



Managing Uncertainty: Exploring Risk Management during the COVID-19 Pandemic through Bibliometrics Analysis

^{1, 2*} Widaryanti, ²Wan Amalina Wan Abdullah and ³Riana Sitawati

¹Department Accounting, Sekolah Tinggi Ilmu Ekonomi Pelita Nusantara, Semarang City, Central Java, Indonesia

²Department Accounting, Universiti Sultan Zainal Abidin, Gong Badak, Trengganu, Malaysia


³Department Accounting, Sekolah Tinggi Ilmu Ekonomi Dharmaputra, Semarang City, Central Java, Indonesia

*Corresponding Author Email: amalina@unisza.edu.my

ABSTRACT

This paper conducted a bibliometric review of research investigating the impact of the COVID-19 pandemic on risk management. Our analysis uses Biblioshiny R Studio software to map and visualize scientific results. Our dataset consists of 380 scientific articles from 193 journals written by 1144 contributors sourced from the Scopus database since the outbreak of the pandemic in 2020. The study shows that the Journal of Risk Research is the most productive journal, with the most regional contributions from the United States. Using keyword grouping, topics that emerged in risk management in the COVID-19 era were described. The focus is risk assessment, management, supply chain management, decision-making, and perception. Our findings improve our understanding of the research landscape and patterns in the field's intellectual, conceptual, and social structures. This paper offers solutions for future studies and discusses implications for policy and management using various keyword analysis techniques.

Keywords: Risk, Management, Covid-19, Biblioshiny, and Visualization

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INTRODUCTION

The COVID-19 epidemic has had a significant and pervasive effect on daily life, enterprises, and economies. Many nations imposed full or partial lockdowns to stop its spread before the World Health Organisation (WHO) officially declared it to be a pandemic. These actions, which included lockdown procedures and social separation, greatly affected firms. Some were forced to work remotely, while others struggled with the limitations, resulting in closures (Papíková & Papík, 2022). It is difficult for many industries to continue operating. One of the industries most impacted by COVID-19 is tourism. Tourism impacts transportation, dining establishments, lodging, retail, and other industries. The supply and demand for products and services have decreased due to the COVID-19 epidemic. In the world, China exports more than any other country. The COVID-19 pandemic has impacted the global trade market since the introduction of COVID-19, which infected China and has significantly affected China's trade activity (Ren et al., 2021). The COVID-19 pandemic will impact a nation's trade sector, particularly with a decline in tax revenue and its imports and exports. Because visitors typically purchase mementos from tourist destinations, the spread of the coronavirus impacts the trade, investment, and micro, small, and medium-sized company (MSMEs) sectors. MSME revenue will decline if the number of tourists declines. The primary reason for this tragedy is the existence of many regulations requiring many people to self-quarantine. The COVID-19 epidemic also affected manufacturing firms, which had to lower the number of workers starting work, resulting in a drop in output. Because of COVID-19, governments everywhere are compelled to downplay the effects of the global economic slump.

Covid-19 has had a significant impact on corporate risk management. Risk is defined as an event or event that, if it occurs, can hinder the achievement of the goals or objectives of a division or company (Subramaniam et al., 2009). Risk management is a systematic process for managing potential risks. Good risk management is when an organization or company can reduce potential losses (Crovini, 2019). The Covid-19 pandemic has forced companies to revisit and change their risk management strategies to face new challenges. Due to disruptions to supply chains, changes in consumer demand, and difficulties in maintaining operations during lockdowns, companies have had to face increased operational risks (Haraguchi et al., 2023). Information technology is essential for business survival during the pandemic. Information technology risk management must be adapted to address the increasing cyberattacks and the threat of remote work risks (Edirisinghe et al., 2020). Companies must quickly adapt to new conditions, such as adjusting business models and operations to ensure business continuity. When lockdowns are lifted, businesses must adapt to the new normal, grappling with emerging risk challenges such as low company performance, downsizing, resource shortages, and rising prices. Understanding the profound impact of the pandemic on risk management is critical. It is essential to review the existing literature that discusses the impact of the pandemic on enterprise risk management. Therefore, this study uses bibliometric analysis.

