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Review

Big data and supply chain crisis financial risk management: A bibliometric review

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Abstract: The presence of a crisis has consistently been an inherent aspect of the Supply Chain, mostly as a result of the substantial number of stakeholders involved and the intricate dynamics of their relationships. The objective of this study is to assess the potential of Big Data as a tool for planning risk management in Supply Chain crises. Specifically, it focuses on using computational analysis and modeling to quantitatively analyze financial risks. The "Web of Science—Elsevier" database was employed to fulfill the aims of this work by identifying relevant papers for the investigation. The data were inputted into VOS viewer, a software application used to construct and visualize bibliometric networks for subsequent research. Data processing indicates a significant rise in the quantity of publications and citations related to the topic over the past five years. Moreover, the study encompasses a wide variety of crisis types, with the COVID-19 pandemic being the most significant. Nevertheless, the cooperation among institutions is evidently limited. This has limited the theoretical progress of the field and may have contributed to the ambiguity in understanding the research issue.

Keywords: big data; supply chain; financial risk; risk management; crisis; sustainability; data modeling

1. Introduction

The crisis has always been a part of the Supply Chain, mainly due to the increased number of stakeholders as well as the complicated interactions between them. As Supply Chains increase in complexity, crisis events are becoming even more frequent with higher impact than in previous years (Honkanen, 2023; James et al., 2011). However, the last five years have proven that crisis has many faces, and "black swans" are more likely to become real hazards than ever before. The COVID-19 pandemic ascertained that unthinkable events may interrupt supply chains on a global scale (Sakas and Giannakopoulos et al., 2021), as well as the Ukrainian–Russian conflict reminded us that border stability sometimes is a disputable condition and a crisis generation source (Mariotti, 2022). Additionally, climate change has proven a huge potential for generating supply chain crisis events, starting from raw materials production up to the "last mile" and the final consumer (Kaniewski et al., 2023).

Crises could be described as forest fires, by considering them either as pure distraction events or an opportunity for regeneration and new development for the organization. However, in order to endure or get an upper hand during a crisis, Supply Chain Management must establish effective techniques and procedures to reduce susceptibility and guarantee uninterrupted service by proactively identifying potential financial risks and possibilities. Despite an increasing understanding of the possible repercussions of a crisis event, numerous firms are insufficiently equipped for its happening, and their risk management strategies are either inadequately planned or nonexistent.

Properly developed risk management plans, including regular financial risk assessment allow for the proactive identification of potential future crises. While it may not always be feasible to completely avoid crises, organizations should develop mitigation measures and contingency plans to lessen the damage and ensure business continuity during such situations. Planning for disasters is a clear indicator of organizational robustness and demonstrates a clear ability to face major supply chain financial risks, however, predicting all kinds of financial risks is practically impossible since "unknown-unknown" risks may arise at any time. Since management dormancy and neglect are pointed out as the major reason for business crises (Sapriel, 2003), integrating financial risk management activities into daily business operations is an essential measure for developing a flexible and robust Supply Chain capable of enduring any crisis. This initiative should be backed by a directive from the company's top management, emphasizing the importance of collaboration among all key business functions.

Although a rigid financial risk management plan is a good guideline for the organization's crisis preparedness, it should incorporate adequate response procedures that will ensure a smooth transition for the company from "business as usual" to "crisis" mode. Businesses are compelled to adjust their industrial practices due to swift fluctuations in the Supply Chain, in order to consistently pursue the highest quality at the most favorable price and with the shortest possible delivery time. This condition triggers a constant reorganization of the supply chains. This organizational mobility requires a dynamic restoration of links and processes within the organization, resulting in a challenging business environment where uncertainty and vulnerability put uninterrupted supply chain processes at stake. This fact highlights, even more, the crucial role of financial risk management in the successful continuity of services for organizations. Reliable and solid financial risk management is a strategic choice for many organizations that consider risk-free supply chains of the same importance as productivity (Roberts, 1990).

The objective of this study is to evaluate the potential of Big Data as a tool for planning financial risk management in the context of Supply Chain crises, in terms of financial risk quantitative analysis through computational scrutiny and modeling. Big Data can be obtained either from within the organization's processes or can be mined from crowdsourced platforms (Sakas and Kamperos et al., 2021).

2. Theoretical background

2.1. Supply chain crises

Crisis, by definition, points at uncertainty since its origins from Greece and specifically form the word "crisis" that can be translated as judgment or decision (Desoutter and Lavissière, 2018). ISO standard 22399 (2007), defines crisis as: "any incident(s), human-caused or natural, that require(s) urgent attention and action to protect life, property, or environment". Other researchers employ a distinct methodology and propose that a crisis is delineated as an abrupt occurrence or sequence of occurrences that compels organizations to respond promptly.

Alternatively, it may stem from a protracted course of action that has already led to irreparable harm (Honkanen, 2023). The definition of a crisis according to other studies is "a low probability, high impact event that threatens the viability of the company and is characterized by ambiguity of cause, effect, and means of resolution, as well as by a belief that decisions must be made swiftly" (Pearson and Clair, 1998). Although each definition approaches the point of matter from a different angle, all could agree on some common characteristics regarding crises. Researchers suggest that every crisis consists of three main elements (King, 2002). Firstly, a crisis is an unforeseen occurrence that has the capacity to disrupt both the internal and external framework of a company. Secondly, it can happen at any moment. Lastly, it has the power to undermine the credibility of a company.

Despite the growing scientific interest in Supply Chain Management (SCM), which has led to numerous studies on the topic (Baldini, 2012; Hittle and Moustafa, 2011; Jüttner and Maklan, 2011; Natarajarathinam et al., 2009; Pfohl et al., 2010; Wagner et al., 2017), the existing literature lacks a comprehensive definition of the supply chain crisis phenomenon. Nevertheless, other studies have put forth noteworthy recommendations. Durugbo and Al-Balushi (2023) differentiate between the concept of a Supply Chain Crisis and the concept of the Supply Chain in a Crisis. By combining these two concepts, researchers suggest four different modes of crises for the Supply Chains. The most challenging of these 4 modes is the "Supply Chain Crisis in Crisis Times", an inherent condition of SCM characterized by chaos, difficulties, and complexity that have a direct and visible impact on a supply chain (Sawyerr and Harrison, 2019).

As supply networks grow alongside communication channels and information speeds, Supply Chain complexity is highlighted by many studies as an emerging financial risk requiring challenging solutions (Childerhouse and Towill, 2004; van der Vorst and Beulens, 2002). According to Blackhurst et al. (2004), Supply Chains fulfill multiple roles focusing firstly on serving as connectors between organizations, secondly making possible collaboration between different Supply Chains in different regions, thirdly demonstrating operational changes based on institutional circumstances, and finally giving rise to partnerships among organizations with varying goals. In an attempt to merge all different viewpoints, Durugbo and Al-Balushi (2023) proposed a Supply Chain Crisis definition as: "a supply chain state or situation triggered by a low-probability, high-impact incident that emerged gradually or abruptly from organizational, institutional and state (or regional) causes and conditions, threatening the values and viability of suppliers, manufacturers, and distributors, and imposing time pressures for supply chain decisions under high uncertainty".

The basic Crisis Management principles covering the "before" "during" and "after" crisis periods, also apply to Supply Chain Crisis Management, highlighting the importance of financial risk management planning before a crisis strikes and the value of fallback plans during damage control and operational continuity restoration. Challenges from these cycles arise from the Supply Chain nature itself, with distribution channels and coordination procedures generating more financial risks and vulnerabilities as complexity increases (Armani et al., 2020; Jüttner and Maklan, 2011; Kurniawan and Zailani, 2010; Merz et al., 2009).

2.2. Supply chain crisis financial risk management

The causes of supply chain risk can be classified into five main categories, as outlined by Wagner and Bode (2009): i) demand side, ii) supplier side, iii) regulatory, legal and bureaucratic, iv) infrastructure, and v) catastrophic risks. The initial two categories of risk sources relate to supply-demand coordination difficulties that arise within the supply chain, whereas the next three categories concentrate on risk sources that may not necessarily originate within the chain. Researchers conclude that the dominant outcome of a risk, under the mentioned categories, when it becomes a hazard, is primarily financial. This can manifest as higher costs for production and transportation, as well as lost earnings and the need to repair damaged infrastructure (Wagner and Bode, 2009).

Although Supply Chain Financial Risk Management (SCFRM) is becoming increasingly important, there is a lack of clear definitions for supply chain risk in the existing literature. Some individuals define supply chain financial risk entirely based on the concept of events. This sense of risk is consistent with the concept of risk that has evolved over the last four centuries, which firmly links risk to the likelihood that disruptive events will occur (Heckmann et al., 2015). When it comes to SCFRM, events are defined by their propensity to happen (probability of financial risk) and the consequences they will entail for the chain (impact of risk) (Heckmann et al., 2015; La Soa et al., 2024). Consequently, definitions of supply chain financial risk often lack clarity and specificity, and fail to incorporate quantification. As a result, assessing, monitoring, and controlling supply chain risk remains difficult, and it is not sufficiently accounted for in quantitative decision models. March and Shapira introduced an early definition of financial risk in the supply chain as the "fluctuation in the range of potential financial outcomes, their probability, and their subjective values" (La Soa et al., 2024; March and Shapira, 1987). Nevertheless, the definition of supply chain risk (SCR) that has gained the most acceptance is the one proposed by Zsidisin. According to Zsidisin, supply risk is defined as the inability of affected companies to effectively manage the consequences of an incident (Goh et al., 2007; Kull and Closs, 2008; March and Shapira, 1987; Zsidisin, 2003).

Risk-taking is considered an inherited characteristic of management nature (La Soa et al., 2024). Any strategic action bears some risk implications since taking a risk equates to deciding in the face of uncertainty. Researchers emphasize the necessity for further investigation into the connection between business strategy, financial risk, and the consequences for supply chain management, as it remains inadequately comprehended (Braithwaite and Hall, 1999). Prior to delving more into the SCFRM idea, it is necessary to differentiate between risk drivers and financial risk control tactics and strategic decisions. Increasing outsourcing as well as supply chain globalization have been outlined as the main source of increased financial risk exposure and organizational vulnerability to any supply chain disruption (Engardio, 2001), however, the need for increased competitiveness can often be the main driver of financial risk since organizations utilize "calculated risks" as leverage for improved performance effectiveness and profitability (Svensson, 2004). Conversely, financial risk control strategies are those calculated strategic actions that organizations take on purpose to lessen the uncertainty brought about by their financial sources (Miller, 1992;

Natufe and Evbayiro-Osagie, 2023). Researchers propose that the primary objectives of SCFRM are to detect and evaluate all potential financial risks and uncertainties in the supply chain, and to create and implement strategies for controlling and monitoring these risks in order to minimize disruptions, both in a reactive and proactive manner (Manuj and Mentzer, 2008; Natufe and Evbayiro-Osagie, 2023; Tang, 2006). SCFRM is an extension of traditional financial risk management since it manages to interlink supply chain partners' upstream and downstream risks (Wieland and Wallenburg, 2012).

An expanding number of crises face Supply Chains, some brought on by unknown and poorly recognized risks and hazards. Because of the interdependence of the world economy, crises have the potential to transcend national boundaries and have a substantial impact on the economy (OECD, 2020). Global Supply Chains are acutely aware that additional systemic shocks might seriously jeopardize their organizational development and profitability in the wake of the financial and budgetary crises. The management of these disruptive occurrences should be high priority goal since actions during times of crisis have a direct impact on the confidence that the market stakeholders have in their organizations.

Developing the skills and resources necessary to get ready for crises that have already happened was the traditional definition of crisis preparation. Adapting strategies that facilitate readiness for unanticipated responses is necessary to prepare for crises in the new environment. Crisis and emergency preparedness are built on a foundation of financial risk awareness. Response planning is made possible by the analysis of financial risks, threats, and vulnerabilities through thorough risk identification and assessment. Risk assessment techniques and methodologies cannot be studied completely separated from their main goal. In other words, while creating emergency response plans is the goal of financial risk assessment for traditional crises, innovative or trans-border crises require a more flexible and dynamic capacity for responses, indicating a more adaptable and comprehensive approach to financial risk assessment. Combining data from multiple sources on the risks and hazards, as well as the organization's vulnerabilities and possible financial risk exposure, is a vital step for this analysis. Along with the growth of databases, archives, and monitoring networks, as well as modeling and mapping technologies, there is an increasing amount of data and information available for financial risk assessments and mapping.

2.3. Managing crisis risks with big data

Big data technology has developed into a crucial instrument for enhancing decision-making and corporate operations today. Furthermore, big data technology makes it possible to understand a combination of data from many sources to detect numerous crises and disasters early (Orenga-Roglá and Chalmeta, 2016). A complicated collection of organized and unstructured data that is incomprehensible to conventional technologies is referred to as big data. It is driven by data science, uses models, and seeks to uncover hidden patterns (Taylor-Sakyi, 2016). Big data have four distinctive features that differentiate them. These features are "Volume" which indicates the amount of data produced consistently throughout a given period, "Variety" that describes the incredibly wide range of data formats and types from both known and unidentified sources, "Velocity" describing the rate at which data is generated and the rate at which it must be processed promptly and finally "Veracity" which is a term that describes the objectivity, security, validity, and dependability of data (Fertier et al., 2016). The massive volume of data that businesses worldwide generate, store, or purchase from many sources is proof of the significance of big data. An organization's standing and competitiveness can be improved by properly utilizing this data, which gives the business a wealth of knowledge about the external environment of the organization. Even while gathering large amounts of data has clear advantages, many organizations have had trouble making use of the massive amounts of information that have been gathered—particularly when information is taken from several sources.

Large data volumes while processing unstructured information can result in formatting and organizing issues. The nature of big data makes them difficult to assimilate, making visualization and forecasting techniques a priority for them to infuse decision-making processes. However, subsequent technological advancements have addressed many of these difficulties. The development of big data techniques to address challenges linked to volume and variety is an ongoing process (Orenga-Roglá and Chalmeta, 2016). One tool that helps address the problem of data volume is the map reduction approach, which allows massive volumes of data to be processed simultaneously. Similarly, metadata is an innovative technique designed to help in processing diverse types of data (Taylor-Sakyi, 2016). However, many companies still struggle to properly exploit big data, especially during times of crisis when quick incorporation, aggregation, and visualization are needed to support fast organizational responses and emergency measures (Emmanouil and Nikolaos, 2015).

Big data are utilized through all four phases of crises as described by Professor C. Hermann in 1963 (Hermann, 1963). Big data-based—crisis risk management applications are activated throughout the Crisis Prevention, Crisis Preparedness, Crisis Response, and Crisis Recovery phases, given that an adequately robust financial risk management plan has been developed beforehand. For big data to help us prepare for a future crisis, experience has to be exploited by collecting and analyzing datasets during crisis events. Big data collected during crises or mass emergencies are described as "Big crisis data" (Qadir et al., 2016). Like big data, there are two categories of large crisis data: structured and unstructured. Crises data sets are mainly unstructured. Six major categories of big data sources have been proposed that, in general, are the main forces behind the big crisis data revolution. These comprise internet activity, sensing technology, crowdsourcing data, public/governmental data, tiny data/MyData, and data exhaustion (Qadir et al., 2016). However, the biggest challenge regarding big crisis data remains the extraction of structured data from unstructured datasets. In this study, we will attempt to compile, classify, and identify research gaps that could lead to recommendations for future research on supply chain crisis financial risk management with big data.

3. Materials and methods

This study strives to offer a better overview regarding the dominant research topics of the "Big Data and Supply Chain Crises Financial Risk Management" scientific field, as well as to further clarify the interconnections among academic researchers and academic institutions worldwide. To explore these identified gaps in the literature, we started our research by formulating the research questions (RQ) as a guide for this systematic bibliometric review:

RQ1: Is Big Data a dominant research focus point for Supply Chain Crisis Financial Risk Management research?

RQ2: Do academic institutions from different countries collaborate to promote research in this scientific field?

RQ3: Is research regarding "Big Data and Supply Chain Crises Financial Risk Management" conducted only by economically developed countries?

RQ4: Has the COVID-19 crisis triggered an increase in related research from academic institutions?

RQ5: Is COVID-19 crisis the event with the most significant influence in Big Data and supply chain crisis financial risk management research?

The objective of this study is to examine the designated research topics and offer a thorough analysis of existing research papers on the management of financial risks in supply chain crises through the utilization of Big Data. The study's research objectives (ROs) are outlined below:

RO1: To understand the locations and methodologies of these research studies.

RO2: To comprehend our understanding of the Big Data and supply chain crisis financial risk management phenomena and its progression in the present period.

RO3: To examine current research on Big Data and supply chain crisis financial risk management across several fields of study.

RO4: To suggest potential areas for further research and provide recommendations.

