to persist but with an increase in the number and diversity of participating countries, such as “China”, “India”, “Iran”, and “Russia”, indicating a gradual expansion of international collaboration patterns.

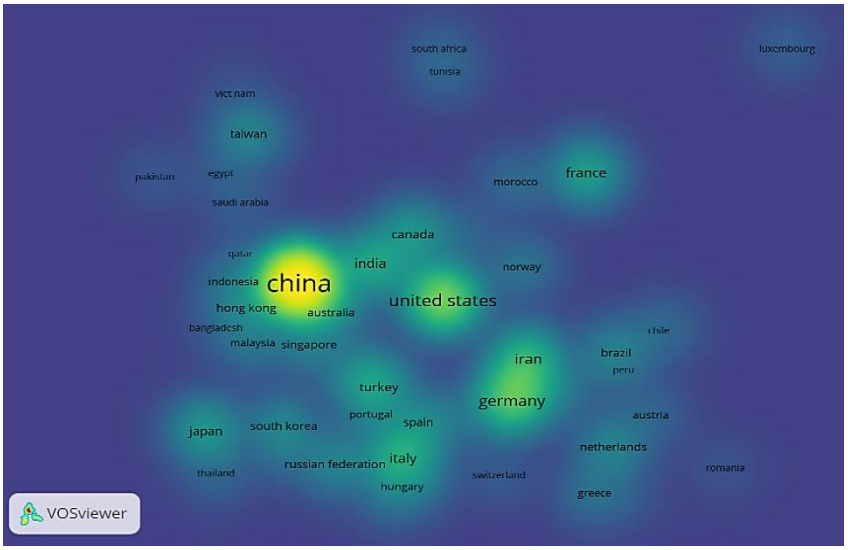
In Figure 6c, the density of the yellow circles illustrates the clusters with the strongest linkages between the analyzed countries within the network. This indicates that certain countries, such as “China”, “United States”, and “Germany”, have close linkages in recent years. The increased contributions from these countries have strengthened inter-country connections and fostered increasingly effective collaboration over time. The analysis results also show that researchers have broken down national boundaries to expand cooperation with other countries. The expanded linkages among authors from various countries enhance the potential for future research contributions and collaboration across the examined research fields. International collaboration results show leadership in publication volume and sustained partnerships, driven by advanced logistics infrastructure and global networks. Emerging economies like India and Iran saw increased collaboration, reflecting a shift in LN research to developing economies, meeting domestic and export market demands.



(a)



(b)



(c)

Figure 6 The network of collaboration between countries

The results summarized in Table 2 also indicate that China is the leading country in contributions to the research (Total Number of Articles is 1,379; Citation is 11,740; Total link strength is 289). The United States ranks second among the top 10 contributing countries (Total Number of Articles is 420; Citation is 12,984; Total link strength is 226). Germany ranks third among these countries (Total Number of Articles is 254; Citation is 4,128; Total link strength is 83). Additionally, other countries have also made significant contributions to the research (details can be found in Table 1). This aggregated result demonstrates that research on "logistics network" is diverse and widespread across many countries worldwide.

Table 2 Top 10 Countries Contributing to Research

Serial Number	Country	Total Number of Articles	Citations	Total Link Strength
1	China	1,379	11,740	289
2	United State	420	12,984	226
3	Germany	254	4,128	83
4	Iran	191	7,532	76
5	India	156	3,558	69
6	France	129	3,905	93
7	United Kingdom	126	3,623	120
8	Italy	123	1,969	34
9	Japan	110	1,052	34
10	Canada	109	3,783	87