This study aims to answer these specific research questions: (a) How is the growth of research findings assessing the impact of the pandemic on risk management? (b) In research on the impact of the pandemic on risk management, what are the most popular topics and journals? (c) Who are the authors most involved in researching how the pandemic affects risk management? (d) Which social (collaborative) and intellectual (citation and co-citation) structures currently fall within the research domain? (e) What current and future themes can additional research cover?

The study contributes to the literature by providing a broad and visual overview of the research landscape on the impact of the pandemic on risk management. This broad picture is achieved through visualization tools and bibliometric techniques. A thorough review of the existing literature helps researchers and practitioners understand the right research direction. It helps them through various complex studies on the issue of risk management in the Covid-19 era. Using shared citations and collaborative patterns, the study analyzed shared words and examined the social and intellectual structure of the domain.

LITERATURE REVIEW

Conducting coronavirus impact checks is crucial for determining the sectors that have shown resilience or vulnerability following significant disruptions to supply chains, firm closures, decreased consumer demand, and the shift to remote employment (Hsu & Yang, 2022). Amid worldwide catastrophes like the pandemic, engaging in regulation introspection regarding the function of boards has become crucial. This guarantees consistent and excellent financial reporting (Hsu & Yang, 2022). Noone et al. (2022) highlighted the need for an agile adhocracy culture in times of crisis, which encourages quick and gradual innovation and considers how a company's scale affects incremental product innovation. Ren et al. (2021) emphasized the transient impact of stringent lockout measures on economic well-being, which persisted for a maximum of twenty-day periods of trade activity.

Research, such as the study conducted by Biswas in 2022, demonstrates that investing in Research and Development (R&D) might mitigate the adverse effects of the pandemic on firm performance. Companies actively participating in R&D activities exhibit increased sales returns and overall revenue growth. Despite the relaxation of restrictions, there is still ongoing research on the impact of the pandemic on firm performance. Scholars are actively striving to derive conclusions and offer thorough advice for companies that have been affected. Ngo & Duong (2024) argued that the decline in the performance of businesses in significantly impacted industries in the Vietnamese market could be attributable to the pandemic. They suggested that the government should implement customized efforts to address this issue. A study by (Tarighi et al., 2023) showed that corporate performance in the Iranian market declined during the pandemic. The study also revealed a significant change in the connection between board features and corporate performance. (Boshnak et al., 2023) found that the business performance in the Saudi Arabian market decreased during the pandemic due to more significant board sizes and board meetings. Nevertheless, there were encouraging developments in the quality of meeting room experiences and gender diversity. Gaining insight into an organization's strategy is paramount when the business environment changes during a crisis. Contemporary bibliometric investigations contribute substantially to the existing body of literature by discovering patterns and unearthing suggestions.

METHODOLOGY

Bibliometric analysis is a methodological review approach that has garnered significant attention in the scientific community. It directs its focus to the network of relationships between journals, documents, authors, and keywords, along with the structure and evolutionary patterns of specific research domains (Van Eck & Waltman, 2014). To address the questions arising from bibliometric analysis, an indispensable measure that should not be overlooked is to use data stored in databases (containing pre-existing literature aligned with the study's purpose). Additionally, visualization software can be used for various mapping and grouping techniques to ensure potential interconnections between nodes (i.e., journals, keywords, authors, and references) within a given network. Software, including bibliosphere analysis, has become increasingly prevalent among the scientific community for bibliometric analysis. Biblioshiny is a tool provided by R Studio, using an interactive web interface that allows users to perform significant bibliometric analyses exclusive to the data analysis framework proposed by (Xie et al., 2020).

The study seeks to assess the social, intellectual, and conceptual structure of previous research on the impact of the pandemic on risk management. In particular, collaborative patterns between authors and regions, citation trends and co-citations among authors, networks of common occurrences among keywords, and the evolution of trends were examined.

Data Collection

Documents for this study were collected from the Scopus database to analyze patterns and trends in studies involving the impact of Covid 19 on risk management. This database is used because it has a broad spectrum of sources, covering essential journals across the sciences, social sciences, arts, and humanities. The initial search is subject to the keyword combination TITLE-ABS-KEY (("COVID-19" OR "Coronavirus" OR "SARS-CoV-2") AND ("Risk Management" OR "Risk Assessment" OR "Risk Mitigation") AND ("Management" OR "Strategy" OR "Response") AND ("Pandemic" OR "Epidemic")) AND (LIMIT-TO (DOCTYPE, "ar")) AND (LIMIT-TO (LANGUAGE, "English"))) uses the "Topic" search category as it helps in combing the title, abstract, author keywords and keywords Plus.