The bibliometric approach utilizes quantitative approaches to investigate the links between different study components using bibliometric data. This analysis provides a comprehensive depiction of the bibliometric and intellectual framework of a certain area (Donthu et al., 2021). The data can be utilized to illustrate the contributions of specific fields, develop correlations, and identify patterns and potential deficiencies (Block and Fisch, 2020). Thus, it provides a systematic mapping and a thorough analysis of performance that assists in identifying the thematic development of a particular subject of study.

The "Web of Science—Elsevier" (WoS) database was utilized for this paper's objectives to locate pertinent papers for the study. Web of Science (WoS) is a highly selective and extensive database that encompasses several scientific disciplines. It is widely utilized in bibliometric analyses in different research studies (Mac Fadden et al., 2021; Montero-Diaz, 2018; Saleem et al., 2021). WoS was selected specifically for its comprehensive coverage across disciplines, high quality requirements, and advanced tools for extracting and visualizing data.

One search was performed on 5 December 2023 with the search request "supply chain (All Fields) and crisis (All Fields) and big data (All Fields)" and limited publication date from 2013 until 2023, resulting in 80 papers. The process is described in **Figure 1**.

Our study focused on English-language journal papers by looking at their titles, abstracts, and author keywords. The selected paper dataset is presented in Appendix A. The Dataset was extracted in txt as well as RIS formats. The distribution of papers during the ten years is presented in **Figure 2**.

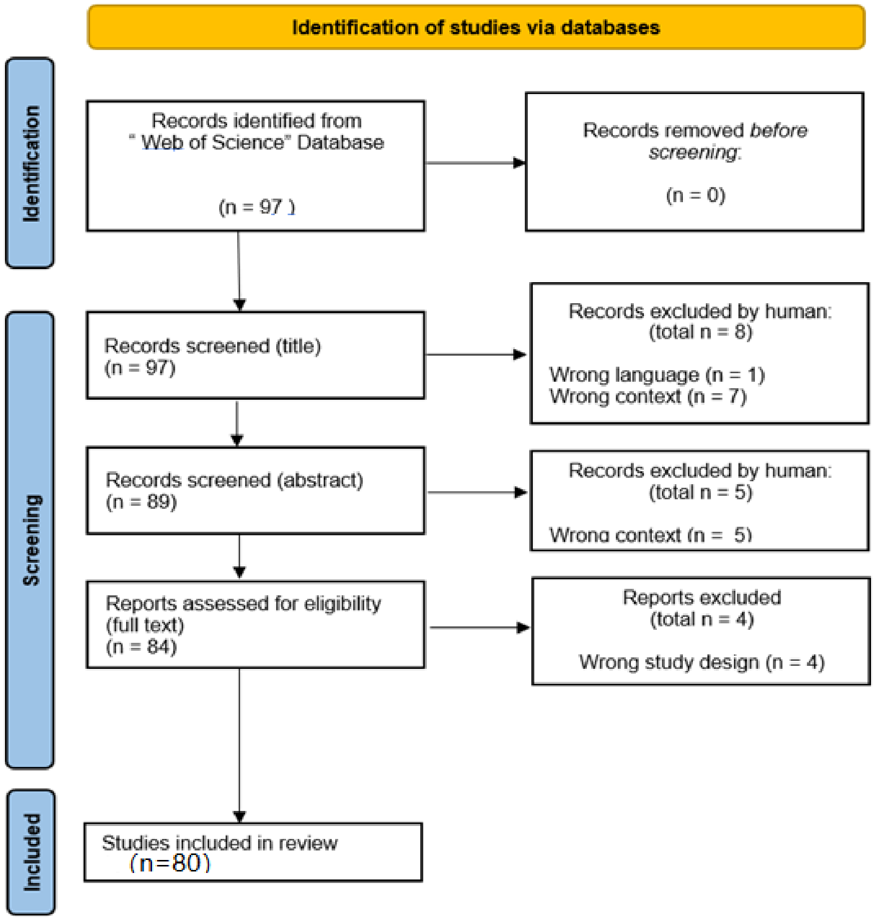

Figure 1. PRISMA flow chart reflecting the data collection process.

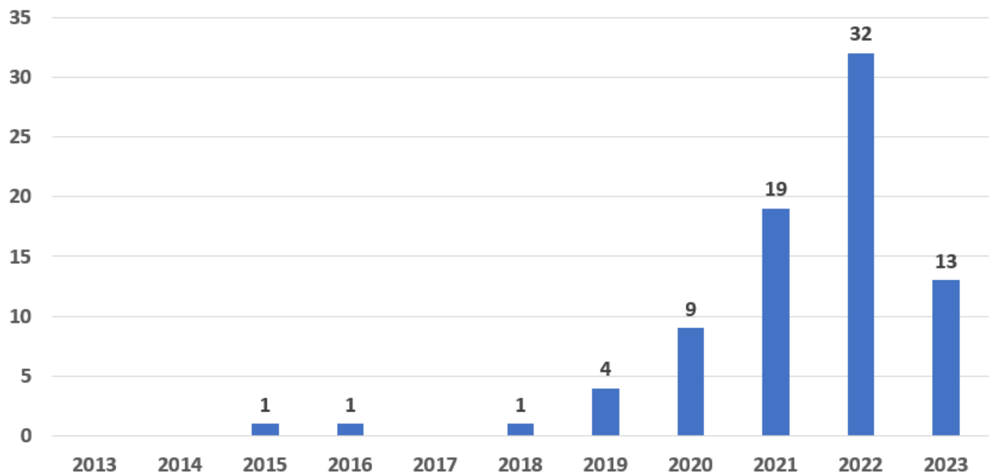

Figure 2. Distribution of publications during the ten years.

We used VOS viewer, a program for building and depicting bibliometric networks, to further process our data (van Eck and Waltman, 2010; van Eck and Waltman, 2017). The Extracted RIS file was imported into VOS viewer (version 1.6.20) to provide the necessary data for the analysis models.

The data analysis was conducted in three distinct segments. Initially, we employed a systematic literature review approach (SLR). The systematic literature review methodology is the most appropriate method for reconciling the many perspectives in the current study field. The current study utilizes rigorous methods to conduct a systematic literature review (SLR) using the 4W (What, Where, Why, How) paradigm. The focus is on examining important themes, contexts, features, and procedures used in previous works of literature. The second component involved doing a performance analysis to identify growth trends of publications. The third component relied on a scientific mapping approach to examine the intellectual structure of the area by creating bibliometric maps. This paper employed five distinct levels of analysis, namely:

1) Text data both in title and abstract fields
2) Co-occurrence filtered by author keywords
3) Bibliographic coupling, both by authors and by documents
4) Co-authorship analysis both by authors and by countries
5) Co-citation filtered by cited sources

All various layers of analysis that were employed, created a systematic overview of significant patterns and conclusions within clusters, effectively managing the large volume of content created by bibliometric analysis.

In order to enhance the reliability of our results, we utilized fractional counting for all other types of analysis in order to mitigate the influence of papers with multiple authors. In addition, binary counting was used for analysis level "1)" to determine the frequency of word or phrase occurrences in each respective field. Full counting takes into account the cumulative frequency of a phrase across all papers.

4. Results

This section will present a comprehensive summary of the results obtained from all three analytical approaches. Specifically, the SLR technique findings will be examined, and then the performance analysis will be conducted. The final component of this chapter will present a comprehensive bibliometric study.

4.1. Systematic literature review (SLR)

The "What" aspect of the SLR will be most effectively examined during the analysis of textual data. "Where" refers to both the publishing journals and the studied sector. **Table 1** presents an analysis of the publishing journals, while **Figure 3** presents a word cloud that visualizes the findings.

A total of 54 distinct publications have published pertinent papers, indicating the extensive scientific range of the subject field. The findings suggest that the journals "Annals of Operations Research" and "Sustainability" have published the most research papers on the topics of Big Data and Supply Chain Crisis Financial Risk Management. Specifically, "Annals of Operations Research" has published 13 papers, while "Sustainability" has published 5 papers.

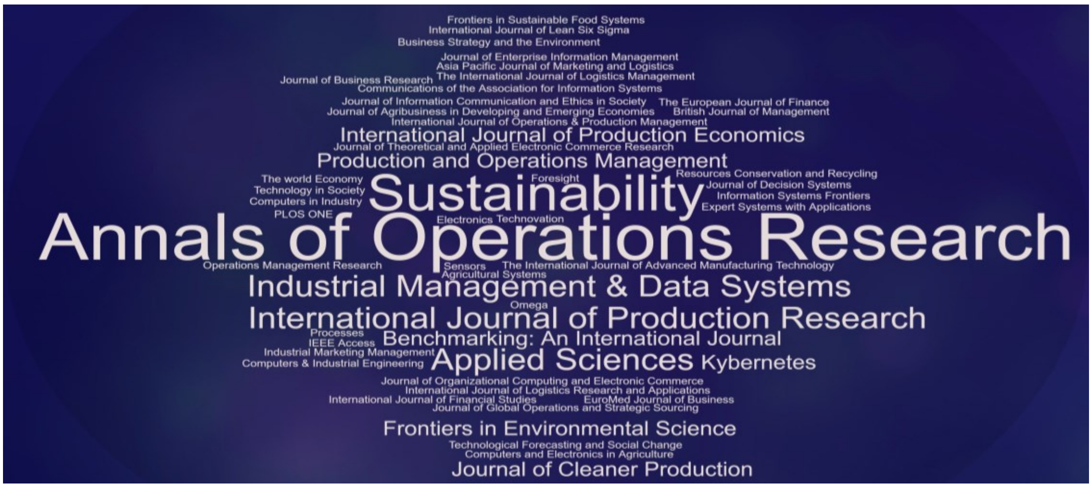

Figure 3. Word cloud representing the results of SLR analysis regarding publishing journals.

Table 1. Results of SLR analysis regarding publishing journals.

Journal	Number of Publications	Journal	Number of Publications
Agricultural Systems	1	International Journal of Production Economics	2
Annals of Operations Research	13	International Journal of Production Research	3
Applied Sciences	3	Journal. of Agribusiness in Devel. and Emerging Econ.	1
Asia Pacific Journal of Marketing and Logistics	1	Journal of Business Research	1
Benchmarking: An International Journal	2	Journal of Cleaner Production	2
British Journal of Management	1	Journal of Decision Systems	1
Business Strategy and the Environment	1	Journal of Enterprise Information Management	1
Com. of the Association for Information Systems	1	Journal of Global Operations and Strategic Sourcing	1
Computers & Industrial Engineering	1	Journal of Organizational Comp. and Electronic Com.	1
Computers and Electronics in Agriculture	1	Journal of Theor. Applied Electronic Com. Research	1
Computers in Industry	1	Kybernetes	2
Electronics	1	Omega	1
Euro Med Journal of Business	1	Operations Management Research	1
Expert Systems with Applications	1	PLOS ONE	1
Foresight	1	Processes	1
Frontiers in Environmental Science	2	Production and Operations Management	2
Frontiers in Sustainable Food Systems	1	Sensors	1
IEEE Access	1	Sustainability	5
Industrial Management & Data Systems	3	Technological Forecasting and Social Change	1
Industrial Marketing Management	1	Technology in Society	1
Information Systems Frontiers	1	Technovation	1
International Journal of Financial Studies	1	The European Journal of Finance	1
International Journal of Lean Six Sigma	1	The Inter. l Jour. of Advanced Manufacturing Tech.	1
Inter. Journal of Logistics Research and Application	1	The International Journal of Logistics Management	1
Inter. Journal of Oper & Production Management	1	he world Economy	1
Jour. of Information Com. and Ethics in Society	1	Resources Conservation and Recycling	1

In the second part of the "Where" component, the sector under study was determined for all the datasets. Overall, a total of 14 distinct industries were identified, with 23.75% of the articles focusing on supply chain management and 15% focusing on business administration. **Table 2** displays an examination of the sectors that were researched, whereas **Figure 4** illustrates the findings using a word cloud visualization.

Table 2. Results of SLR analysis regarding studied sectors.

Sector	Frequency	
Agribusiness	5	6.25%
Blockchains	3	3.75%
Business Administration	12	15.00%
Communications	7	8.75%
Crisis Management	1	1.25%
Disaster Management	1	1.25%
Energy Production	1	1.25%
Finance	5	6.25%
Food Industry	4	5.00%
Health Industry	2	2.50%
Humanitarian Supply Chains	9	11.25%
Manufacturing	9	11.25%
Pharmaceutical Industry	2	2.50%
Supply Chain Management	19	23.75%

Figure 4. Word cloud representing the results of SLR analysis regarding studied sectors.

Table 3. Results of SLR analysis regarding methodologies used.

Methodology	Frequency	
Conceptual research study	18	22.50%
Quantitative research study	33	41.25%
Qualitative research study	20	25.00%
Mixed research study	9	11.25%

The "Why" of the SLR analysis can be effectively elucidated by the utilization of bibliometric analysis, which is a more dynamic and comprehensive methodology.

The "How" component, which refers to the methodologies employed in our dataset, is examined in **Table 3**, where in **Figure 5**, a visualization of the results is demonstrated.

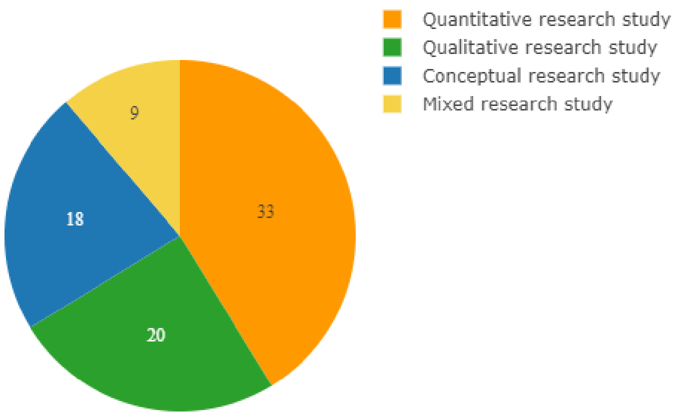

Figure 5. Pie chart representing the results of SLR analysis regarding methodologies used.

4.2. Performance analysis

Publications in the specific scientific field have been very limited during the pre-COVID period. Our research at WoS database resulted in 3 papers that met the criteria for the 2013–2018 period. There is a significant increase in relevant research during the first year of the pandemic (2019) resulting in 4 publications. The following 4-year period (2020–2023) was the most productive year with a total of 73 research papers representing 91.25 percent of total research. 2022 is the most prolific year, demonstrating 40 percent of total research volume with 32 research paper publications.

These findings indicate that the COVID-19 pandemic is likely the primary catalyst for study in the scientific disciplines of Big Data and Supply Chain Crisis Financial Risk Management.

All seven levels of science mapping analysis are presented below with analytical details regarding bibliometric analysis program inputs, and graphical outputs, as well as a descriptive discussion on the analysis outcomes, to provide a better understanding of the resulting data.

4.3. Text data (title and abstract fields)

Binary counting was applied. Five instances of a phrase were required to be present. 75 terms took part in the text-data network out of the total 125 that matched the threshold. 20 terms were excluded as relevant to titles and content descriptions. Results presented three large, and one small cluster.

- cluster 1 (red) contained 19 nouns/phrases,
- cluster 2 (green) included 19 nouns/phrases,
- cluster 3 (blue) contained 16 nouns/phrases and
- cluster 4 (yellow) included 1 nouns/phrases,

Large clusters exhibit distinct shapes and are characterized by their proximity in certain areas. The terms "model" and "challenge" exhibit the most significant total link strength, while the terms "risk", "resource", "performance", and "perspective" also appear to be of considerable importance. Additionally, the term "risk" shows a high total link strength score, indicating a strong connection to supply chain crises and big data scientific research topics. The aforementioned findings provide additional evidence to corroborate the claim that the utilization of Big Data and data modeling as financial risk management techniques are a subject of immense scientific interest in the academic realm. A substantial number of scholarly investigations are currently dedicated to exploring this domain.

Furthermore, it is noteworthy that researchers are currently directing their attention towards exploring the potential of not directly related technologies such as "blockchain" and "artificial intelligence" for employment as financial risk management tools in the framework of supply chain crises. Additionally, there is a notable emphasis on terms related to organizational sustainability, such as "effectiveness", "uncertainty", and "reliability" in the research conducted. The results are presented in **Table B1** (Appendix B) and **Figures 6** and **7**.

