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Research Hotspot and Frontier Analysis of Supply Interruption Based on WOS Core Database and Citespace

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Abstract

The performance of supply chain members is largely negatively affected by the risk of supply disruptions. In recent years, the potential risk of supply disruption caused by global emergencies has increased dramatically, and the issue of supply disruption has gradually become the focus of scholars, especially in terms of how to reduce risks and formulate emergency strategies. This article provides an in-depth exploration of the field of supply disruption through a comprehensive bibliometric review and visualization of 643 publications in the WOS core database. In addition, time distribution, influential authors, organizations, and core journals are analyzed in detail based on the CiteSpace visualization tool. Through core author analysis, literature co-citation, keyword clustering and highlighting, key research topics and future development trends in the field of supply disruption were determined. This paper combines bibliometric methods with system totals to provide researchers and practitioners in the field of supply disruption with important clues to capture current research hotspots and potential research directions.

Keywords: Supply interruption, knowledge map, visualization, CiteSpace, research hotspots.

1. Introduction

The persistent issue of supply disruptions has roots that predate the very concept of Supply Chain Management (SCM)[1]. As economic globalization has progressed, fostering closer commercial ties among nations, enterprises have increasingly embraced highly specialized operations and lean manufacturing practices. This shift towards outsourcing resources has, in turn, resulted in a rise in complexity and uncertainty within global supply chains. The alarming frequency of supply disruptions, whether direct or indirect, poses a significant threat to both social stability and security, further highlighting the inherent fragility of supply chains. Notably, data from the Global Supply Chain Disruption Event Watch AI platform reveals a substantial increase in supply disruption events, with a staggering 7,929 occurrences recorded in the first half of 2022 alone, marking a notable 46% year-on-year escalation. These disruptions have far-reaching repercussions, casting a shadow over the financial and operational performance of the entire supply chain. For example, the outbreak of the COVID-19 pandemic towards the end of 2019 disrupted the global flow of personnel and goods, causing significant delivery delays and shortages of essential products. Simultaneously, the abrupt surge in demand for specific goods crucial for pandemic control has added a layer of complexity to forecasting demand for various consumer goods, presenting a formidable challenge. In 2020, according to *Fortune*'s statistics, a substantial 94% of the top 1,000 companies were significantly impacted by disruptions in raw material supplies and production. Notably, the Volkswagen Group bore the brunt of the COVID-19 outbreak, particularly grappling with disruptions in chip supplies essential for Electronic Stability Programs (ESP) and Electronic Control Units (ECU)[2].

Kleindorfer posited that natural disasters, operational mismanagement in businesses, as well as social, political, and economic instability, are all factors that can lead to supply disruption events[3]. Whether stemming from natural disasters such as earthquakes and tsunamis, man-made threats like fires, strikes, and terrorism, or severe legal disruptions such as environmental regulations[4], supply disruptions have the potential to set in motion structural dynamics and chain reactions within the supply chain. The occurrence of supply disruption events not only affects a wide scope and exhibits high transmissibility, but also introduces complexity, making it challenging to control and significantly increasing the difficulty of supply chain recovery. In the event of a supply disruption, multi-party coordination is essential for effective governance. Nevertheless, there remains a notable scarcity of research elucidating the scientific principles governing activities in the realm of supply disruptions. Consequently, conducting a systematic quantitative analysis of the academic achievements in the field of "supply disruptions" holds crucial importance as a scholarly reference.

The scientific management of supply disruptions is a crucial issue. To unravel the evolution and research trends surrounding supply disruptions, this study employs visual knowledge mapping for analysis. Knowledge mapping, utilizing visualization techniques, aims to discover, describe, analyze, and ultimately showcase the interrelations between data or text. By effectively organizing, storing, managing, and updating large-scale knowledge, it enables efficient reasoning, computations, and problem-solving[5]. CiteSpace, built on Java programming, represents a tool for showcasing data visualization and constructing knowledge maps[6]. Therefore, this study utilizes the CiteSpace software to conduct a systematic knowledge structure and distribution analysis of literature related to the theme of "supply disruptions" in the Web of Science core database. The exploration delves into the current state of research in the field of supply disruptions, encompassing publication timelines, output volume, core journals, and co-occurrence networks. By thoroughly outlining the research status in the field of supply disruptions as documented in the Web of Science core database from 1985 to 2022, this study aims to unearth development trends, hotspots of interest, and potential research opportunities. It seeks to identify which areas within the field of supply disruptions remain vacant and require scholars to fill in the gaps.