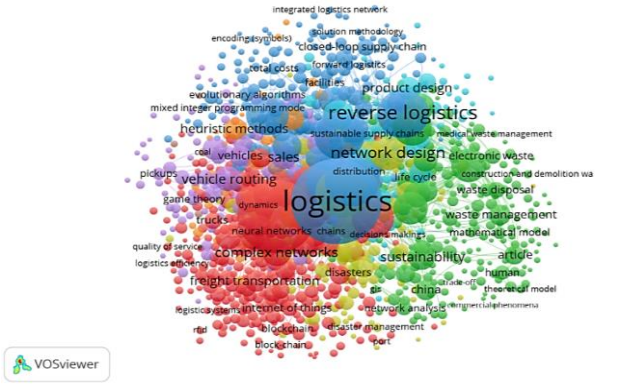
Source: Compilation by the author from Scopus data

4.3 Keyword co-occurrence analysis

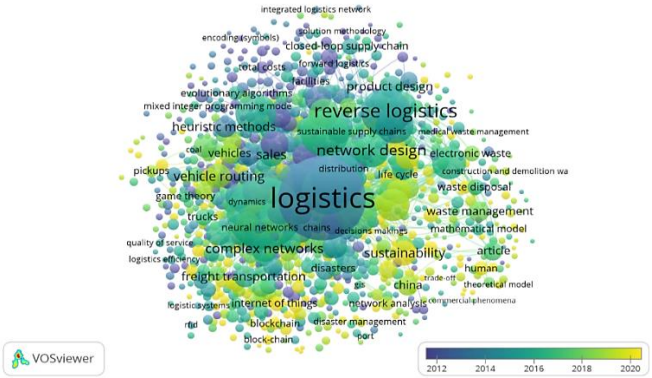
From the 3,686 documents collected from Scopus data, a total of 1,140 keywords were identified under the condition of setting a baseline frequency requirement of 5 for each keyword. The results of the keyword analysis revealed that the keywords were grouped into 8 clusters, with a total of 66,519 links and a total link strength of 143,184.

In Figure 7, the frequency of keyword occurrences is represented by circles of different sizes. Larger circles indicate that the corresponding keywords are used more frequently in the documents. The visual results in Figure 7a show that keywords represented by blue circles (e.g., the term “Logistics”) and red circles (e.g., the term “logistics network”) have the highest link strength among all items and are associated with other fields such as “Optimization”, “Transportation”, and “Supply chain”. This illustrates the co-occurrence of related keywords appearing simultaneously in research studies. Figure 7b represents the weights of the keywords and their average citation scores. The lowest average citation scores are indicated by dark blue, while the highest are shown in yellow. Interestingly, the results indicate that keywords such as “Logistics” and “Logistics network”, despite having strong link weights and high frequency of occurrence, have low average citation scores. Conversely, keywords such as “Sustainability”, “Circular economy”, and “Operating cost” have lower frequency but very high average citation scores. A possible reason is that frequently occurring keywords often represent broad concepts, leading to dispersed citations and lower average citation counts. In contrast, less common but specialized and emerging keywords tend to attract more focused attention, are regarded as pioneering contributions, and therefore are more likely to achieve higher citation counts. From the analysis, it can be concluded that having a high frequency of keyword occurrences does not necessarily lead to high average citation scores, and the opposite is also true.

In addition, Figure 8 highlights the most frequently cited keywords related to the topic. Keywords such as “logistics”, “logistics network”, and “optimization” have the highest frequency of occurrence. This demonstrates the similarities identified through analysis using VOSviewer software while also providing a visual representation of the most frequently occurring keywords.



(a)



(b)