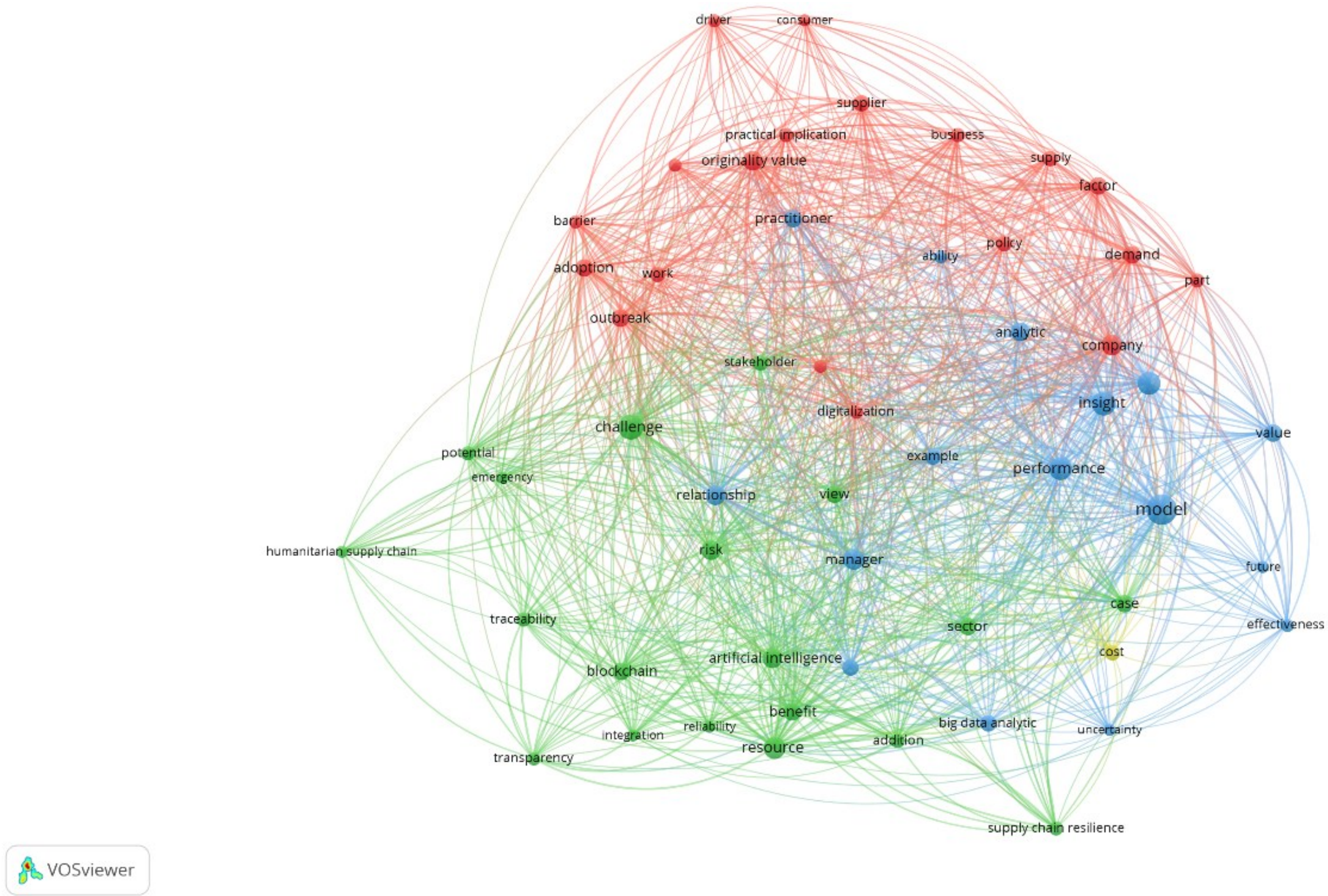

Figure 6. Text data (title and abstract fields)—Network visualization.

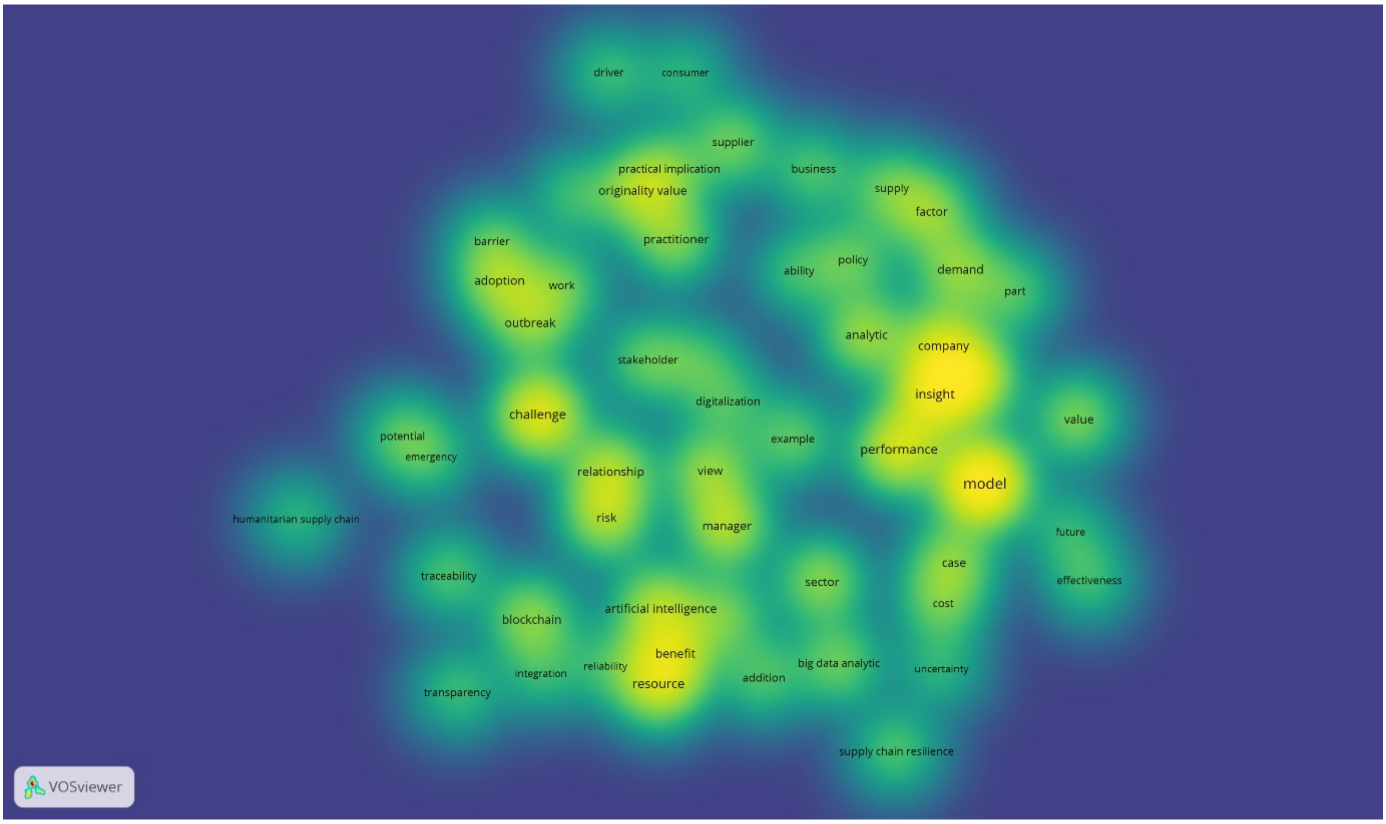

Figure 7. Text data (title and abstract fields)—Density visualization.

4.4. Co-occurrence (by author keywords)

Co-occurrence analysis is a bibliometric method employed to examine the potential correlation between two bibliographic items that are present in the same dissertation. The keyword's minimum occurrence threshold was set to two. Out of the 337 keywords, 48 satisfied the criteria and were included in the co-occurrence network. We decided to exclude the keyword "0" as irrelevant and "Systematic Literature Review" due to its connection to methodological terminology. Four medium and two small clusters were created.

- cluster 1 (red) contained 9 keywords.
- cluster 2 (green) included 9 keywords.
- cluster 3 (blue) contained 9 keywords.
- cluster 4 (yellow) included 8 keywords.
- cluster 5 (purple) included 6 keywords.
- cluster 6 (light blue) included 5 keywords.

The consistency is good resulting in well-shaped clusters with several interconnections between them. "Big Data", "Supply Chain", "Covid-19" and "Sustainability" are suggested as the dominant keywords. The term "Risk Management ", presents a significant total link strength score, participating as an important keyword. The term "Big Data" is linked to all other clusters demonstrating its' leading significance among all other researched terms. Although clusters are not isolated, most terms link mainly with keywords from the same group demonstrating limited connections with the other groups. The results are presented in **Table B2** (Appendix B) and **Figures 8** and **9**.

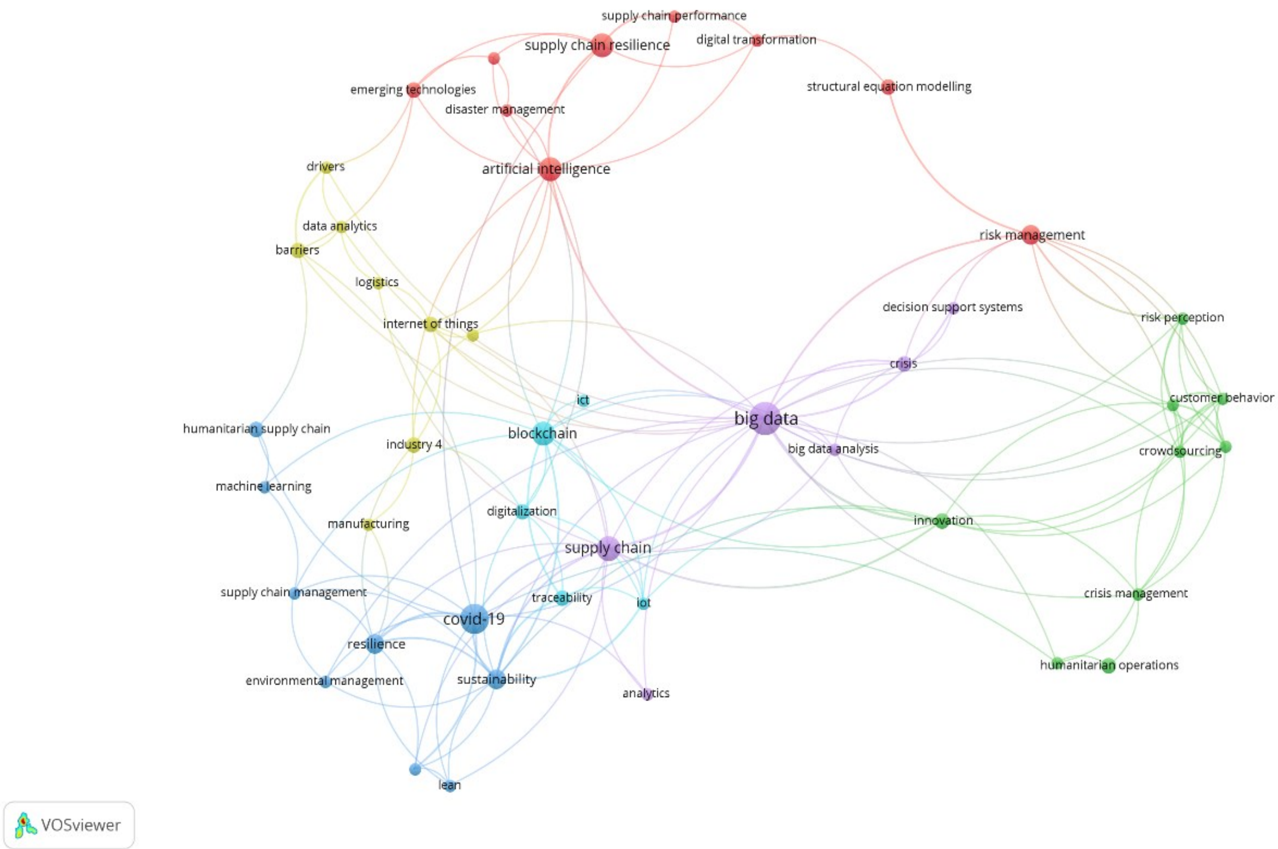

Figure 8. Co-occurrence (by author keywords) network visualization.

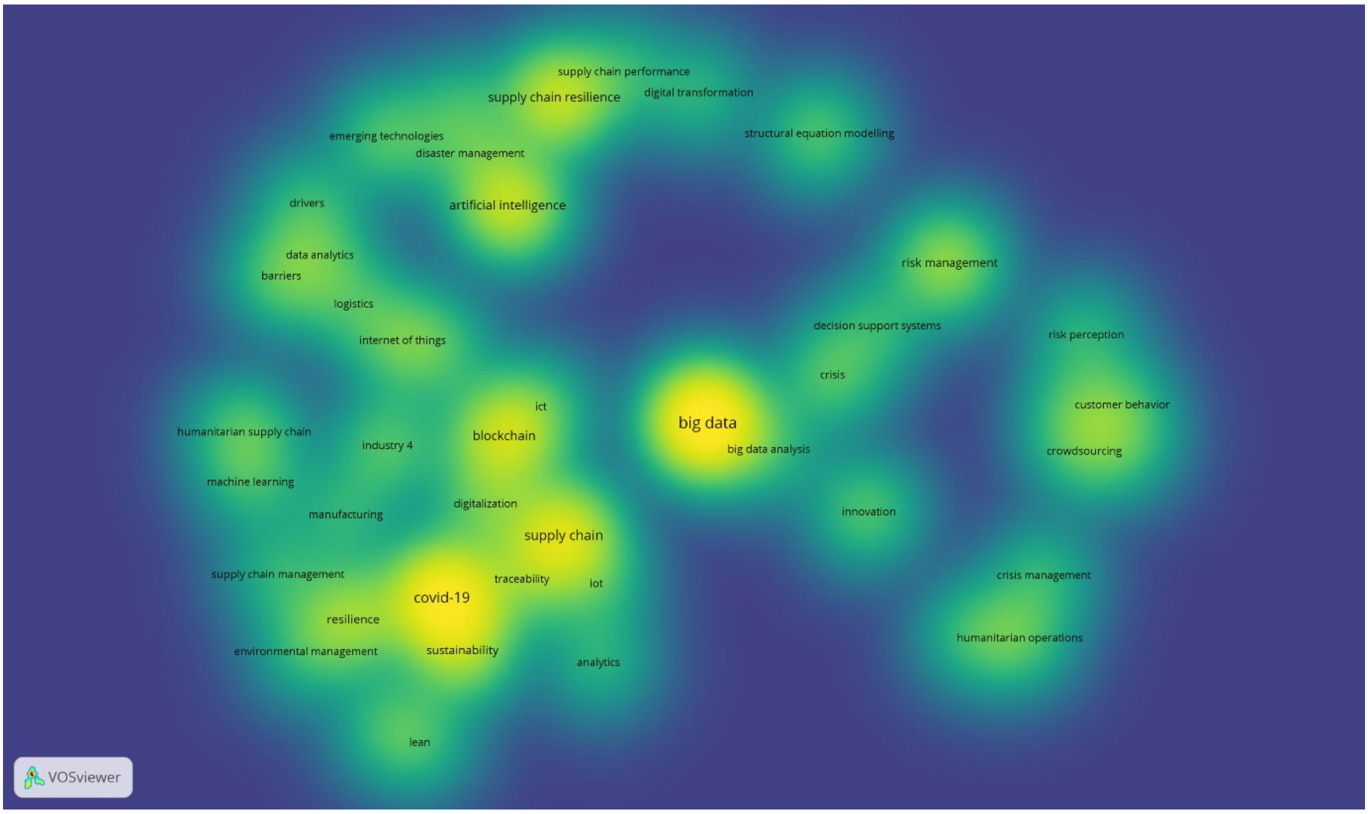

Figure 9. Co-occurrence (by author keywords)—Density visualization.

4.5. Bibliographic coupling

4.5.1. By authors

Bibliographic coupling refers to the situation where two publications both reference the same third publication. The minimum number of documents an author may have set to two (2), while the minimum number of citations an author could have zero (0). Out of the total of 295 writers, only 17 met the necessary criteria and participated in the bibliographic coupling network. Two medium-sized clusters and one small cluster were created.

- cluster 1 (red) contained 7 authors.
- cluster 2 (green) included 7 authors.
- cluster 3 (blue) contained 3 authors.

Clusters are very well-formed and indicate at least 2 research teams with bibliographic coupling connections. According to bibliographic coupling, the strength of a relationship between two researchers is directly related to their proximity in the coupling network (van Eck and Waltman, 2010). The findings imply that there is little collaboration among researchers, indicating the presence of introverted research groups. The results are presented in **Table B3** (Appendix B) and **Figures 10** and **11**.

Figure 10. Bibliographic coupling (by authors) network visualization.