2. Research Methods and Data Sources

2.1 Data sources

To ensure the reliability and authority of data acquisition, the Web of Science core database was selected as the data source. Literature retrieval was conducted using advanced search settings with the following specifications: Topic: "TS=('supply disruption*' OR 'supply interruption*' OR 'supply disruption risk*')", Language: "English", Document Type: "Article, Review", Time Span: "All Years". Following the search, a total of 644 records were obtained. After filtering and cleaning the raw data, 643 valid data points remained. The full records and referenced bibliography were exported in plain text format. Subsequently, after further processing and cleaning by CiteSpace, 632 data points were established as the foundational data for bibliometric research. The data retrieval was conducted on February 14, 2023.

2.2 Research methods

CiteSpace, developed by the research team led by Chen Chaomei in the United States, is an effective information visualization software for creating scientific knowledge maps. It vividly presents core authors, institutions, types of journals, the evolution of keywords, citing literature nodes, and more within a certain knowledge domain. As such, it has become one of the prominent tools in academia for studying hot topics or trends[7]. In this study, CiteSpace software was employed to analyze the existing literature on supply disruptions included in the Web of Science core database from multiple perspectives. This analysis aims to delineate the current research status, trace the evolution of knowledge, focus on key research points, and unveil future development trends in the field of supply disruptions.

3. Current Research Status in the Field of Supply Disruptions

3.1 Temporal distribution characteristics

Based on the citation reports generated from the literature retrieved from the Web of Science core database concerning “supply disruptions”, it was found that although the initial search in the database began in 1985, the actual research on supply disruptions commenced in 2009, marking a relatively late onset. From the data illustrated in Figure 1, it is evident that the annual publication of papers ranged from approximately 30 to 70, indicating a modest volume of publications. However, there is an overall upward trend in the volume of publications, reaching its peak in 2021 with 97 papers. The citation frequency and publication trends demonstrate a consistent alignment. It can be inferred that the global financial crisis of 2008, leading to crises in food and natural gas supplies, prompted scholars to focus on supply disruption events. Additionally, the outbreak of the COVID-19 towards the end of 2019 and the beginning of 2020 not only resulted in shortages of medical resources but also triggered supply disruption crises across various industries and countries, garnering widespread attention. Moreover, Figure 1 reveals a significant increase in citation numbers in 2011 and 2012, likely attributed to certain disruption events that caught the attention of scholars. For instance, the global automotive industry supply chain was halted for several months following the 2011 Japan earthquake and tsunami. Similarly, the floods in Thailand in the same year caused disruptions in the supply of electronic products and automotive components.