Figure 7 Visualization of Keyword Co-occurrence

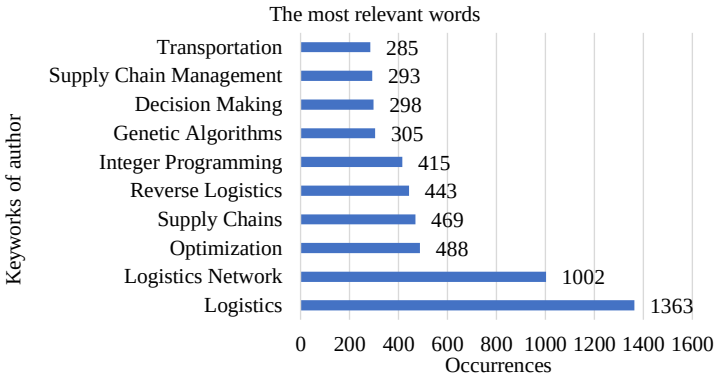


Figure 8 Graphical illustration of the most frequently referenced keywords

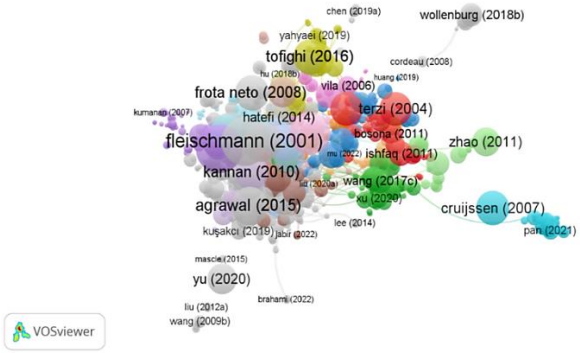
4.4 Analysis of citations

A citation is understood as a connection between two items, in which one item refers to the other. VOSviewer considers these citation connections as undirected. Consequently, a differentiation is not established between the scenario in which item A pertains to item B and the situation where item B pertains to item A [44].

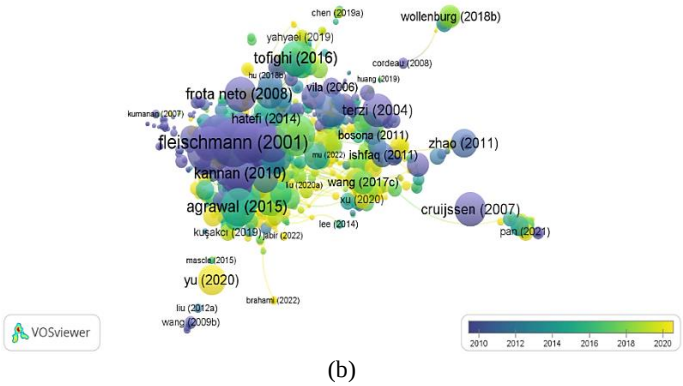
The minimum standard for citations from 3,686 documents was set at 5, resulting in 1,602 documents meeting this standard. However, the study excluded 103 documents with no links. Therefore, after removing the non-compliant documents, 1,499 documents remained eligible for analysis.

The visualization results from Figure 9 show that documents located closer to each other have stronger relationships. Specifically, Figure 9a features circles in various colors representing different documents, with the size of these circles reflecting the number of citations each document has; the larger the circle, the higher the number of citations. For instance, "Fleischmann (2001)" has 680 citations and is represented by a light brown color; "Fleischmann (2000)" has 649 citations and is represented by a purple color; and "Govindan (2017)" has 511 citations and is represented by a light pink color. The visualization in Figure 9b, on the other hand, displays the weights and average citation scores of the documents using colors ranging from blue (low average citations) to yellow (high average citations). The results indicate that while documents such as "Wang (2020a)", "Abbasi (2023)", and "Gao (2020)" have low citation counts, they exhibit very high average citation scores. Conversely, "Fleischmann (2001)" and "Fleischmann (2000)" have high citation counts but low average citation scores. This discrepancy could be attributed to the publication years of these documents.

Co-citation analysis: Co-citation map analysis is a scientific method used to evaluate the relationships between documents based on their co-citation frequency. This method is employed to identify and analyze the connections between documents that are cited together by other works [44, 45]. The study uses sources as the unit of analysis to evaluate the necessary parameters. The circles represent the sources, while the lines indicate the co-citation links between them. Furthermore, the dimensions of the circles signify the weights of citations.