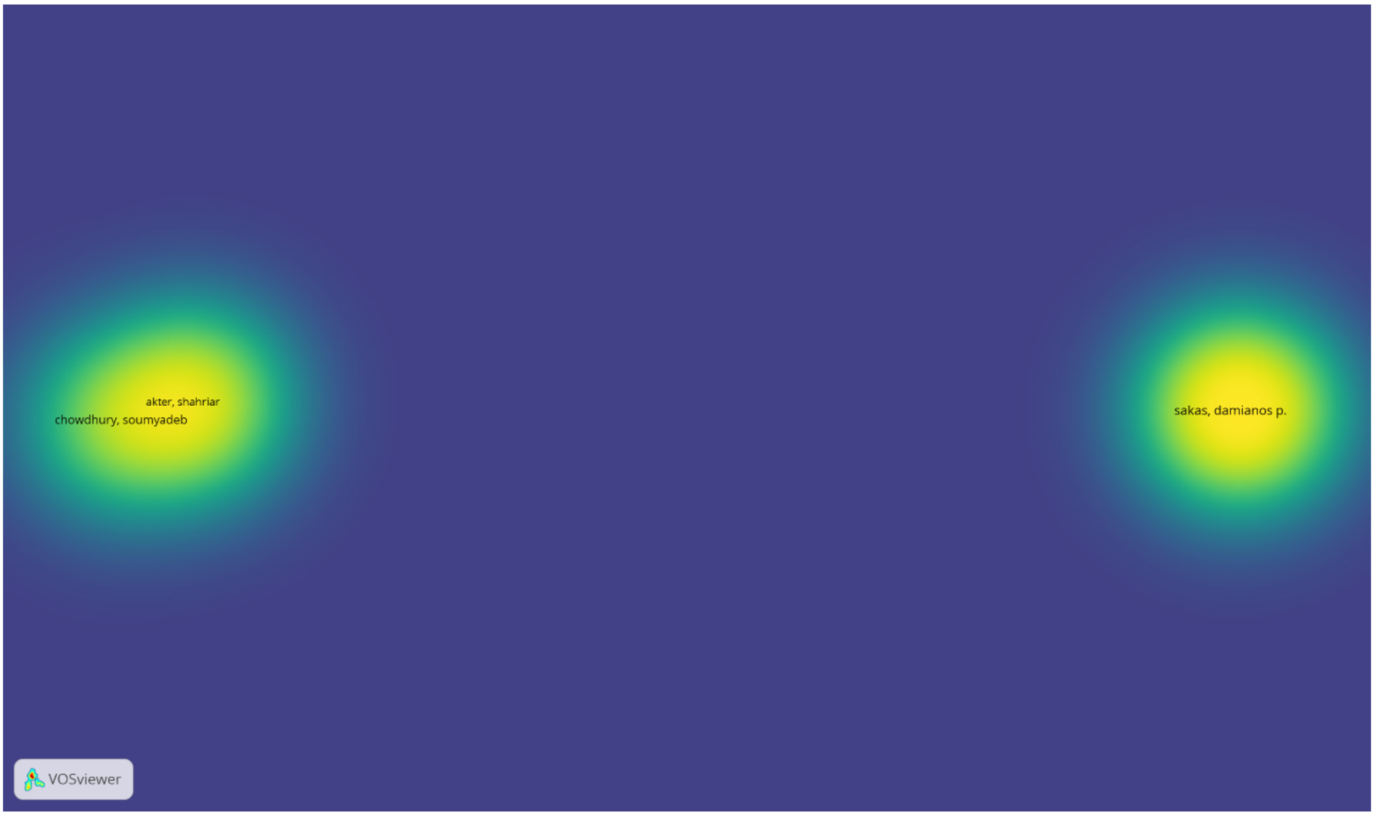

Figure 11. Bibliographic coupling (by authors) density visualization.

4.5.2. By documents

The minimal threshold for the number of citations a work might have established at two (2). 61 documents fulfilled the criteria and took part in the bibliographic coupling network. A total of 9 clusters were formed with 2 large clusters, 1 medium, and six small clusters.

- cluster 1 (red) contained 17 papers.
- cluster 2 (green) included 14 papers.
- cluster 3 (blue) contained 10 papers.
- cluster 4 (yellow) included 5 papers.
- cluster 5 (purple) included 5 papers.
- cluster 6 (light blue) included 4 papers.
- cluster 7 (orange) included 2 papers.
- cluster 8 (brown) included 2 papers.
- cluster 9 (light purple) included 2 papers.

Big clusters exhibit a distinct shape. "Ivanov (2020)" and "Sarkis (2021)" can be suggested as the documents with the highest coupling degree. Most clusters are well-formed and present a high level of interlinking between them. Smaller clusters also present a tendency to interlink, however, most of them have limited interconnections, and some exhibit a rather disintegrated form (orange, brown, and light purple). "Ivanov (2020)" from the blue cluster is the document with the highest total link strength (524). In this document (Ivanov, 2020), a novel concept known as the viable supply chain (VSC) is theorized by researchers. According to this theory, viability is an underlying quality of the supply chain that encompasses three perspectives:

sustainability, resilience, and agility. The second highest total link strength score is achieved by "Sarkis (2021)" (305) in the blue cluster as well. In this paper (Sarkis, 2021), researchers aim to offer research guidelines for future studies on supply chain sustainability in the aftermath of COVID-19. Researchers conclude that while there are short-term benefits to environmental sustainability, long-term implications are still unknown and need further study. Resilience and sustainability go hand in hand, and both need to be studied. The results are presented in **Table B4** (Appendix B) and **Figures 12** and **13**.

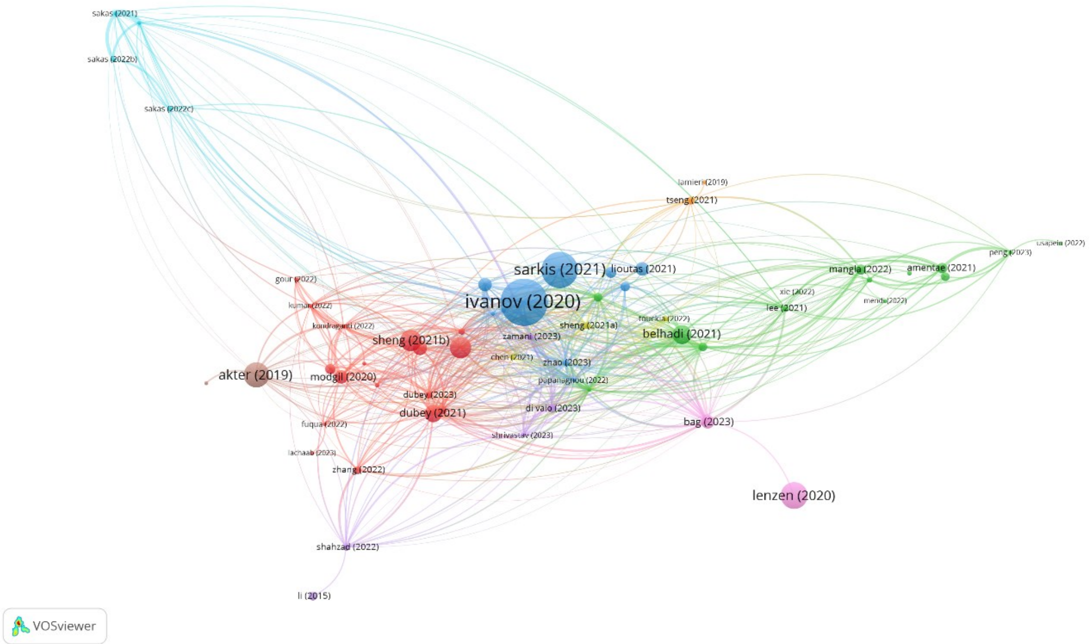

Figure 12. Bibliographic coupling (by documents) network visualization.

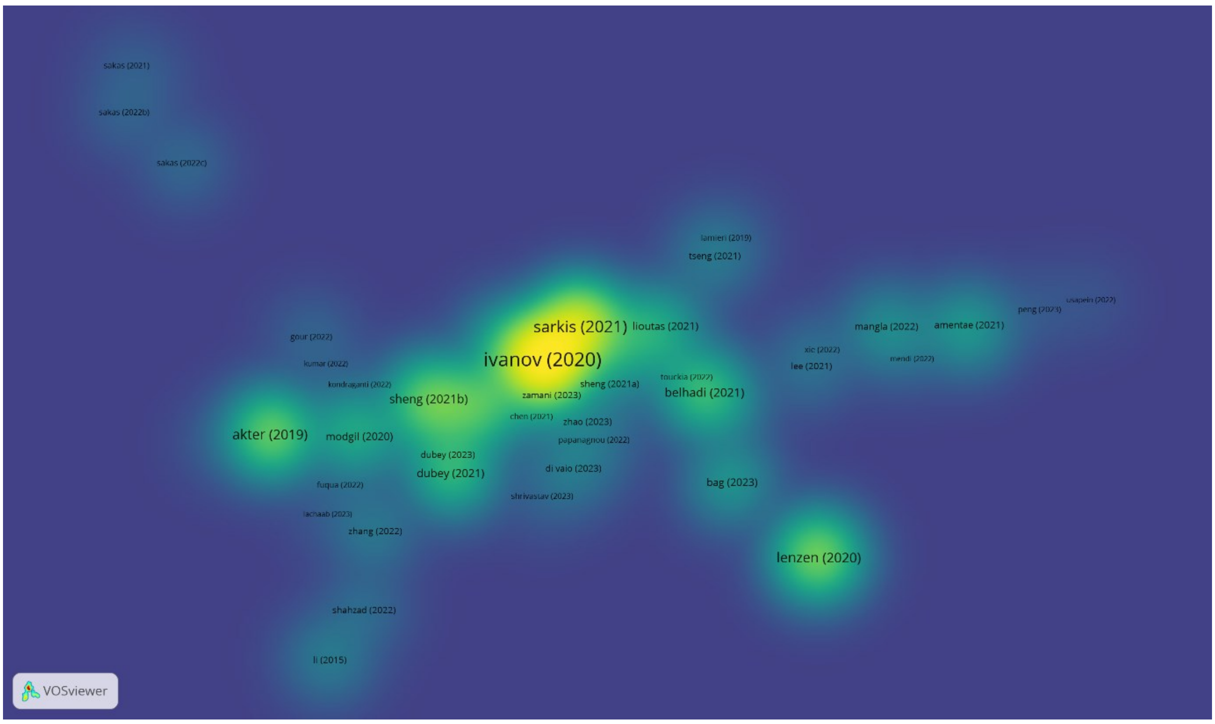

Figure 13. Bibliographic coupling (by documents) density visualization.

4.6. Co-authorship

4.6.1. By authors

An author must have a minimum of two (2) documents and a minimum of three (3) citations. Out of a total of 295 authors, only 17 fulfilled the criteria and took part in the analysis. A total of 6 clusters were formed with 1 medium and 5 small clusters.

- cluster 1 (red) contained 7 authors.
- cluster 2 (green) included 4 authors.
- cluster 3 (blue) contained 3 authors.
- cluster 4 (yellow) included 1 author.
- cluster 5 (purple) included 1 author.
- cluster 6 (light blue) included 1 author.

Analysis resulted in three distinctive clusters with no interconnection between them as well as in three single–author clusters. Larger clusters propose the existence of well-cooperated research teams that could result in high-quality research outcomes. However, the conclusions of the authors' bibliographic coupling analysis are supported by the findings, which also point to introverted research teams and low levels of research collaboration. The findings show that more scholarly collaboration is required to further this scientific field's study. The results are presented in **Table B5** (Appendix B) and **Figures 14** and **15**.

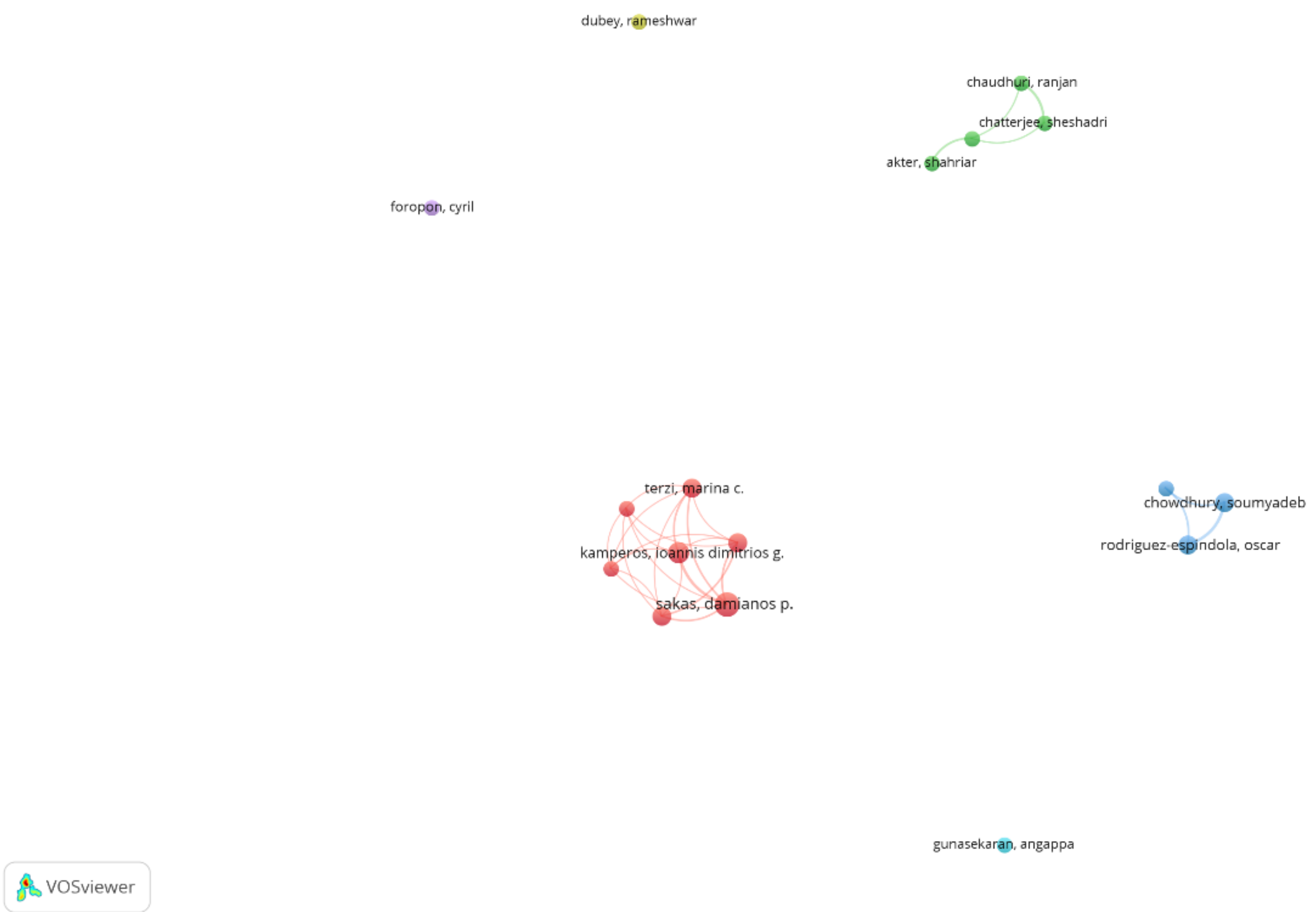

Figure 14. Co-authorship (by author) network visualization.

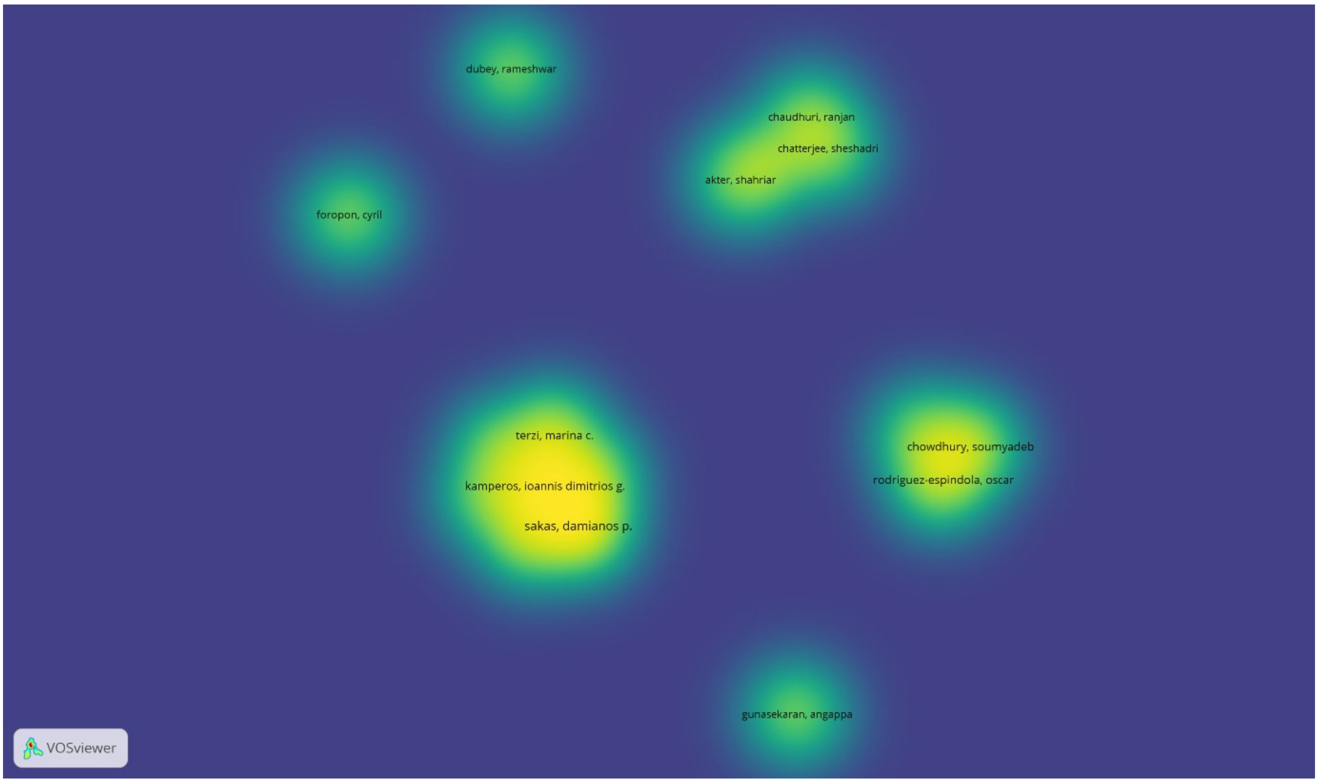

Figure 15. Co-authorship (by author) density visualization.