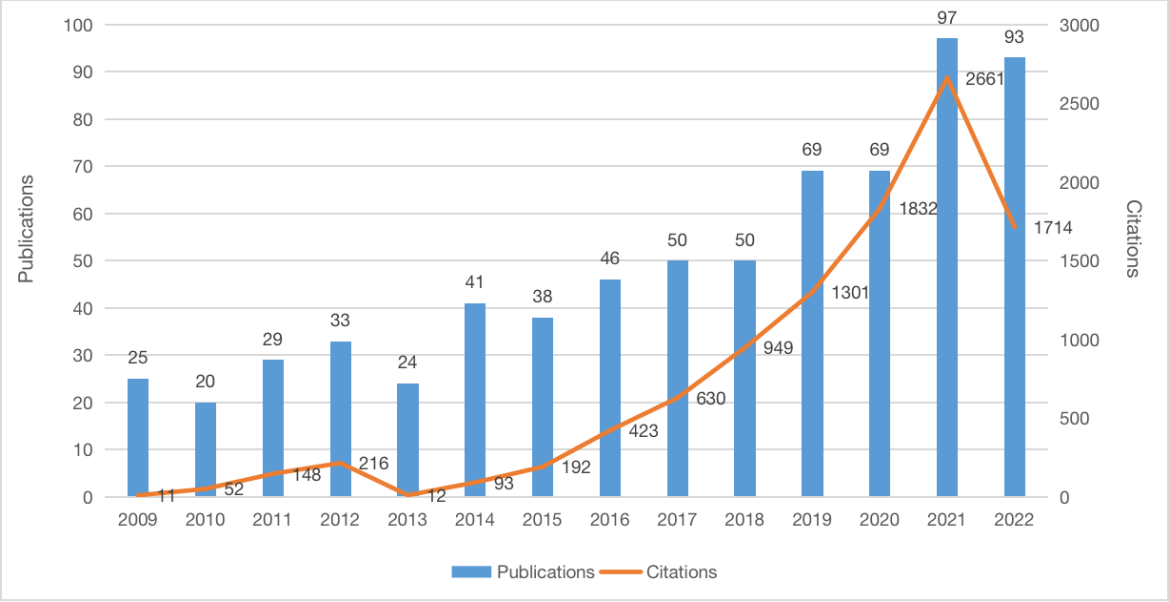

Figure 1 Number of papers published and citation frequency per year

3.2 Co-authorship network analysis

The co-authorship network showcases the contributions of researchers in the field of supply disruptions and their collaborative relationships[8]. By generating the co-authorship knowledge map in CiteSpace (refer to Figure 2), a total of 68 nodes and 46 links were identified, with a network density of 0.0202. Analysis of Figure 2 reveals that the top three authors with the highest publication volumes are ZHAO L., LI J., and LI S., each having contributed 7 papers in the field of supply disruptions. An examination of the scholars’ works highlights unique insights from ZHAO L. and others on procurement strategies, risk management, and product distribution coordination under the threat of supply disruptions. LI J. and colleagues focused primarily on energy supply disruptions and recovery strategies during the period of 2019-2020, producing 5 articles in just two years, particularly addressing issues such as power supply and clean energy. During the period of 2019-2022, LI S.’s research centered on risk identification and reliability assessments in the context of supply disruptions. Additionally, HOU J. et al. primarily investigated contract signing under supply disruption scenarios, and the maintenance of relationships with alternative suppliers. SNYDER L. delved into the impact of supply disruptions on supply chain design, while CHEN Y. and others initially concentrated on the effects of disruptions at specific nodes on the entire supply chain. Post the outbreak of the COVID-19 pandemic, their focus shifted to procurement and pricing strategies. Furthermore, Figure 2 illustrates that these authors occupy

crucial positions within the network, with a deep degree of interdisciplinary research collaboration, indicative of their collective emphasis on key research issues in the field of supply disruptions.

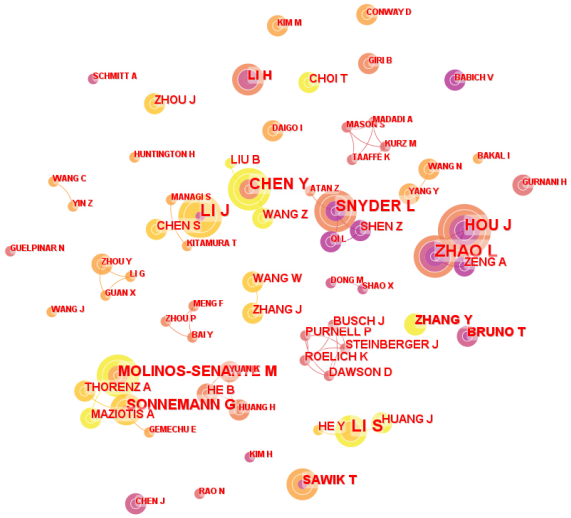

Figure 2 Co-authorship knowledge mapping

3.3 Core journal analysis

Table 1 displays the top 10 SCI and SSCI journals in the WOS core database that have literature on the theme of "supply disruptions", collectively constituting 27.3% of the total data. The journal with the lowest impact factor among these publications stands at 3.252. Notably, the International Journal of Production Research boasts a substantial impact factor of 9.018, reflecting both the authoritative nature of this journal and the current trends within the field, solidifying its position as a leading academic journal in the domain of "supply disruptions". The academic journals cover various research categories such as computer science, industrial engineering, operations research, sustainability, and financial economics. This diversity indicates a fruitful exchange and integration of papers related to supply disruptions with other fields, showcasing a rich interdisciplinary dialogue within these journals. The varied nature of these journals confirms the interdisciplinary nature of supply disruption events, highlighting their broad impact and inherent complexity that is challenging to control. These characteristics not only expand scholars' research horizons but also deepen the complexity of research endeavors in this area.