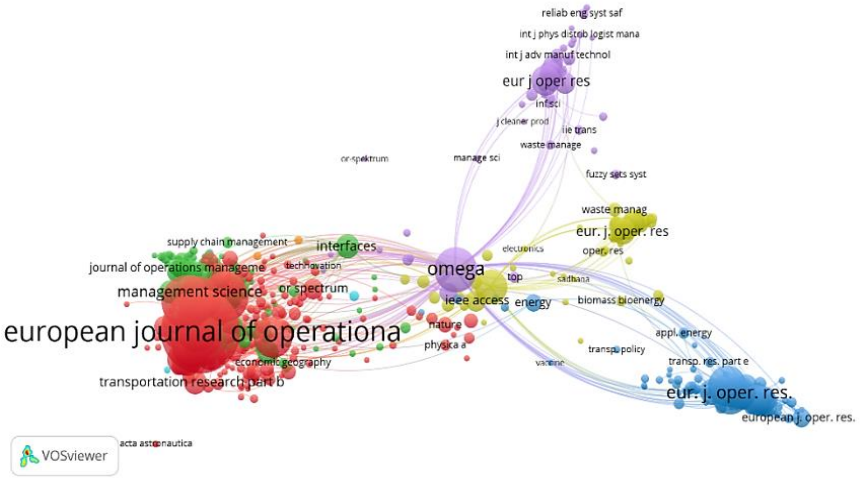


(a)

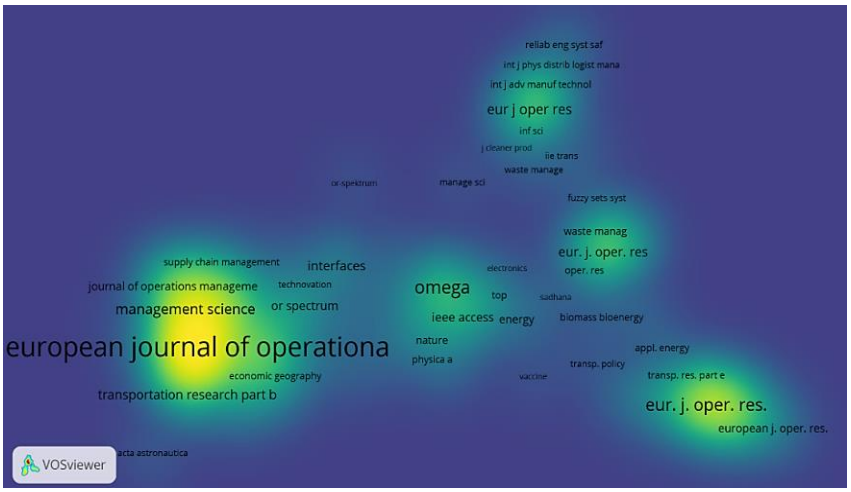


(b)

Figure 9 Visual Citation Analysis Illustration



(a)



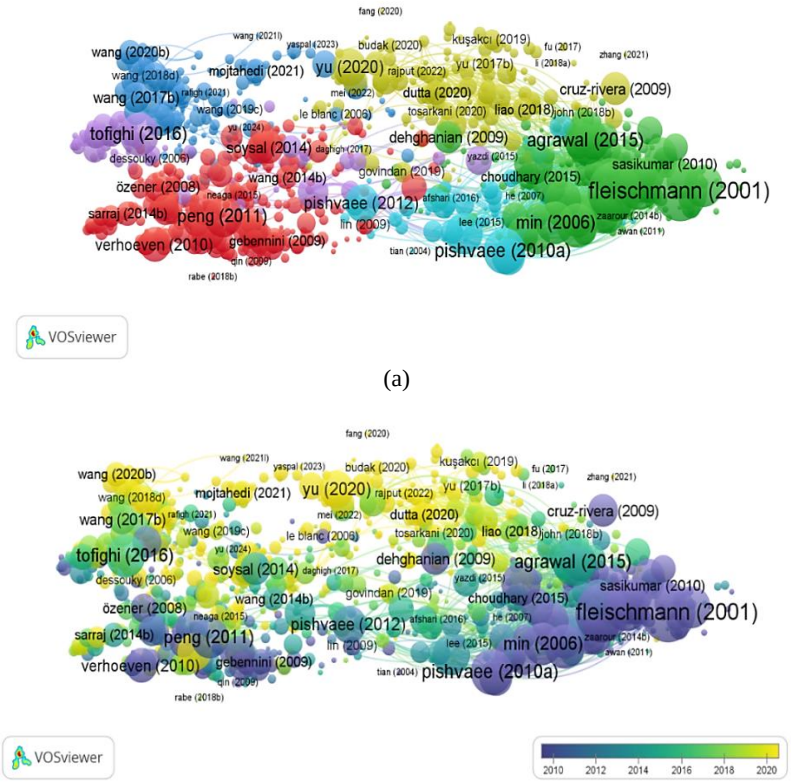
(b)