4.6.2. By countries

Each country had a minimum document count of one (1). All 42 countries were included in the analysis, however, only 39 are presented in the diagrams because they had no co-authorship activity with another country. A total of 9 clusters were formed with 2 medium and seven small clusters.

- cluster 1 (red) contained 7 countries.
- cluster 2 (green) included 6 countries.
- cluster 3 (blue) contained 5 countries.
- cluster 4 (yellow) included 4 countries.
- cluster 5 (purple) included 4 countries.
- cluster 6 (light blue) included 4 countries.
- cluster 7 (orange) included 4 countries.
- cluster 8 (brown) included 3 countries.
- cluster 9 (light purple) included 2 countries.

England and France demonstrate the highest Total Link Strength scores, with the United States of America, the People's Republic of China, and India following suit. Most clusters are rather merged signifying a high interlinking level, with some smaller clusters being more isolated than others. Although economically robust countries (World Economic Outlook, 2023) come forward as the leading academic centers for research in this scientific topic, smaller economies like Greece, Ireland, Malaysia, and Bangladesh also engage with this topic, with a significant group of Asian countries to be represented in many of the clusters formed.

The results align with the research conducted by Dembereldorj et al. (2028), which suggests the presence of a positive, nonlinear relationship between university performance and GDP. Evidence from citation and research metrics suggests that the significance of research is in its quality rather than its quantity and number of publications. It is concluded that universities that prioritize extensive research can indirectly contribute to the economic development of countries through their research quality. However, if we adopt a different point of view, these results could comply with the findings of Miao (2023) who proposes that the pattern of technological research progress has a substantial influence on the economic growth of a region.

The results are presented in **Table B6** (Appendix B) and **Figures 16** and **17**.

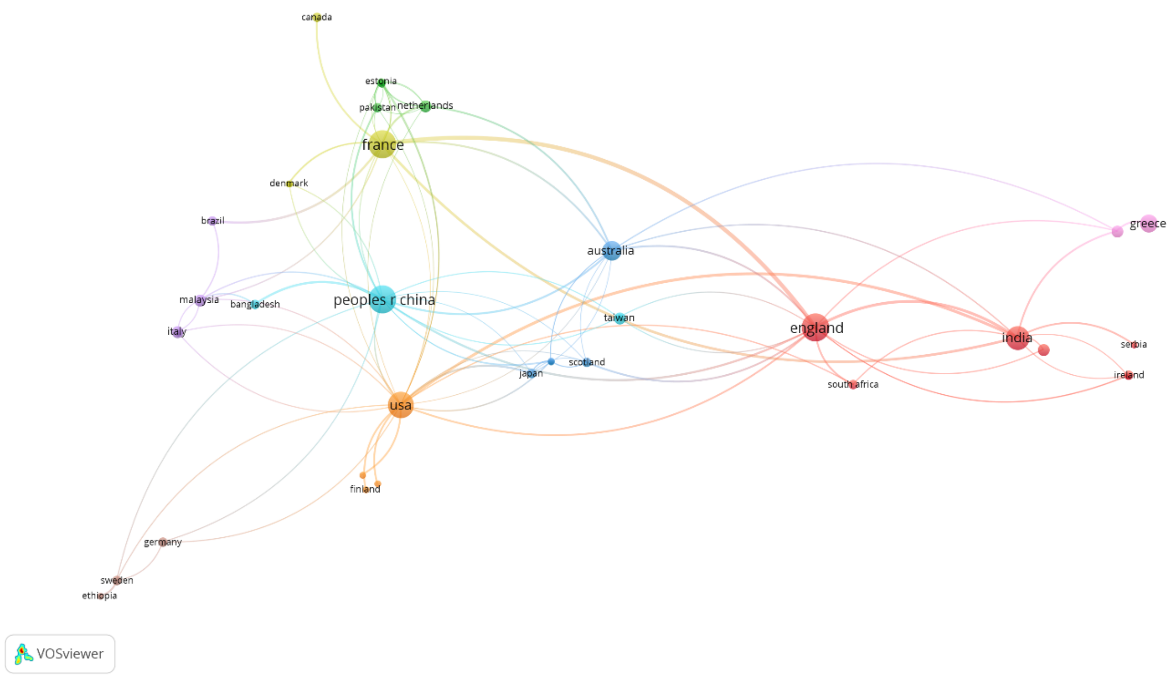

Figure 16. Co-authorship (by country) network visualization.

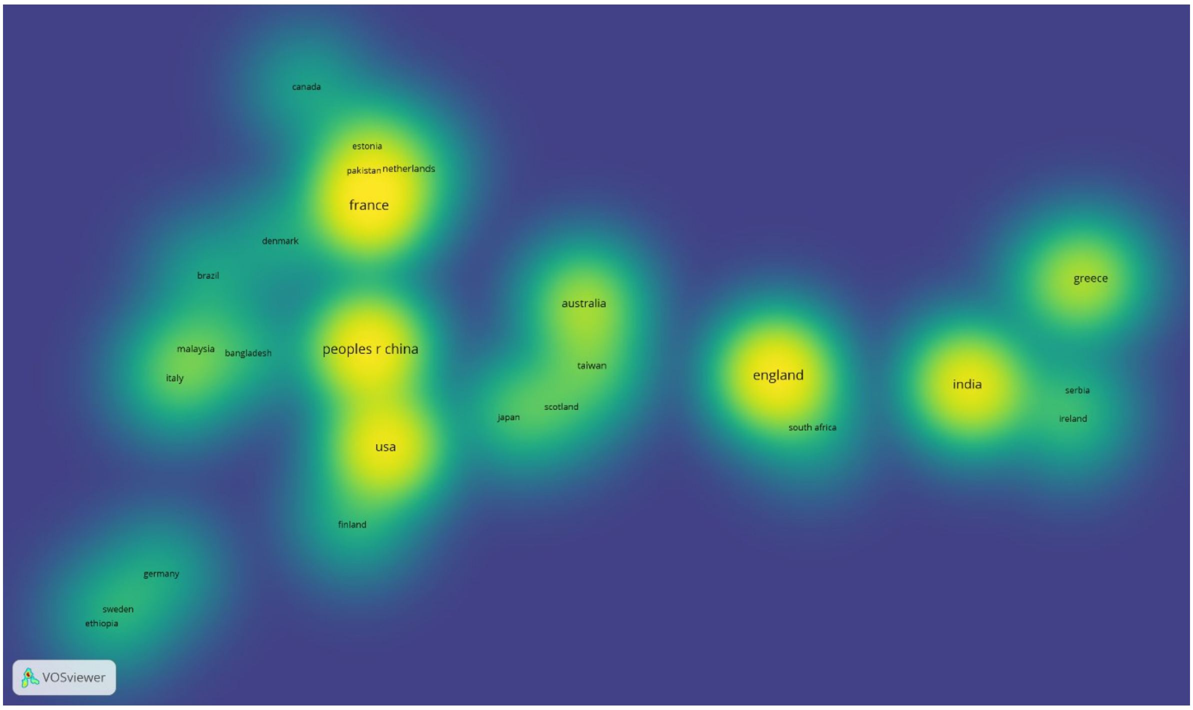

Figure 17. Co-authorship (by country) density visualization.

4.7. Co-citation (by cited sources)

Based on how frequently two sources are mentioned alongside one another in other documents, co-citation serves as an indicator of their semantic relatedness. A minimal threshold of twenty (20) citations was established for a source to be included in the bibliometric analysis. This limit allowed 55 sources to participate. A total of 5 clusters were formed with 3 range, 1 medium, and one small cluster.

- cluster 1 (red) contained 19 sources.
- cluster 2 (green) included 15 sources.
- cluster 3 (blue) contained 11 sources.
- cluster 4 (yellow) included 9 sources.
- cluster 5 (purple) included 1 source.

Despite the complexity of the diagram due to the high interlinking level between sources, clusters present a very distinctive formation. The small number of formed clusters is an additional indication of the clusters' rigidness. The large number of connections among clusters suggests that all researchers retrieve theoretical support from a "common pool of knowledge" to promote their study. "International Journal of Production Economics" a very well-respected journal with an Impact Factor of 12 presents the highest Total Link strength score (241.78). The subjects covered in this journal are mostly related to the intersection between engineering and management. The topic is treated in its entirety regarding the industries related to process and manufacturing sector, and as well as production in general. The journal's focus is multidisciplinary. This journal is followed by "The International Journal of Production Research" with a Total Link strength score (238.87) and an Impact Factor of 9.2. This journal's main goal is to spread knowledge about decision support systems for logistics, operations management, and manufacturing. The results are presented in **Table B7** (Appendix B) and in **Figures 18** and **19**.

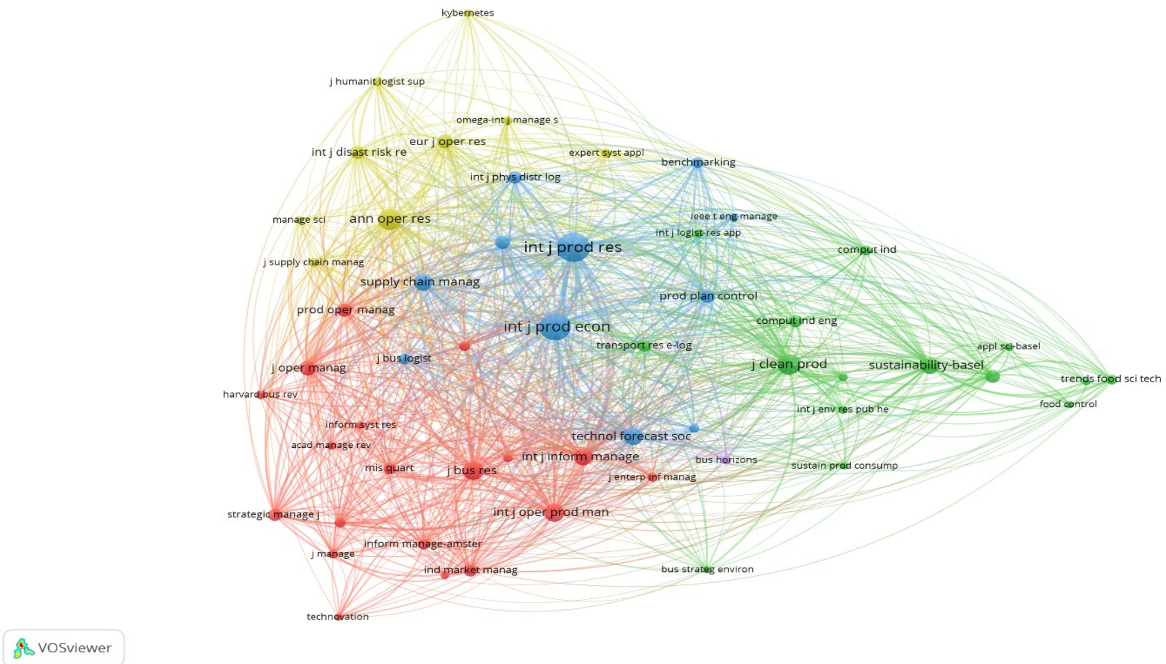

Figure 18. Co-citation (by cited source) network visualization.

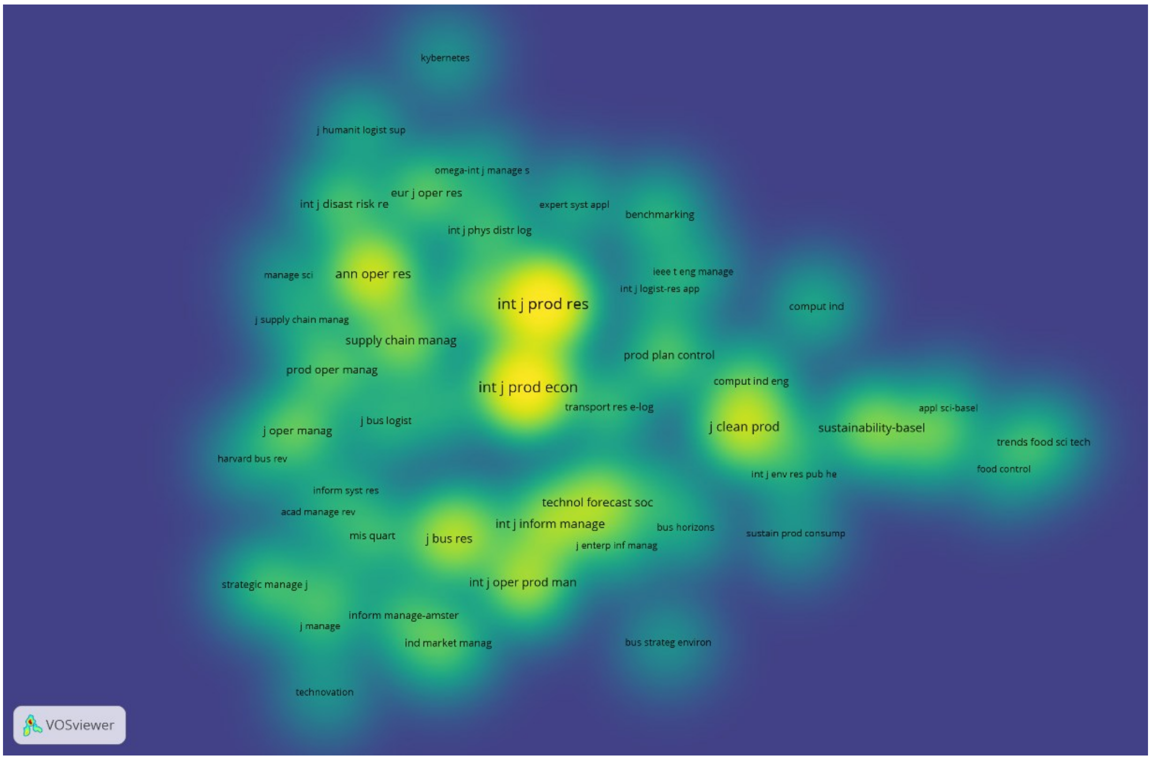

Figure 19. Co-citation (by cited source) density visualization.

5. Discussion

Results of performance analysis and all seven levels of bibliometric analysis present various areas of scientific interest, that can lead to useful outcomes. Although crises have been an area of interest for supply chains for many years (van der Vorst and Beulens, 2002), Research interest has significantly increased, particularly in response to the COVID-19 outbreak and the resulting disruption in supply chains. (Sakas and Giannakopoulos et al., 2021). This suggestion is supported by the data presented in **Figure 1**, implying a significant increase in published papers during and after the pandemic crisis. This notion is also supported by the co-occurrence analysis by author keywords, which classify as dominant the keyword "COVID-19".

Co-occurrence analysis by author keywords as well as text data analysis suggests that big data and data modeling is an area of emerging interest for supply chain crisis management as well as presents the strong connection between the terms of supply chain crisis management and financial risk management. These results further support the proposition of utilizing big data and data modeling as a supply chain crisis financial risk management tool answering Q1 of this study. This tendency implies the orientation of supply chain organizations towards crisis preparedness and vulnerability mitigation through effective financial risk management procedures based on both external and internal big data and data modeling-based quantitative analysis procedures.

Although economically robust economies lead the way in scientific research regarding big data and supply chain crisis financial risk management, results of co-authorship by countries, suggest that smaller countries, with developed economies have focused on the same scientific topic as well, to fortify their supply chains against upcoming crises, by adopting computerized methods as crisis financial risk management tools. Although this suggestion could describe a global supply chain inclination, bibliometric analysis results imply that a significant number of underdeveloped Asian economies follow that option providing an important insight regarding Q3 of this study.