Table 1 Top 10 core journals with relevant literature

Ranking	Name of journals	Impact factors	Number	Proportion
1	Energy Pulicy	7.576	37	5.75%
2	International Journal of Production Research	9.018	24	3.73%
3	International Journal of Production Economics	4.407	19	2.95%
4	Computers & Industrial Engineering	7.18	18	2.80%
5	Omega-The International Journal of Management Science	8.673	15	2.33%
6	Applied Energy	5.261	14	2.17%
7	European Journal of Operational Research	6.363	13	2.02%
8	Sustainability	3.889	13	2.02%
9	Energies	3.252	12	1.86%
10	Journal of Cleaner Production	7.051	11	1.71%

3.4 Analysis of key research forces

Utilizing the analytical search function of the WOS database, a scrutiny of the primary research forces in the field of supply disruptions was conducted based on countries/regions, academic institutions, and funding agencies. As depicted in Table 2, the United States and China emerge as the primary sources of literature in this domain, cumulatively amounting to 360 articles, representing a significant 55.9% of the total. Recent

occurrences such as the economic trade wars and the global outbreak of the COVID-19 pandemic have profoundly impacted supply chain stability, thereby drawing the attention of scholars from both nations to the issue of supply disruptions. When examining academic institutions, the University of California, USA, leads in terms of publication volume, followed closely by Southeast University (China), Shanghai JiaoTong University, the Indian Institute of Technology, and the UDICE French research universities, among others. Notably, a majority of the prolific academic institutions are concentrated in economically advanced regions, indicating that research in underdeveloped areas concerning this subject is still in its nascent stages. In scrutinizing funding agencies, it is observed that the primary sources of funding originate from China, the United States, the United Kingdom, the European Union, and Japan. These funding bodies offer robust support to countries/regions and scholars engaged in research within relevant domains, thereby fostering a conducive research environment for advancement.

Table 2 Distribution of top 10 research forces by publication volume

Items	Sources
Countries/regions	USA (192);PEOPLESRCHINA(168);ENGLAND(54);GERMANY(38);CANADA(26);INDIA(26);AUSTRALIA(25);JAPAN(24);NETHERLANDS(23);SPAIN(22)
Academic institution	UNIVERSITY OF CALIFORNIA SYSTEM[USA](17); SOUTHEAST UNIVERSITY CHINA[China](13); INDIANINSTITUTE OF TECHNOLOGY SYSTEMIIT SYSTEM[India](12); SHANGHAI JIAO TONG UNIVERSITY[China](12); UDICE FRENCH RESEARCH UNIVERSITIES[France](12); UNITED STATES DEPARTMENT OF ENERGY DOE[USA](11); UNIVERSITYOF LONDON[UK](11); UNIVERSITY OF MICHIGAN[USA](11); UNIVERSITY OF MICHIGAN SYSTEM[USA](11); CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIOUE CNRS[France](10)
Funding agencies	National Natural Science Foundation Of China Nsfc(China)(114); National Science Foundation Nsf(USA)(28); Fundamental Research Funds For The Central(China)(24); Universities Uk Research Innovation Ukri (UK)(18);European Commission(EU)(13); United States Department Of Health Human Services(USA)(9);Engineering Physical Sciences Research Council Epsrc(UK)(8); United States Department Of Energy Doe (USA)(8); Ministry Of Education Culture Sports Science And Technology Japan Mext(Japan)(7); National Institutes Of Health Nih Usa(USA)(7)

4. Research Hotspots in the Field of Supply Disruptions

4.1 Analysis of core authors and their research content

Highly prolific authors are those who have contributed a substantial number of publications in a particular research field, yet this does not inherently signify their academic influence or value. Conversely, highly cited authors are typically regarded as a crucial indicator of significant impact within a research domain[9]. Employing CiteSpace to generate a knowledge mapping of authors cited in this field, As shown in Figure 3. the core authors (high contributors) and their research content were meticulously analyzed. The data of the top 10 most cited scholars are outlined in Table 3.