Figure 10 Co-citation analysis utilizing the source as the analytical unit

The results from Figure 10a show that the "European Journal of Operational Research" (red cluster) has the highest number of citations (3,634 citations) and forms a cluster with co-cited sources such as the "International Journal of Production Economics", "Journal of Cleaner Production", and "Transportation Research, Part E: Logistics and Transportation Review". The purple cluster has a relatively high number of citations and strong interconnections, including sources like "Omega", "European Journal of Operational Research", and "Journal of Cleaner Production". Additionally, there are yellow, blue, and green clusters with lower citation counts and weaker connections. Lower citation strength reflects the limited publication volume of these journals related to the research topic. However, they remain important for mapping as they are significant reference sources on this subject. Furthermore, Figure 10b provides further clarity on the cited sources through the yellow clusters, identifying the "European Journal of Operational Research", "Management Science", and "International Journal of Production Economics" as the most frequently cited sources.

4.5 Bibliographic coupling analysis

Bibliographic coupling analysis is a method used to determine the relationship between publications based on shared references [46, 47]. The clustering of documents was performed using the modularity-based algorithm of VOSviewer, which optimizes the grouping of publications by maximizing the connection strength within clusters and minimizing inter-cluster connections. This approach allows for the clear identification of core research groups while preserving the broader structure of the document network. Additionally, the topic selected a minimum number of documents per author as 5. Figure 11 illustrates the connection between authors through shared references who cite common sources, determined by citation links. Specifically, Figure 11a shows that "Shaparvari (2018)" is represented in green and is connected to "Agrawal (2015)" and "Aras (2010)". Meanwhile, "Zhang (2022c)" is represented in yellow and is linked to "Tosakani (2020)" and "Liao (2018)". Additionally, there is a connection between "Pishvaee (2010a)", represented in light blue, and "Keyvanshokooh (2013)" and "Darastani (2019)". Figure 11b represents the average citation score using a color scale ranging from blue to yellow, where blue indicates a low average citation score and yellow indicates the highest average citation score. The observed results reveal that documents such as "Yu (2020)", "Wang (2020a)", "Wang (2020b)", and "Yadav (2022)" have the highest number of citations. The results show that strongly connected research clusters often revolve around authors sharing theoretical frameworks and LN optimization methods. Tight research linkages indicate the field is in a phase of knowledge convergence, poised for interdisciplinary research advancements.



(a)

(b)

Figure 11 Bibliographic Coupling Analysis (Unit of Analysis: Documents)

5. Discussion and conclusion

By employing bibliometric tools to map the intellectual structure, topic trends, and important contributors of logistics networks, this study contributes to the field's understanding. Using Microsoft Excel and VOSviewer, analyses were performed on 3,686 Scopus-indexed papers that were retrieved using the keyword “Logistics network”. These analyses covered co-authorship, keyword co-occurrence, citation patterns, and bibliographic coupling.