Co-authorship analysis indicates that researchers in this scientific field are conducting research in introverted research teams with limited interconnections with other researchers from different research institutions. These results provide an answer to Q2 of this study. Although this result could be explained in many ways, more inter-academia collaboration could be encouraged to promote research in this scientific field.

Recent examples of crises of different natures have proven that all aspects of economies link together in an unavoidable domino effect up to the last members of the supply chains. As the latest example, the war crisis in the area of Israel has triggered serious problems to world trade through the Red Sea and the Suez Canal, threatening European economies with high rises in product prices for the final consumers. This implication of the Thucydidean Theory (Kokaz, 2001) to modern economies, joined by the wave of the climate crisis, clearly introduces global supply chains to an era of instability where emerging financial risks of various natures are the new standard. Utilization of new technologies regarding big data and data modeling through forecasting applications as an effective supply chain crisis financial risk management tool should be the focus point of economic and trade organizations who want to invest in organizational sustainability and vulnerability mitigation within this financial risk eruption environment.

Although there is ample research on the correlation between Big Data and the management of financial risks in supply chains, there is a scarcity of review papers that specifically address the context of crises. Through a comparison of the present study with a relevant study conducted by Zamani et al. (2022), which primarily utilized systematic literature review (SLR) analysis with internationally recognized researchers and experts, it is evident that the bibliometric approach proposed in this paper offers a more impartial and comprehensive method for identifying research directions and fostering academic collaboration. This is achieved through detailed visual representations of the dynamics within the research field.

6. Limitations

The study addresses three research inquiries: Initially, we endeavored to determine whether Big Data is a prominent area of research in the field of Supply Chain Crisis Financial Risk Management. Furthermore, our study specifically examined the utilization of collaboration between academic institutions across international borders to enhance research activities. Our third objective was to examine the impact of a country’s economic progress on research efforts in Big Data and Supply Chain Crises Financial Risk Management.

A weakness that affects in general the purpose of the study is that it solely relies on the Web of Science database. Utilization of more database results could provide a more solid result regarding our research questions, however practical challenges regarding analysis through the bibliometric software would apply. Another constraint of the original study's contribution is its exclusive reliance on metadata related to the text, source, and citation information. Additional details such as the methodology employed, and the software utilized would enhance the comprehensiveness and utility of the research findings in the particular scientific domain.

7. Conclusions and future work

This study conducted a bibliometric analysis of Big Data and supply chain crisis financial risk management from 2013 to 2023. Its aim was to map out and identify the research structure related to this topic. There has been a significant rise in the quantity of publications and citations on the subject during the previous five years. Furthermore, the study contributions encompass a diverse range of crisis kinds, with the COVID-19 pandemic crisis being the most prominent. However, the collaboration between institutions is clearly restricted. This has constrained the theoretical advancement of the area and may have added to the confusion in comprehending the research topic.

The techniques and approach devised in this study are not exclusive to Big Data. In future research, the approach and experiences used in the current study can be extended to the research areas of Artificial Intelligence (AI) and Machine Learning (ML) in the context of managing financial risks in supply chain crises. Furthermore, the examination of co-authorship in this work provides a vital viewpoint on the correlation between a nation's economic advancement and its research endeavors in the fields of Big Data and financial risk management in supply chain crises. Additional research could be undertaken to establish the association between a country's financial growth indexes and the research performance of its academic institutions, specifically in reference, but not limited, to the scientific issue being researched in this study.

Conflict of interest: The authors declare no conflict of interest.

References

Armani, A. M., Hurt, D. E., Hwang, D., et al. (2020). Low-tech solutions for the COVID-19 supply chain crisis. Nature Reviews Materials, 5(6), 403–406. https://doi.org/10.1038/s41578-020-0205-1

Baldini, G., Oliveri, F., Braun, M., et al. (2012). Securing disaster supply chains with cryptography enhanced RFID. Disaster Prevention and Management: An International Journal, 21(1), 51–70. https://doi.org/10.1108/09653561211202700

Blackhurst, J., Wu, T., & O'Grady, P. (2004). Network-based approach to modelling uncertainty in a supply chain. International Journal of Production Research, 42(8), 1639–1658. https://doi.org/10.1080/00207540310001646064

Block, J. H., & Fisch, C. (2020). Eight tips and questions for your bibliographic study in business and management research. Management Review Quarterly, 70(3), 307–312. https://doi.org/10.1007/s11301-020-00188-4

Braithwaite, A., & Hall, D. (1999). Risky Business? Critical Decisions in Supply Chain Management: Part 1. Supply Chain Practice, 1(2), 40–55.

Childerhouse, P., & Towill, D. R. (2004). Reducing uncertainty in European supply chains. Journal of Manufacturing Technology Management, 15(7), 585–598. https://doi.org/10.1108/17410380410555835

Dembereldorj, Z., Dangaasuren, G., & Jagdag, D. (2018). Relationships between University Performances and Economic Growth. International Journal of Higher Education, 7(4), 123. https://doi.org/10.5430/ijhe.v7n4p123

Desoutter, M., & Lavissière, A. (2018). Handling Supply Chain Crises when everything has been done to avoid them. Supply Chain Forum: An International Journal, 19(3), 219–232. https://doi.org/10.1080/16258312.2018.1484250

Donthu, N., Kumar, S., Mukherjee, D., et al. (2021). How to conduct a bibliometric analysis: An overview and guidelines. Journal of Business Research, 133, 285–296. https://doi.org/10.1016/j.jbusres.2021.04.070

Durugbo, C. M., & Al-Balushi, Z. (2022). Supply chain management in times of crisis: a systematic review. Management Review

Quarterly, 73(3), 1179–1235. https://doi.org/10.1007/s11301-022-00272-x

Emmanouil, D., & Nikolaos, D. (2015). Big data analytics in prevention, preparedness, response and recovery in crisis and disaster management. In: Proceedings of the 18th International Conference on Circuits, Systems, Communications and Computers (CSCC 2015). pp. 476–482.

Engardio, P. (2001). Why the Supply Chain Broke Down. Business Week, 3724, 41–41.

Fertier, A., Montarnal, A., Barthe-Delanoë, A. M., et al. (2016). Adoption of big data in crisis management toward a better support in decision-making. In: Proceedings of Conference on Information System for Crisis Response and Management (ISCRAM 16).

Goh, M., Lim, J. Y. S., & Meng, F. (2007). A stochastic model for risk management in global supply chain networks. European Journal of Operational Research, 182(1), 164–173. https://doi.org/10.1016/j.ejor.2006.08.028

Heckmann, I., Comes, T., & Nickel, S. (2015). A critical review on supply chain risk—Definition, measure and modeling. Omega, 52, 119–132. https://doi.org/10.1016/j.omega.2014.10.004

Hermann, C. F. (1963). Some Consequences of Crisis Which Limit the Viability of Organizations. Administrative Science Quarterly, 8(1), 61. https://doi.org/10.2307/2390887

Hittle, B., & Moustafa Leonard, K. (2011). Decision making in advance of a supply chain crisis. Management Decision, 49(7), 1182–1193. https://doi.org/10.1108/00251741111151208

Honkanen, U. (2013). How Companies Are Securing Their Supply Chain during Crisis Situations. Available online: https://urn.fi/URN:NBN:fi:amk-201301301870 (accessed on 13 December 2023).

International Monetary Funt. (2024). World Economic Outlook 2023—GDP, Current Prices. Available online: https://www.imf.org/external/datamapper/NGDPD@WEO (accessed on 7 February 2024).

ISO. (2012). "ISO/PAS 22399:2007." ISO. Available online: https://www.iso.org/standard/50295.html (accessed on 13 December 2023).

Ivanov, D. (2020). Viable supply chain model: integrating agility, resilience and sustainability perspectives—lessons from and thinking beyond the COVID-19 pandemic. Annals of Operations Research, 319(1), 1411–1431. https://doi.org/10.1007/s10479-020-03640-6

James, E. H., Wooten, L. P., & Dushek, K. (2011). Crisis Management: Informing a New Leadership Research Agenda. Academy of Management Annals, 5(1), 455–493. https://doi.org/10.5465/19416520.2011.589594

Jüttner, U., & Maklan, S. (2011). Supply chain resilience in the global financial crisis: an empirical study. Supply Chain Management: An International Journal, 16(4), 246–259. https://doi.org/10.1108/13598541111139062

Kaniewski, D., Marriner, N., Morhange, C., et al. (2023). Climate change threatens olive oil production in the Levant. Nature Plants, 9(2), 219–227. https://doi.org/10.1038/s41477-022-01339-z

King, G. (2002). Crisis Management & Team Effectiveness: A Closer Examination. Journal of Business Ethics, 41(3), 235–249. https://doi.org/10.1023/A:1021200514323

Kokaz, N. (2001). Moderating power: a Thucydidean perspective. Review of International Studies, 27(1), 027–049. https://doi.org/10.1017/s0260210500010275

Kull, T., & Closs, D. (2008). The risk of second-tier supplier failures in serial supply chains: Implications for order policies and distributor autonomy. European Journal of Operational Research, 186(3), 1158–1174. https://doi.org/10.1016/j.ejor.2007.02.028

Kurniawan, R., & Zailani, S. (2010). Supply Chain Vulnerability and Mitigation Strategy of the Manufacturing Firms in Indonesia: Manager's Perspectives. International Business Management, 4(3), 116–123. https://doi.org/10.3923/ibm.2010.116.123

La Soa, N., Duy, D. D., Thanh Hang, T. T., et al. (2024). The Impact of Environmental Accounting Information Disclosure on Financial Risk: The Case of Listed Companies in the Vietnam Stock Market. Journal of Risk and Financial Management, 17(2), 62. https://doi.org/10.3390/jrfm17020062

Mac Fadden, I., Santana, M., Vázquez-Cano, E., et al. (2020). A science mapping analysis of 'marginality, stigmatization and social cohesion' in WoS (1963–2019). Quality & Quantity, 55(1), 275–293. https://doi.org/10.1007/s11135-020-01004-7

Manuj, I., & Mentzer, J. T. (2008). Global supply chain risk management strategies. International Journal of Physical Distribution & Logistics Management, 38(3), 192–223. https://doi.org/10.1108/09600030810866986

March, J. G., & Shapira, Z. (1987). Managerial Perspectives on Risk and Risk Taking. Management Science, 33(11), 1404–1418. https://doi.org/10.1287/mnsc.33.11.1404

Mariotti, S. (2022). A warning from the Russian–Ukrainian war: avoiding a future that rhymes with the past. Journal of Industrial and Business Economics, 49(4), 761–782. https://doi.org/10.1007/s40812-022-00219-z

Merz, M., Hiete, M., & Bertsch, V. (2009). Multicriteria decision support for business continuity planning in the event of critical infrastructure disruptions. International Journal of Critical Infrastructures, 5(1/2), 156. https://doi.org/10.1504/ijcis.2009.022854

Miao, W. (2023). Research on the Impact of University Innovation Capacity on Regional Economic Growth in Beijing. BCP Business & Management, 48, 160–170. https://doi.org/10.54691/bcpbm.v48i.5262

Miller, K. D. (1992). A Framework for Integrated Risk Management in International Business. Journal of International Business Studies, 23(2), 311–331. https://doi.org/10.1057/palgrave.jibs.8490270

Montero-Díaz, J., Cobo, M. J., Gutiérrez-Salcedo, M., et al. (2018). A science mapping analysis of 'Communication' WoS subject category (1980-2013). Comunicar, 26(55), 81–91. https://doi.org/10.3916/c55-2018-08

Natarajarathinam, M., Capar, I., & Narayanan, A. (2009). Managing supply chains in times of crisis: a review of literature and insights. International Journal of Physical Distribution & Logistics Management, 39(7), 535–573. https://doi.org/10.1108/09600030910996251

Natufe, O. K., & Evbayiro-Osagie, E. I. (2023). Credit Risk Management and the Financial Performance of Deposit Money Banks: Some New Evidence. Journal of Risk and Financial Management, 16(7), 302. https://doi.org/10.3390/jrfm16070302

OECD. (2020). The Territorial Impact of COVID-19: Managing the Crisis across Levels of Government. OECD. Available online: https://read.oecd-ilibrary.org/view/?ref=128_128287-5agkkojaaa&title=The-territorial-impact-of-covid-19-managing-the-crisis-across-levels-of-government (accessed on 13 December 2023).

Orenga-Roglá, S., & Chalmeta, R. (2016). Social customer relationship management: taking advantage of Web 2.0 and Big Data technologies. SpringerPlus, 5(1). https://doi.org/10.1186/s40064-016-3128-y

Pearson, C. M., & Clair, J. A. (1998). Reframing Crisis Management. The Academy of Management Review, 23(1), 59. https://doi.org/10.2307/259099

Pfohl, H. C., Köhler, H., & Thomas, D. (2010). State of the art in supply chain risk management research: empirical and conceptual findings and a roadmap for the implementation in practice. Logistics Research, 2(1), 33–44. https://doi.org/10.1007/s12159-010-0023-8

Qadir, J., Ali, A., ur Rasool, R., et al. (2016). Crisis analytics: big data-driven crisis response. Journal of International Humanitarian Action, 1(1). https://doi.org/10.1186/s41018-016-0013-9

Roberts, K. H. (1990). Managing High Reliability Organizations. California Management Review, 32(4), 101–113. https://doi.org/10.2307/41166631

Sakas, D. P., Giannakopoulos, N. T., Reklitis, D. P., et al. (2021). The Effects of Cryptocurrency Trading Websites on Airlines' Advertisement Campaigns. Journal of Theoretical and Applied Electronic Commerce Research, 16(7), 3099–3119. https://doi.org/10.3390/jtaer16070169

Sakas, D. P., Kamperos, I. D. G., & Reklitis, P. (2021). Estimating Risk Perception Effects on Courier Companies' Online Customer Behavior during a Crisis, Using Crowdsourced Data. Sustainability, 13(22), 12725. https://doi.org/10.3390/su132212725

Saleem, F., Khattak, A., Ur Rehman, S., et al. (2021). Bibliometric Analysis of Green Marketing Research from 1977 to 2020. Publications, 9(1), 1. https://doi.org/10.3390/publications9010001

Sapriel, C. (2003). Effective crisis management: Tools and best practice for the new millennium. Journal of Communication Management, 7(4), 348–355. https://doi.org/10.1108/13632540310807485

Sarkis, J. (2020). Supply chain sustainability: learning from the COVID-19 pandemic. International Journal of Operations & Production Management, 41(1), 63–73. https://doi.org/10.1108/ijopm-08-2020-0568

Sawyerr, E., & Harrison, C. (2019). Developing resilient supply chains: lessons from high-reliability organisations. Supply Chain Management: An International Journal, 25(1), 77–100. https://doi.org/10.1108/scm-09-2018-0329

Singh, N., & Hong, P. (2023). CSR, Risk Management Practices, and Performance Outcomes: An Empirical Investigation of Firms in Different Industries. Journal of Risk and Financial Management, 16(2), 69. https://doi.org/10.3390/jrfm16020069

Svensson, G. (2004). Vulnerability in business relationships: the gap between dependence and trust. Journal of Business & Industrial Marketing, 19(7), 469–483. https://doi.org/10.1108/08858620410564418

Tang, C. S. (2006). Robust strategies for mitigating supply chain disruptions. International Journal of Logistics Research and Applications, 9(1), 33–45. https://doi.org/10.1080/13675560500405584

Taylor-Sakyi, K. (2016). Big Data: Understanding Big Data. Available online: https://arxiv.org/ftp/arxiv/papers/1601/1601.04602.pdf (accessed on 25 December 2023).

van der Vorst, J. G. A. J., & Beulens, A. J. M. (2002). Identifying sources of uncertainty to generate supply chain redesign strategies. International Journal of Physical Distribution & Logistics Management, 32(6), 409–430. https://doi.org/10.1108/09600030210437951

van Eck, N. J., & Waltman, L. (2009). Software survey: VOSviewer, a computer program for bibliometric mapping. Scientometrics, 84(2), 523–538. https://doi.org/10.1007/s11192-009-0146-3

van Eck, N. J., & Waltman, L. (2017). Citation-based clustering of publications using CitNetExplorer and VOSviewer. Scientometrics, 111(2), 1053–1070. https://doi.org/10.1007/s11192-017-2300-7

Supply Chain Risk. (2009). In G. A. Zsidisin & B. Ritchie (Eds.), International Series in Operations Research & Management Science. Springer US. https://doi.org/10.1007/978-0-387-79934-6

Wagner, S. M., Mizgier, K. J., & Papageorgiou, S. (2017). Operational disruptions and business cycles. International Journal of Production Economics, 183, 66–78. https://doi.org/10.1016/j.ijpe.2016.10.002

Wieland, A., & Wallenburg, C. M. (2012). Dealing with supply chain risks. International Journal of Physical Distribution & Logistics Management, 42(10), 887–905. https://doi.org/10.1108/09600031211281411