Table 3 Top 10 authors by citation count

Ranking	Authors	Citations
1	TOMLIN B	145
2	SNYDER LV	84
3	PARLAR M	55
4	CHOPRA S	42
5	SCHMITT AJ	37
6	IVANOV D	36
7	TANG CS	35
8	BABICH V	25
9	YANG ZB	22
10	HENDRICKS KB	18

Tomlin stands out with the highest citation count. In his work *On the Value of Mitigation and Contingency Strategies for Managing Supply Chain Disruption Risks* published in 2006, he initially posited that procurement to alleviate supply chain disruptions is more favorable than inventory buffering. His research indicates that a hybrid mitigation strategy (purchasing from reliable suppliers and holding inventory if the capacity of unreliable suppliers is limited or if the company is risk-averse) might be optimal[10]. Snyder, cited 84 times, primarily reviews Operations Research/Management Science (OR/MS) literature on supply chain disruptions in his work *OR/MS models for supply chain disruptions: a review*. The academic works on this subject are categorized into six classes: assessing supply disruptions, strategic decisions, procurement decisions, contracts and incentives, inventory, and facility location[11]. Ivanov's publication *The impact of digital technology and Industry 4.0 on the ripple effect and supply chain risk analytics* delves into the influence of digitalization and Industry 4.0 on the analysis of ripple effects and supply chain risk control. This research framework amalgamates outcomes from two distinct domains - the impact of digitalization on supply chain management and the impact of supply chain management on controlling ripple effects[12]. These articles represent highly cited works by the authors, simultaneously serving as pivotal contributions to the field of supply disruptions. They systematically present the foundational framework and research directions within this domain.

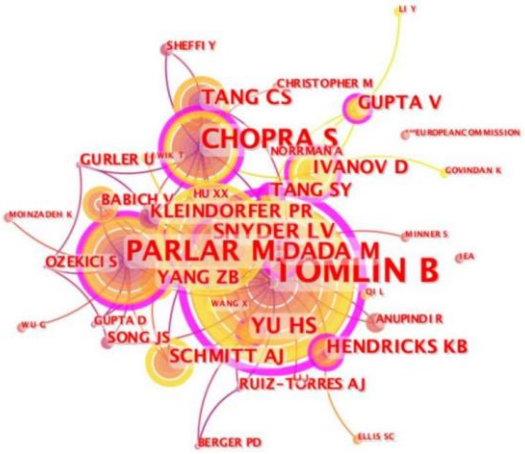

Figure 3 Knowledge mapping of co-cited authors

4.2 Analysis of highly co-cited literature

The analysis of co-cited literature primarily focuses on references with high citation counts, playing a crucial role in uncovering the developmental trajectories within a specific field. Delving into co-cited literature aids scholars interested in the domain to unearth potential research opportunities. Within CiteSpace, selecting the node type as "Reference", the top 10 co-cited publications by citation frequency were categorized based on research content, as depicted in Table 4.

Table 4 Information on highly co-cited literature

Ranking	Citation frequency	Titles	The first authors	Years
1	43	OR/MS models for supply chain disruptions: a review	SNYDER LV	2016
2	17	Simulation-based ripple effect modelling in the supply chain	IVANOV D	2017
3	11	On the Value of Mitigation and Contingency Strategies for Managing Supply Chain Disruption Risks	TOMLIN B	2006
4	11	Infinite-horizon models for inventory control under yield uncertainty and disruptions	SCHMITT AJ	2012
5	11	Contingent sourcing under supply disruption and competition	GUPTA V	2015
6	10	Managing Risk of Supply Disruptions: Incentives for Capacity Restoration	HU XX	2013
7	9	Optimal newsvendor policies for dual-sourcing supply chains: A disruption risk management framework	XANTHOPOULOS A	2012
8	9	Competition and cooperation in a single-retailer two-supplier supply chain with supply disruption	LI J	2010

9	8	Supply Disruptions, Asymmetric Information, and a Backup Production Option	YANG ZB	2009
10	8	A newsvendor's procurement problem when suppliers are unreliable	DADA M	2007