Because of their sophisticated logistics infrastructure, substantial research funding, and active involvement in international trade networks, China, the US, and Germany were found to have the strongest collaborative links. This finding aligns with the findings of Wang et al. [22] and Coşkun and Kazan [23], who highlighted these nations' leading roles in international collaboration and logistics innovation. Despite their high frequency, “Logistics” and “Logistics network” have comparatively low average citation scores, according to the keyword analysis. According to this trend, even if these subjects are essential to the field, their wide reach restricts the breadth of their scholarly influence. Habibullah and Pudjianto [20] have pointed out this problem, arguing that in order to increase research influence, one must concentrate on more specialized issues. On the other hand, the less used terms “Circular economy” and “Sustainability” showed greater citation scores, suggesting that academics are becoming more interested in sustainable logistics techniques. By contrasting these results with other research, this study not only validates existing knowledge but also identifies uncharted territory, offering a clear path forward for further logistics network governance research.

By highlighting significant writers, organizations, and topic clusters, these findings lay the groundwork for future studies and point researchers in the direction of uncharted territory. The report emphasizes how crucial it is to promote global cooperation and increase research on new areas of logistics network administration. A three-stage collaboration model is suggested in order to put these collaboration-related concerns into effect. Step 1 (Network Mapping): Use bibliometric mapping to find important organizations, research teams, and theme overlaps in order to create possible collaborations. Stage 2 (Structured Engagement): To promote continuous communication, create official partnership agreements, cooperative research agendas, and shared data platforms. Stage 3 (Co-creation and Dissemination): To optimize research impact and policy relevance, carry out multi-institutional projects, co-author papers, and host collaborative workshops or policy forums. In order to improve research capacity and speed up knowledge transfer in the area of logistics network governance, this strategy seeks to promote consistent, goal-oriented collaboration.

Both theory and practice benefit greatly from this research. Theoretically, by using a bibliometric technique that methodically maps the field's intellectual structure, thematic evolution, and emerging trends, it enhances the corpus of knowledge on logistics network governance. By combining descriptive statistical techniques with VOSviewer-based network analysis, the study provides a thorough understanding of research progress, highlighting important writers, organizations, and nations influencing the conversation. Practically speaking, it highlights critical areas for cooperation, investment, and policy intervention, offering policymakers, logistics professionals, and industry stakeholders, particularly in the agricultural goods sector, actionable insights. By obtaining and synthesizing bibliometric data, presenting the results in a methodical and clear manner, and highlighting the need for more thorough investigation of this field, the study also advances future research. Additionally, it provides a useful reference and methodological framework for further research in adjacent businesses as well as inside logistics networks. Based on the analysis results, future studies could focus on topics such as: linking logistics network governance with sustainability and the circular economy; clusters connecting governance with resilience and risk management; cross-border and regional collaboration; or keywords related to digitization, blockchain, and big data analytics.

However, although the study has evaluated many aspects of the issue, there are still certain limitations. First, the dataset utilized for examination was extracted from Scopus, so many relevant studies on logistics networks worldwide have not been considered or included in the analysis. Second, the number of citations of the analyzed documents, which were selected based on a large number of citations, may not fully reflect the quality of each individual study. Third, because VOSviewer is reliable at processing large datasets and generating high-quality network maps, it was used in this study to perform bibliometric mapping and visualization. Future research might think about incorporating other tools like CiteSpace or Gephi to offer supplementary viewpoints and validate the findings from VOSviewer. Since the focus of this study was on large-scale network mapping rather than qualitative content analysis, a thorough manual content review of the most referenced publications was not conducted. To provide deeper contextual insights, future research could integrate content analysis and bibliometric mapping.

6. Acknowledgements

This topic is part of the author's doctoral dissertation. Therefore, the author would like to express gratitude to Nam Can Tho University, where the author is currently employed. Additionally, the author extends thanks to the Malaysia University of Science and Technology, where the author is pursuing a PhD program.

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