Zamani, E. D., Smyth, C., Gupta, S., et al. (2022). Artificial intelligence and big data analytics for supply chain resilience: a systematic literature review. Annals of Operations Research, 327(2), 605–632. https://doi.org/10.1007/s10479-022-04983-y

Zsidisin, G. A. (2003). A grounded definition of supply risk. Journal of Purchasing and Supply Management, 9(5–6), 217–224. https://doi.org/10.1016/j.pursup.2003.07.002

Appendix A

Selected Publications Dataset

Aggio, C., Milesi, D., Verre, V., et al. (2022). Rise and fall (and recovery?) of the blueberry business in Argentina: An analysis of private and public-private strategies. Journal of Agribusiness in Developing and Emerging Economies, 12(4), 584–603. https://doi.org/10.1108/JADEE-10-2021-0270

Akter, S., Motamarri, S., Sajib, S., et al. (2021). Theorising the Microfoundations of analytics empowerment capability for humanitarian service systems. In: Annals of Operations Research. Springer. https://doi.org/10.1007/s10479-021-04386-5

Akter, S., & Wamba, S. F. (2019). Big data and disaster management: A systematic review and agenda for future research. In: Annals of Operations Research. Springer. pp. 939–959. https://doi.org/10.1007/s10479-017-2584-2

Amentae, T. K., & Gebresenbet, G. (2021). Digitalization and Future Agro-Food Supply Chain Management: A Literature-Based Implications. Sustainability, 13(21). https://doi.org/10.3390/su132112181

Ashiru, F., Nakpodia, F., & You, J. J. (2023). Adapting emerging digital communication technologies for resilience: Evidence from Nigerian SMEs. In: Annals of Operations Research. Springer. pp. 795–823. https://doi.org/10.1007/s10479-022-05049-9

Bag, S., Dhamija, P., Luthra, S., & Huisingh, D. (2023). How big data analytics can help manufacturing companies strengthen supply chain resilience in the context of the COVID-19 pandemic. International Journal of Logistics Management, 34(4), 1141–1164. https://doi.org/10.1108/IJLM-02-2021-0095

Balaman, S. Y. (2016). Investment planning and strategic management of sustainable systems for clean power generation: An ε-constraint based multi objective modelling approach. Journal of Cleaner Production, 137, 1179–1190. https://doi.org/10.1016/j.jclepro.2016.07.202

Begum, H., Abbas, K., Alam, A. S. A. F., et al. (2022). Impact of the COVID-19 pandemic on the environment and socioeconomic viability: A sustainable production chain alternative. Foresight, 24(3/4), 456–475. https://doi.org/10.1108/FS-02-2021-0053

Belhadi, A., Mani, V., Kamble, S. S., et al. (2021). Artificial intelligence-driven innovation for enhancing supply chain resilience and performance under the effect of supply chain dynamism: An empirical investigation. In: Annals of Operations Research. Springer. https://doi.org/10.1007/s10479-021-03956-x

Chang, J. J., & Hu, Z. J. (2023). The effect of overconfidence in a robust competing game. Kybernetes. https://doi.org/10.1108/K-02-2023-0261

Chatterjee, S., Chaudhuri, R., Shah, M., & Maheshwari, P. (2022). Big data driven innovation for sustaining SME supply chain operation in post COVID-19 scenario: Moderating role of SME technology leadership. Computers & Industrial Engineering, 168. https://doi.org/10.1016/j.cie.2022.108058

Chatterjee, S., Chaudhuri, R., & Vrontis, D. (2023). Role of fake news and misinformation in supply chain disruption: Impact of technology competency as moderator. In: Annals of Operations Research. Springer. pp. 659–682. https://doi.org/10.1007/s10479-022-05001-x

Chen, Y., & Biswas, M. I. (2021). Turning Crisis into Opportunities: How a Firm Can Enrich Its Business Operations Using Artificial Intelligence and Big Data during COVID-19. Sustainability, 13(22). https://doi.org/10.3390/su132212656

Chowdhury, S., Rodriguez-Espindola, O., Dey, P., & Budhwar, P. (2023). Blockchain technology adoption for managing risks in operations and supply chain management: Evidence from the UK. In: Annals of Operations Research. Springer. pp. 539–574. https://doi.org/10.1007/s10479-021-04487-1

Comes, T., Van de Walle, B., & Van Wassenhove, L. (2020). The Coordination-Information Bubble in Humanitarian Response: Theoretical Foundations and Empirical Investigations. In: Production and Operations Management. Wiley. pp. 2484–2507. https://doi.org/10.1111/poms.13236

Di Vaio, A., Latif, B., Gunarathne, N., et al. (2023). Digitalization and artificial knowledge for accountability in SCM: a systematic literature review. Journal of Enterprise Information Management. https://doi.org/10.1108/JEIM-08-2022-0275

Dohale, V., Ambilkar, P., Gunasekaran, A., & Bilolikar, V. (2022). Examining the barriers to operationalization of humanitarian supply chains: Lessons learned from COVID-19 crisis. In: Annals of Operations Research. Springer. https://doi.org/10.1007/s10479-022-04752-x

Dubey, R. (2023). Unleashing the potential of digital technologies in emergency supply chain: The moderating effect of crisis leadership. Industrial Management & Data Systems, 123(1), 112–132. https://doi.org/10.1108/IMDS-05-2022-0307

Dubey, R., Bryde, D. J., Blome, C., et al. (2021). Facilitating artificial intelligence powered supply chain analytics through alliance management during the pandemic crises in the B2B context. Industrial Marketing Management, 96, 135–146. https://doi.org/10.1016/j.indmarman.2021.05.003

Fertier, A., Martin, G., Barthe-Delanoe, A. M., et al. (2021). Managing events to improve situation awareness and resilience in a supply chain. In: Computers in Industry. Elsevier. 132. https://doi.org/10.1016/j.compind.2021.103488

Flynn, G., Nagle, T., & Fitzgerald, C. (2022). Data Evolution in Times of Crisis: An Organizational Mindfulness Perspective. In: Information Systems Frontiers. Springer. https://doi.org/10.1007/s10796-022-10275-4

Fuqua, D., & Hespeler, S. (2022). Commodity demand forecasting using modulated rank reduction for humanitarian logistics planning. Expert Systems with Applications, 206. https://doi.org/10.1016/j.eswa.2022.117753

Gour, A., Aggarwal, S., & Kumar, S. (2022). Lending ears to unheard voices: An empirical analysis of user-generated content on social media. In: Production and Operations Management. Wiley. pp. 2457–2476. https://doi.org/10.1111/poms.13732

Guruswamy, S., Pojic, M., Subramanian, J., et al. (2022). Toward Better Food Security Using Concepts from Industry 5.0. Sensors, 22(21). https://doi.org/10.3390/s22218377

Hassoun, A., Marvin, H. J. P., Bouzembrak, Y., et al. (2023). Digital transformation in the agri-food industry: Recent applications and the role of the COVID-19 pandemic. Frontiers in Sustainable Food Systems, 7. https://doi.org/10.3389/fsufs.2023.1217813

Hong, P., Ahn, N. Y., & Jung, E. (2023). Linkage role of ICT and Big Data in COVID-19: A case of Korea's digital and social communication practices. Journal of Information Communication & Ethics in Society, 21(2), 161–180. https://doi.org/10.1108/JICES-02-2022-0020

Huang, J., Xie, D., Qiu, Y., et al. (2023). Green supply chain management: A renewable energy planning and dynamic inventory operations for perishable products. International Journal of Production Research. https://doi.org/10.1080/00207543.2023.2220047

Ivanov, D. (2020). Viable supply chain model: Integrating agility, resilience and sustainability perspectives-lessons from and thinking beyond the COVID-19 pandemic. In: Annals of Operations Research. Springer. https://doi.org/10.1007/s10479-020-03640-6

Joseph Jerome, J. J., Saxena, D., Sonwaney, V., & Foropon, C. (2022). Procurement 4.0 to the rescue: Catalysing its adoption by modelling the challenges. Benchmarking-an International Journal, 29(1), 217–254. https://doi.org/10.1108/BIJ-01-2021-0030

Justy, T., Pellegrin-Boucher, E., Lescop, D., et al. (2023). On the edge of Big Data: Drivers and barriers to data analytics adoption in SMEs. Technovation, 127. https://doi.org/10.1016/j.technovation.2023.102850

Kapetanopoulou, P., Kouroutzi, A., & Anastasiadou, S. (2021). The Impact of Information Systems Implementation in the Greek Manufacturing Enterprises. Applied Sciences-Basel, 11(24). https://doi.org/10.3390/app112411781

Kondraganti, A., Narayanamurthy, G., & Sharifi, H. (2022). A systematic literature review on the use of big data analytics in humanitarian and disaster operations. In: Annals of Operations Research. Springer. https://doi.org/10.1007/s10479-022-04904-z

Kumar, A., Joshi, S., Sharma, M., & Vishvakarma, N. (2022). Digital humanitarianism and crisis management: An empirical study of antecedents and consequences. Journal of Humanitarian Logistics and Supply Chain Management, 12(4), 570–593. https://doi.org/10.1108/JHLSCM-02-2022-0020

Lachaab, M., & Omri, A. (2023). Machine and deep learning-based stock price prediction during the COVID-19 pandemic: The case of CAC 40 index. Euromed Journal of Business. https://doi.org/10.1108/EMJB-05-2022-0104

Lamieri, M., & Sangalli, I. (2019). The propagation of liquidity imbalances in manufacturing supply chains: Evidence from a spatial auto-regressive approach. European Journal of Finance, 25(15), 1377–1401. https://doi.org/10.1080/1351847X.2019.1596962

Lee, C. H., Yang, H. C., Wei, Y. C., & Hsu, W. K. (2021). Enabling Blockchain Based SCM Systems with a Real Time Event Monitoring Function for Preemptive Risk Management. Applied Sciences-basel, 11(11). https://doi.org/10.3390/app11114811

Lee, O. K. D., Jiang, S., Hyun, Y., & Jeong, H. (2022). The Role of Information Technologies in Crises: A Review and Conceptual Development of IT-Enabled Agile Crisis Management. Communications of The Association for Information Systems, 50, 857–890. https://doi.org/10.17705/1CAIS.05038

Lenzen, M., Li, M., Malik, A., et al. (2020). Global socio-economic losses and environmental gains from the Coronavirus pandemic. Public Library Science, 15(7). https://doi.org/10.1371/journal.pone.0235654

Li, W. Y., Choi, T. M., & Chow, P. S. (2015). Risk and benefits brought by formal sustainability programs on fashion enterprises under market disruption. Resources Conservation and Recycling, 104(B), 348–353. https://doi.org/10.1016/j.resconrec.2014.08.005

Lioutas, E. D., & Charatsari, C. (2021). Enhancing the ability of agriculture to cope with major crises or disasters: What the experience of COVID-19 teaches us. Agricultural Systems, 187. https://doi.org/10.1016/j.agsy.2020.103023

London, J., Jr., & Matthews, K. (2022). Crisis communication on social media-lessons from Covid-19. Journal of Decision Systems, 31(1–2), 150–170. https://doi.org/10.1080/12460125.2021.1926612

Longo, F., Mirabelli, G., Solina, V., et al. (2022). A Simulation-Based Framework for Manufacturing Design and Resilience Assessment: A Case Study in the Wood Sector. Applied Sciences-basel, 12(15). https://doi.org/10.3390/app12157614

Lu, X., Horn, A. L., Su, J., & Jiang, J. (2019). A Universal Measure for Network Traceability. Omega-International Journal of Management Science, 87(SI), 191–204. https://doi.org/10.1016/j.omega.2018.09.004

Mangla, S. K., Kazancoglu, Y., Yildizbasi, A., et al. (2022). A conceptual framework for blockchain-based sustainable supply chain and evaluating implementation barriers: A case of the tea supply chain. Business Strategy and the Environment, 31(8), 3693–3716. https://doi.org/10.1002/bse.3027

Mendi, A. F. (2022). Blockchain for Food Tracking. Electronics, 11(16). https://doi.org/10.3390/electronics11162491

Modgil, S., Singh, R. K., & Foropon, C. (2020). Quality management in humanitarian operations and disaster relief management: A review and future research directions. In: Annals of Operations Research. Springer. https://doi.org/10.1007/s10479-020-03695-5

Nand, A., Sohal, A., Fridman, I., et al. (2023). An exploratory study of organizational and industry drivers for the implementation of emerging technologies in logistics. Industrial Management & Data Systems. https://doi.org/10.1108/IMDS-08-2022-0467

Nguyen, A., Lamouri, S., Pellerin, R., et al. (2022). Data analytics in pharmaceutical supply chains: State of the art, opportunities, and challenges. International Journal of Production Research, 60(22), 6888–6907. https://doi.org/10.1080/00207543.2021.1950937

Ogbuke, N., Yusuf, Y. Y. Y., Gunasekaran, A., et al. (2023). Data-driven technologies for global healthcare practices and COVID-19: Opportunities and challenges. In: Annals of Operations Research. Springer. https://doi.org/10.1007/s10479-023-05462-8

O'Leary, D. E. (2020). Evolving Information Systems and Technology Research Issues for COVID-19 and Other Pandemics. Journal of Organizational Computing and Electronic Commerce, 30(1), 1–8. https://doi.org/10.1080/10919392.2020.1755790

Papanagnou, C., Seiler, A., Spanaki, K., Papadopoulos, T., & Bourlakis, M. (2022). Data-driven digital transformation for emergency situations: The case of the UK retail sector. International Journal of Production Economics, 250. https://doi.org/10.1016/j.ijpe.2022.108628

Peng, X., Zhao, Z., Wang, X., et al. (2023). A review on blockchain smart contracts in the agri-food industry: Current state, application challenges and future trends. Computers and Electronics in Agriculture, 208. https://doi.org/10.1016/j.compag.2023.107776

Queiroz, M. M., Jabbour, C. J. C., Jabbour, A. B. L. de S., et al. (2022). Peace engineering and compassionate operations: A framework for leveraging social good. Benchmarking-an International Journal. https://doi.org/10.1108/BIJ-01-2022-0021

Rodriguez-Espindola, O., Chowdhury, S., Beltagui, A., & Albores, P. (2020). The potential of emergent disruptive technologies for humanitarian supply chains: The integration of blockchain, Artificial Intelligence and 3D printing. International Journal of Production Research, 58(15), 4610–4630. https://doi.org/10.1080/00207543.2020.1761565

Rodriguez-Espindola, O., Chowdhury, S., Dey, P. K., et al. (2022). Analysis of the adoption of emergent technologies for risk management in the era of digital manufacturing. Technological Forecasting and Social Change, 178. https://doi.org/10.1016/j.techfore.2022.121562

Roman Pais Seles, B. M., Lopes de Sousa Jabbour, A. B., Chiappetta Jabbour, C. J., et al. (2018). Business opportunities and challenges as the two sides of the climate change: Corporate responses and potential implications for big data management towards a low carbon society. Journal of Cleaner Production, 189, 763–774. https://doi.org/10.1016/j.jclepro.2018.04.113

Sakas, D. P., Giannakopoulos, N. T., Margaritis, M., & Kanellos, N. (2023). Modeling Supply Chain Firms' Stock Prices in the Fertilizer Industry through Innovative Cryptocurrency Market Big Data. International Journal of Financial Studies, 11(3). https://doi.org/10.3390/ijfs11030088

Sakas, D. P., Giannakopoulos, N. T., Terzi, M. C., et al. (2022). Social Media Strategy Processes for Centralized Payment

Network Firms after a War Crisis Outset. Processes, 10(10). https://doi.org/10.3390/pr10101995

Sakas, D. P., Kamperos, I. D. G., Reklitis, D. P., et al. (2022). The Effectiveness of Centralized Payment Network Advertisements on Digital Branding during the COVID-19 Crisis. Sustainability, 14(6). https://doi.org/10.3390/su14063616

Sakas, D. P., Kamperos, I. D. G., & Reklitis, P. (2021). Estimating Risk Perception Effects on Courier Companies' Online Customer Behavior during a Crisis, Using Crowdsourced Data. Sustainability, 13(22). https://doi.org/10.3390/su132212725

Sakas, D. P., Kamperos, I. D. G., & Terzi, M. C. (2022). The Long-Term Risk Familiarity Effect on Courier Services' Digital Branding during the COVID-19 Crisis. Journal of Theoretical and Applied Electronic Commerce Research, 17(4), 1655–1684. https://doi.org/10.3390/jtaer17040084

Sarkis, J. (2021). Supply chain sustainability: Learning from the COVID-19 pandemic. International Journal of Operations & Production Management, 41(1), 63–73. https://doi.org/10.1108/IJOPM-08-2020-0568

Shahzad, F., Du, J., Khan, I., & Wang, J. (2022). Decoupling Institutional Pressure on Green Supply Chain Management Efforts to Boost Organizational Performance: Moderating Impact of Big Data Analytics Capabilities. Frontiers in Environmental Science, 10. https://doi.org/10.3389/fenvs.2022.911392