Exploration of the aftermath of supply disruptions has centered on procurement decisions and inventory management, specifically focusing on dual sourcing, backup suppliers, and contractual agreements to coordinate supplies. Snyder undertook a comprehensive review of 180 articles in the field of supply disruptions, categorizing research points into six distinct classes[13]. Ivanov's study illuminated that the ripple effects in the supply chain stem from the propagation of disruptions from initial points to supply, production, and distribution networks. Through literature analysis and modeling examples, valuable managerial insights for ripple effect analysis applied to supply chains were identified[14]. Tomlin, in 2006, advocated the use of a dual sourcing procurement strategy, emphasizing that procuring partially from reliable suppliers and maintaining inventory represents an optimal solution to address supply disruptions[10]. Gupta and colleagues delved into the impact of emergency procurement strategies in competitive environments. Their findings underscored that supply disruptions and procurement lead times jointly influence company procurement decisions, highlighting the efficacy of supplier capacity reservations in mitigating disruption effects[14]. Hu et al. demonstrated that suppliers facing disruptions must decide whether to invest in recovery capabilities. Comparing scenarios where buyers stimulate capacity recovery using price or order quantity as incentives before or after disruptions, traditional methods involved diversifying orders to expensive yet reliable suppliers. Results favored pre-disruption commitments by both buyers and suppliers. Additionally, with increasing market demand, buyer preferences for alternative supplier search strategies escalated[15]. Research by Li et al. delved into retail procurement strategies and supplier pricing strategies within the supply chain environment. They devised a coordination mechanism based on supply disruptions to maximize supplier profits[16]. Yang et al. explored the issue of manufacturers choosing supplier backup production under situations of symmetric and asymmetric information. Findings suggested that asymmetric information might lead manufacturers to halt procurement from unreliable suppliers; in cases of symmetric information, supplier reliability outweighed backup production value to manufacturers[17]. Furthermore, scholars have increasingly focused on utilizing the newsboy model to determine procurement strategies under conditions of uncertain production or demand[17-20].

5. Analysis of Research Development Trends in the Supply Disruption Domain

5.1 Keyword clustering analysis

The hallmark of research hotspots lies in scholars' collective attention towards a specific research direction within a defined period, yielding copious research outcomes where scientific issues are interlinked. By employing CiteSpace, a keyword clustering analysis was conducted, resulting in the formation of 53 clusters. The modularity value for clustering stood at 0.5605 (exceeding 0.3), indicating a significant delineation of community structures, with an average silhouette value of 0.8356 (greater than 0.7), suggesting the credibility of the clustering outcomes. The analysis focused on the top 10 clusters (refer to Figure 4), and the pertinent information on the keyword cluster map is detailed in Table 5.

Table 5 Keyword clustering

Cluster ranking	Cluster size	Silhouette values	Years	Generated clustering keywords
#0	39	0.912	2018	critical raw material
#1	37	0.953	2014	supply chain
#2	27	0.886	2014	supply risk
#3	27	0.928	2014	energy security
#4	20	0.955	2017	quality
#5	19	0.893	2016	market disruption
#6	18	0.957	2016	dynamic programming
#7	18	0.845	2013	supply disruption
#8	17	0.977	2011	conditional value
#9	16	0.969	2013	asymmetric information

The current impact of supply disruptions on various fields of development, as inferred from the above-clustered keywords and relevant literature analysis, indicates several research focal points:

(1) Discussing supply disruptions from the perspectives of critical raw materials and energy security. The concept of "resource criticality" has emerged in recent years as a policy focus and research theme, primarily addressing the supply disruption risks to mineral resources due to economic and geopolitical reasons. Scholars like Mancini integrated critical raw material assessments with life cycle assessments, testing resource security using characteristic factors based on European supply risk factors. Their conclusions indicate that using the "supply risk/production data" ratio better reflects the importance of critical raw materials, thus aiding in assessing the EU's resource supply security through life cycle evaluations[21]. Cimprich focused on the "critical" theme of raw materials, reviewing three methods for product-level supply risk assessment - geopolitical supply risk, economic scarcity potential, and an integrated approach assessing resource efficiency. They preliminarily evaluated the potential impacts of raw material supply disruptions on product systems (i.e., "external to internal" impacts) and the impacts of product systems on the environment (i.e., "internal to external" impacts) [22]. The integration of supply disruptions with energy highlights a focus on the specific impacts of energy disruptions, such as water resources, electricity systems, petroleum resources, and natural gas resources. The sustainable management of these resources determines the current and future societal global human well-being and security. Zanfei proposed that water companies must ensure freshwater supply for all users in scenarios of climate change and urban expansion. They introduced a new model - the development of a graph convolutional neural network model - for rapid, reliable, and accurate detection of supply disruption anomalies[23]. SiskosD emphasized electricity supply resilience, with the increasing risk of prolonged power outages. Supply disruptions and electricity price fluctuations significantly affect the electricity supply in European countries. They suggested evaluating and ranking the resilience of each country's electricity supply network based on three main dimensions - resistance, stability, and recovery - and providing guidance at the national level on areas needing improvement[24]. Related high-frequency keywords include energy security, natural gas, impact and so on.