Shakibaei, H., Farhadi-Ramin, M. R., Alipour-Vaezi, M., et al. (2023). Designing a post-disaster humanitarian supply chain using machine learning and multi-criteria decision-making techniques. Kybernetes. https://doi.org/10.1108/K-10-2022-1404

Sheng, J., Amankwah-Amoah, J., Khan, Z., & Wang, X. (2021). COVID-19 Pandemic in the New Era of Big Data Analytics: Methodological Innovations and Future Research Directions. British Journal of Management, 32(4), 1164–1183. https://doi.org/10.1111/1467-8551.12441

Sheng, M. L., & Saide, S. (2021). Supply chain survivability in crisis times through a viable system perspective: Big data, knowledge ambidexterity, and the mediating role of virtual enterprise. Journal of Business Research, 137, 567–578. https://doi.org/10.1016/j.jbusres.2021.08.041

Shrivastav, S. K. (2023). Exploring the application of analytics in supply chain during COVID-19 pandemic: A review and future research agenda. Journal of Global Operations and Strategic Sourcing, 16(2), 492–519. https://doi.org/10.1108/JGOSS-06-2022-0053

Touckia, J. K., Hamani, N., & Kermad, L. (2022). Digital twin framework for reconfigurable manufacturing systems (RMSs): Design and simulation. International Journal of Advanced Manufacturing Technology, 120(7–8), 5431–5450. https://doi.org/10.1007/s00170-022-09118-y

Tseng, M. L., Bui, T. D., Lim, M. K., et al. (2021). Comparing world regional sustainable supply chain finance using big data analytics: A bibliometric analysis. Industrial Management & Data Systems, 121(3), 657–700. https://doi.org/10.1108/IMDS-09-2020-0521

Usapein, P., Tuntiwiwattanapun, N., Polburee, P., et al. (2022). Transition Pathway Palm Oil Research Framework Toward a Bio-Circular-Green Economy Model Using SWOT Analysis: A Case Study of Thailand. Frontiers in Environmental Science, 10. https://doi.org/10.3389/fenvs.2022.877329

van Blokland, W. B., van de Koppel, S., Lodewijks, G., & Breen, W. (2019). Method for performance measurement of car companies from a stability-value leverage perspective the balancing act between investment in R&D, supply chain configuration and value creation. International Journal of Lean Six Sigma, 10(1), 411–434. https://doi.org/10.1108/IJLSS-03-2017-0024

Wang, Y., Yan, F., Jia, F., & Chen, L. (2023). Building supply chain resilience through ambidexterity: An information processing perspective. International Journal of Logistics-research and Applications, 26(2), 172–189. https://doi.org/10.1080/13675567.2021.1944070

Wilk, V., Roni, S. M., & Jie, F. (2023). Supply chain insights from social media users' responses to panic buying during COVID-19: The herd mentality. Asia Pacific Journal of Marketing and Logistics, 35(2), 290–306. https://doi.org/10.1108/APJML-06-2021-0400

Wolfe, R. (2021). Yours is bigger than mine! Could an index like the Producer Subsidy Equivalent help in understanding the comparative incidence of industrial subsidies? World Economy, 44(2), 328–345. https://doi.org/10.1111/twec.13069

Xie, J., & Chen, C. (2022). Supply chain and logistics optimization management for international trading enterprises using IoT-based economic logistics model. In: Operations Management Research. Springer. pp. 711–724. https://doi.org/10.1007/s12063-022-00254-y

Zamani, E. D., Smyth, C., Gupta, S., & Dennehy, D. (2023). Artificial intelligence and big data analytics for supply chain resilience: A systematic literature review. In: Annals of Operations Research. Springer. pp. 605–632.

https://doi.org/10.1007/s10479-022-04983-y

Zhang, L., Ma, D., & Hu, J. (2021). Research on the Sustainable Operation of Low-Carbon Tourism Supply Chain under Sudden Crisis Prediction. Sustainability, 13(15). https://doi.org/10.3390/su13158228

Zhang, Q., Gao, B., & Luqman, A. (2022). Linking green supply chain management practices with competitiveness during covid 19: The role of big data analytics. Technology in Society, 70. https://doi.org/10.1016/j.techsoc.2022.102021

Zhao, N., Hong, J., & Lau, K. H. (2023). Impact of supply chain digitalization on supply chain resilience and performance: A multi-mediation model. International Journal of Production Economics, 259. https://doi.org/10.1016/j.ijpe.2023.108817

Zheng, M., Zhang, S., Zhang, Y., & Hu, B. (2021). Construct Food Safety Traceability System for People's Health Under the Internet of Things and Big Data. IEEE Access, 9, 70571–70583. https://doi.org/10.1109/ACCESS.2021.3078536

Appendix B

Table B1. Text data (title and abstract fields).

	Term	Links	Total link strength	Occurrences
CLUSTER 1	Adoption	44	97	11
	Barrier	41	61	6
	Business	37	65	7
	Company	49	123	14
	Consumer	26	31	5
	Demand	44	80	11
	Digitalization	44	62	6
	Driver	32	44	6
	Factor	42	93	11
	Implementation	35	60	6
	Originality value	47	106	13
	Outbreak	43	83	10
	Part	33	51	7
	Policy	39	57	8
	Policymaker	34	54	6
	Practical implication	43	70	7
	Supplier	42	76	9
	Supply	37	61	8
	Work	42	71	8
CLUSTER 2	Addition	38	51	7
	Artificial intelligence	44	84	13
	Benefit	2	79	11
	Blockchain	43	84	11
	Case	38	72	10
	Challenge	51	147	21
	Emergency	30	40	5
	Humanitarian supply chain	23	29	5
	Integration	30	40	5
	Potential	38	64	7
	Reliability	29	41	5
	Resource	47	119	16
	Risk	49	115	13
	Sector	43	75	11
	Stakeholder	42	75	8
	Supplies chain resilience	29	47	7
	Traceability	34	56	7
	Transparency	31	51	6
	View	41	86	11

Table B1. (*Continued*).

	Term	Links	Total link strength	Occurrences
CLUSTER 3	Ability	20	24	6
	Analytic	36	58	12
	Bigdata analytic	33	54	9
	Effectiveness	29	40	6
	Example	37	60	8
	Future	23	33	5
	Insight	48	129	19
	Manager	45	98	14
	Model	49	183	30
	Performance	49	122	18
	Perspective	46	118	17
	Practitioner	34	64	10
	Relationship	43	101	13
	Supply chain management	38	72	9
	Uncertainty	35	41	5
	Value	37	70	10
CLUSTER 4	Cost	29	46	8

Table B2. Co-occurrence (by author keywords).

	Keyword	Links	Total link strength	Occurrences
CLUSTER 1	Artificial intelligence	12	14	7
	Big data analytics	4	4	2
	Digital transformation	4	4	2
	Disaster management	3	3	2
	Emerging technologies	5	5	3
	Risk management	9	12	5
	Structural equation modeling	2	3	3
	Supply chain performance	3	4	2
	Supply chain resilience	6	8	7
CLUSTER 2	Crisis management	8	8	2
	Crowdsourcing	8	11	2
	Customer behavior	8	11	2
	Fuzzy cognitive mapping	8	11	2
	Humanitarian operations	2	2	3
	Innovation	11	14	3
	Risk perception	6	7	2
	Text analytics	4	4	2
	Web analytics	8	11	2

Table B2. (*Continued*).

	Keyword	Links	Total link strength	Occurrences
CLUSTER 3	Covid-19	13	18	11
	Environmental management	5	5	2
	Humanitarian supply chain	3	3	3
	Lean	5	5	2
	Machine learning	3	3	2
	Pandemic	5	6	2
	Resilience	9	12	5
	Supply chain management	6	6	2
	Sustainability	13	19	5
CLUSTER 4	Barriers	6	7	3
	COVID-19 pandemic	4	4	2
	Data analytics	4	4	2
	Drivers	4	5	2
	Industry 4	6	6	3
	Internet of Things	6	6	3
	Logistics	3	3	2
	Manufacturing	2	2	2
CLUSTER5	Analytics	3	3	2
	Big data	25	33	14
	Big data analysis	5	5	2
	Crisis	5	6	3
	Decision support systems	3	4	2
	Supply chain	15	20	8
CLUSTER 6	Blockchain	13	15	7
	Digitalization	6	6	3
	ICT	1	1	2
	IoT	7	8	2
	Traceability	5	7	3

Table B3. Bibliographic coupling (by author).

	Author	Links	Total link strength	Documents
CLUSTER 1	Akter	12	156.86	2
	Chatterjee	16	211.59	2
	Chaudhuri	16	211.59	2
	Dubey	14	56.06	2
	Foropon	16	48.50	2
	Gunasekaran	9	24.60	2
	Vrontis	12	263.17	2

Table B3. (*Continued*).

	Author	Links	Total link strength	Documents
CLUSTER 2	Giannakopoulos	10	270.16	3
	Kamperos	15	417.76	4
	Kanellos	10	270.16	3
	Nasiopoulos	9	200.41	2
	Reklitis	9	200.41	2
	Sakas	15	486.65	5
	Terzi	15	352.38	3
CLUSTER 3	Albores	12	332.79	2
	Chowdhury	12	445.92	3
	Rodrigez-espindola	12	445.92	3

Table B4. Bibliographic coupling (by documents).

	Document		Links	Total link strength	Citations
CLUSTER 1	comes	(2020)	16	16.00	28
	dohale	(2022)	22	25.00	11
	dubey	(2021)	29	59.00	71
	dubey	(2023)	24	40.00	13
	fertier	(2021)	22	10.00	6
	flymn	(2022)	5	3.00	3
	fuqua	(2022)	19	6.00	3
	gour	(2022)	9	7.00	6
	modgil	(2020)	27	35.00	44
	nguyen	(2022)	27	17.00	18
	rodrigez-espindola	(2020)	27	22.00	108
	romanpaisseles	(2018)	16	12.00	50
	sheng	(2021b)	26	20.00	111
	wilk	(2023)	18	14.00	7
CLUSTER 2	amentae	(2021)	12	23.00	27
	guruswamy	(2022)	15	16.00	8
	joseph jerome	(2022)	34	37.00	19
	lee	(2021)	26	27.00	11
	lu	(2019)	1	1.00	7
	mangla	(2022)	21	31.00	27
	peng	(2023)	8	16.00	3
	xie	(2022)	8	3.00	4
	zheng	(2021)	6	7.00	18

Table B4. (*Continued*).

	Document		Links	Total link strength	Citations
CLUSTER 3	begum	(2022)	10	6.00	31
	chatterjee	(2022)	24	39.00	44
	chatterjee	(2023)	30	38.00	4
	ivanov	(2020)	31	37.00	524
	lioutas	(2021)	4	4.00	45
	sarkis	(2021)	15	15.00	305
	wang	(2023)	19	21.00	24
	zhao	(2023)	31	84.00	10
CLUSTER 4	belhadi	(2021)	29	38.00	88
	chen	(2021)	20	15.00	8
	longo	(2022)	6	5.00	3
	papanagnou	(2022)	32	49.00	4
	sheng	(2021a)	31	28.00	14
	touckia	(2022)	2	2.00	9
	zamani	(2023)	28	44.00	14
CLUSTER 5	di vaio	(2023)	25	35.00	19
	li	(2015)	1	1.00	20
	shahzad	(2022)	20	22.00	10
	shrivastav	(2023)	28	29.00	4
	zhang	(2022)	17	18.00	17
CLUSTER 6	sakas	(2021)	19	23.00	3
	sakas	(2022a)	3	19.00	6
	sakas	(2022b)	4	7.00	8
CLUSTER 7	lamieri	(2019)	1	1.00	4
	tseng	(2021)	13	11.00	17
CLUSTER 8	chowdhury	(2023)	32	60.00	20
	rodrigez-espindola	(2022)	34	82.00	3
CLUSTER 9	akter	(2019)	22	14.00	153
	london	(2022)	1	2.00	4
CLUSTER 10	bag	(2023)	39	44.00	43
	lanzen	(2020)	1	1.00	173

Table B5. Co-authorship (by author).

	Keyword	Links	Total link strength	Documents
CLUSTER 1	giannakopoulos	6	3.00	3
	kamperos	6	4.00	6
	kanellos	6	3.00	3
	nasiopoulos	6	2.00	2
	reklitis	6	2.00	2
	sakas	6	5.00	5
	terzi	6	3.00	3
CLUSTER 2	akter	1	1.00	2
	chatterjee	2	2.00	2
	chaudhuri	2	2.00	2
	vrontis	3	2.00	2
CLUSTER 3	albores	2	2.00	2
	chaudhuri	3	2.00	3
	rodrigez-espindola	3	2.00	3
CLUSTER 4	dubey	0	0.00	2
CLUSTER 5	foropon	0	0.00	2
CLUSTER 6	gunasekaran	0	0.00	2

Table B6. Co-authorship (by country).

	Keyword	Links	Total link strength	Documents
CLUSTER 1	England	11	15.00	17
	India	10	11.00	12
	Ireland	3	1.00	2
	Serbia	1	1.00	1
	South Africa	3	2.00	2
	Turkey	2	1.00	3
	Wales	3	1.00	1
CLUSTER 2	Estonia	7	1.00	1
	Netherlands	8	3.00	3
	Norway	7	1.00	1
	Pakistan	8	2.00	2
	Spain	7	1.00	1
	Un Arab Emirates	7	1.00	1
CLUSTER 3	Australia	11	6.00	8
	Ecuador	6	1.00	1
	Indonesia	6	1.00	1
	Japan	6	2.00	2
	Scotland	7	2.00	2

Table B6. (*Continued*).

	Keyword	Links	Total link strength	Documents
CLUSTER 4	Canada	1	1.00	2
	Denmark	3	1.00	1
	France	16	14.00	17
	Maroco	3	1.00	1
CLUSTER 5	Brazil	2	2.00	2
	Italy	3	1.00	3
	Malaysia	7	3.00	3
	Sri Lanka	3	1.00	1
CLUSTER 6	Bangladesh	2	2.00	2
	P R China	17	9.00	17
	Philippines	3	1.00	1
	Taiwan	3	1.00	3
CLUSTER 7	Finland	1	1.00	1
	Iran	1	1.00	1
	South Korea	1	1.00	1
	USA	24	12.00	15
CLUSTER 8	Ethiopia	1	1.00	1
	Germany	3	1.00	2
	Sweden	4	2.00	2
CLUSTER 9	Cyprus	4	3.00	3
	Greece	1	1.00	7

Table B7. Co-citation (by cited sources).

	Journal	Links	Total link strength	Citations
CLUSTER 1	acad manage rev	50	22.51	23
	brit j manage	53	36.96	38
	decis support syst	54	32.11	35
	harvard bus rev	51	25.47	27
	ind market manag	54	49.84	53
	inform manage-amster	52	40.25	42
	inform syst front	52	25.92	27
	inform syst res	50	19.74	22
	int j inform manage	54	98.38	104
	int j oper prod man	54	107.76	118
	j bus res	54	113.77	124
	j enterp inf manag	54	29.01	30
	j manage	51	30.81	32
	j marketing res	52	20.72	21
	j oper manag	53	69.94	74
	mis quart	52	46.44	49
	prod oper manag	54	59.59	64
	strategic manage j	53	50.86	54
	technovation	49	17.25	21

Table B7. (*Continued*).

	Journal	Links	Total link strength	Citations
	appl sci-basel	47	20.78	23
	bus strateg environ	48	18.37	20
	comput ind	54	32.89	34
	comput ind eng	54	50.15	52
	food control	37	15.19	20
	ieee acess	54	53.69	65
	int j env res pub he	53	22.44	23
CLUSTER 2	int j logist-res app	54	23.89	24
	j clean prod	54	121.3	142
	resour conserv recy	53	26.56	27
	sensors-basel	44	18.8	20
	sustain prod consump	53	20.1	21
	sustainability-basel	54	79.88	93
	transport res e-log	54	47.91	49
	trends food sci tech	45	27.5	36
	benchmarking	54	40.63	43
	ieee t eng manage	52	26.03	27
	ind manage data syst	53	28.51	30
	int logist manag	52	61.31	65
	int phys distr log	54	49.31	51
CLUSTER 3	int j prod econ	54	241.78	275
	int prod res	54	273.87	295
	j bus logist	53	37.99	39
	prod plan control	54	62.64	64
	supply chain manag	54	88.62	93
	technol forecast soc	54	95.3	106
	ann oper res	53	143.66	162
	eur j oper res	54	63.95	68
	expert syst appl	54	30.88	32
	int j disast risk re	52	50.71	60
CLUSTER 4	j humanit logist sup	48	29.22	31
	j supply chain manag	53	27.69	28
	kybernetes	43	15.07	20
	manage sci	47	19.5	21
	omega-int j manage s	52	23.28	24
CLUSTER 5	bus horizons	54	26.57	28