(2) Exploring supply disruptions from the perspectives of market disruptions and emergency decision-making. Emergency decision-making includes incentivizing recovery, backup production, emergency procurement, etc. Li et al. considered production disruptions due to random supply failures in accordance with order production plans. They established a joint decision-making model with procurement time and quantity to optimize or avoid potential stockout risks, offering specific management recommendations for adjusting dynamic procurement strategies under different market environments and customer behaviors to mitigate various disruptions[25]. Mokhtar presented a multiphase decision-making framework utilizing American option valuation methods and least squares Monte Carlo simulation techniques to address dynamic programming models, enabling procurers to devise optimal supply inventory strategies under uncertain supply conditions[26]. In market disruptions, buyers often consider order allocation strategies, specifically multi-source procurement. Mahapatra considered the optimal supplier selection and order allocation with limited and expandable production capacity, failure probabilities, full unit price discounts, and spot supply. By maximizing total purchasing value and minimizing expected total costs to measure supplier quality, a multi-objective model is established and solved using NSGA-II and MOPSO evolutionary algorithms. The results indicate that increased demand will lead to higher levels of procurement strategies, dependent on suppliers' maximum capacity and the minimum order allocated to selected suppliers[27]. The clustering encompasses key terms such as model, risk, decision, and competition, indicating the significant role of model-based approaches in addressing research issues related to supply disruptions.

(3) Discussing supply disruptions from a game theory perspective. In the domain of supply disruptions, there exists a dual negotiation between buyers and sellers, involving strategic reserves, risk sharing, pricing strategies, procurement strategies, option contracts, etc. Research by Hu shows that both buyers and sellers prefer pre-signed risk-sharing contracts. [15] Li et al. studied the impact of decision sequences on enhancing internal reliability of suppliers and company equilibrium pricing strategies within a supply chain composed of manufacturers and suppliers facing disruption risks. The decision order enhances supplier under leadership within the supply chain, but this does not always result in higher returns for the supply chain. The results

indicate that each company prefers making decisions first, and any decision sequence can become a determining factor within the supply chain. Additionally, supply chains can achieve coordination through profit-sharing contracts[28]. The cluster contains keywords such as coordination, diversification, asymmetric information, optimization, and contract, indicating the influence of information levels and trust levels in the domain of supply disruptions on decision makers' decisions and resource allocation.

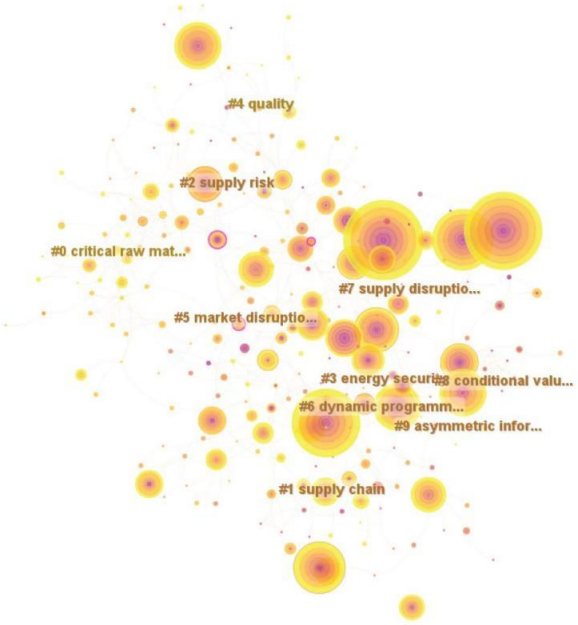

Figure 4 Network mapping of keyword clustering

5.2 Keyword burst analysis

Through the lens of keyword burst analysis, this examination elucidates the prevailing subjects within the research landscape. Figure 5 illustrates the identification of 8 burst keywords using the CiteSpace tool, unveiling the dynamic nature of research evolution. The exploration into supply disruption research reveals a nuanced progression over time. Initiating in the realms of 2009, the nascent studies grappled with core concepts such as supply security, policies, economic models, risks, and performance evaluation. These foundational themes remained prominent up until 2012, signifying a period of conceptual exploration. However, with the escalating occurrences of supply disruptions, scholarly attention gradually shifted towards empirical analyses to better align research endeavors with real-world disruptions. The monumental impact of the COVID-19 outbreak reverberated across global industries, catalyzing a surge in research dedicated to the resilience and recovery capacities within supply chains. This pivotal development underscores a transition in scholarly emphasis over time, transcending the mere reduction of losses from supply disruptions to encompass broader societal concerns. Scholars have increasingly delved into enhancing the performance of all stakeholders within the supply chain and strategizing to bolster overall supply chain resilience.

Top 8 Keywords with the Strongest Citation Bursts

Keywords	Year	Strength	Begin	End	2009 - 2022
security of supply	2009	4.55	2009	2012	
policy	2009	3.58	2009	2014	
eoq model	2009	3.35	2009	2012	
supply risk	2009	3.29	2009	2012	
performance	2009	2.95	2009	2012	
empirical analysis	2009	2.87	2013	2016	
resilience	2009	4.44	2019	2020	
recovery	2009	2.85	2019	2022	

Figure 5 Dynamic mapping of keyword burst detection

6. Conclusion

Harnessing the capabilities of the information visualization software CiteSpace, this study systematically sifted through and visually explored the corpus of relevant literature from the Web of Science core database spanning the years 2009 to 2022 with “supply disruption” as its focal point. Through multifaceted analyses encompassing basic statistical scrutiny, distribution of vital academic clusters, keyword clustering, and keyword bursts, the investigation unraveled the domain’s trajectory and research focal points, leading to the following conclusions:

(1) A knowledge mapping is emerging, represented by supply disruption, risk management, supply chain performance, and supply chain security, signifying a gradual maturation of the fundamental ideational framework around supply disruption. The concept of supply disruption first surfaced in scholars’ research landscape in 2009, introducing emergency strategies for the first time, with pivotal shifts in research focus observed in 2013 and 2019. However, compared to other domains within the supply chain realm, current research output remains relatively modest, with no significant improvement in research quality, maintaining an annual publication output of merely 30 to 70 papers.

(2) Research efforts across regions manifest significant imbalances, with the United States and China emerging as primary powerhouses in the domain of supply disruption research, collectively accounting for 55% of the total literature. While the United States not only spearheaded research on supply disruption among nations but also served as the cradle of supply chain concepts, boasting the highest publication output in the field, with rich academic accomplishments placing it at the core of research. China follows as the second-highest publisher, with the most substantial investment in research funding.

(3) Present-day researchers’ principal focus on supply disruption revolves around demand uncertainty, supply resilience, and emergency decision-making. A minority of scholars integrate supply disruption with specific industries, particularly in the energy sector, encompassing resources such as water, power systems, natural gas, and petroleum. The study of supply disruption, however, remains somewhat confined and lacks real-world applications, exhibiting deficiencies in both depth and breadth of research.

Based on the aforementioned analysis, this study outlines the following future prospects:

(1) Despite supply disruption research being interdisciplinary in nature, its categories primarily converge in engineering, operations research, management, business and economics, industrial engineering, and computer science. Therefore, diversifying categories further can facilitate interdisciplinary research. For instance, while transportation stands as a peripheral category in the realm of supply disruption, it nonetheless exerts considerable influence on disruption risks and decisions of supply chain members. Hence, in exploring supply disruption, multimodal transportation, transshipment, and their associated costs and timeliness present potential avenues for future research.

(2) Strengthening the application of digital technologies and computer science in the domain of supply disruption. In recent years, a minority of scholars have delved into leveraging digital technologies and computer

science (e.g., blockchain, artificial intelligence) to mitigate risks in supply chain management and establish resilient supply chains. While this research trend is on the rise, future studies could emphasize exploring the design of supply chain management systems using computer technologies. For example, utilizing historical data in conjunction with computer technology to predict the probability of disruption risks and establish corresponding proactive prevention systems. Furthermore, predicting the duration of disruptions through digital technologies is crucial, providing a basis for risk-averse decisions among supply chain members, enabling them to take suitable response measures during disruptions, minimizing losses, and swiftly restoring normal operations.

(3) The concept of sustainable development (resilient development) has taken center stage, particularly within the environmental conservation domain. As more and more companies seek to maximize profits, they are also increasingly focusing on sustainable supply development. Supply interruptions have significant negative impacts on the sustainability development of supply chain members, encompassing economic, ecological, and social aspects. Sustainable development will have a profound impact on the performance of the supply chain, especially in the selection of reliable suppliers. Choosing suppliers with strong environmental records and social responsibilities, establishing long-term stable partnerships, can better address the challenges of unforeseen events. Therefore, integrating the principles of sustainable development with supply chain management not only enhances the competitiveness and long-term growth of businesses but also enables better responses to the challenges posed by supply interruptions, achieving the triple sustainability goals of economic, environmental, and social development.

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