A total of 380 documents were obtained from the search. However, after refining the search only for articles and types of early access documents written in English, a final sample of 380 documents was obtained. The record is limited to a specific subject area, i.e., business, management, and accounting, as this study aims to identify trends in business, management, and accounting studies that analyze the impact of the COVID-19 pandemic on risk management. At the time of conducting the investigation, the level of exploration was limited to a period spanning from 2020 to 2023, taking into account the origins of transmission, the start of literature on topics of interest, and the point in time when data collection was carried out in September of

2023. The final sample is carefully examined, proving adequate to achieve the research objectives. Figure 1 details the data collection procedures, including inclusion and exclusion criteria.

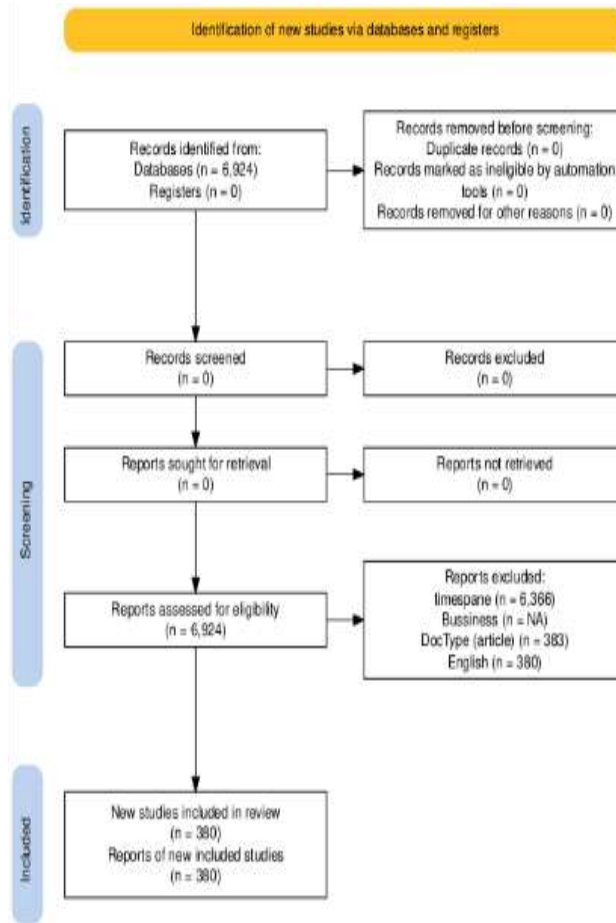


Figure 1: PRISMA

FINDINGS AND DISCUSSION

Growth of research results

The final selection of 380 scientific articles was taken from a corpus of 193 journals, which included 1339 keywords and 835 plus keywords. A total of 1144 individuals contributed to the paper's authorship, 41 being the authors of single-written papers, while 1103 were multi-author document authors (table 1). In addition, the documents, in total, have amassed a cumulative total of 3213 citations. Figure 2 shows the number of articles on Covid 19 and risk management after the emergence of the pandemic, in addition to the complete number of the average citations per year received on the search date. As illustrated in Figure 2, 2020 saw a total of 37 publications investigating the impact of the pandemic on risk management, collecting 2383 citations. However, the publication reached 88 the following year, with 2688 citations in 2021. In the data assessment at Scopus in 2022, 138 publications were recorded, collecting 1080 citations. In 2023, there were 117 publications with a total of 339 citations.

Table 1: Main Information on Management Risk and COVID-19 Publications

Description	Results
Timespan	2020:2023
Sources (Journals, Books, etc)	193
Documents	380
Annual Growth Rate %	46,78
Document Average Age	1,12
Average citations per doc	17,11
DOCUMENT CONTENTS	
Keywords Plus (EN)	1068
Author's Keywords (DE)	1339
AUTHORS	

Authors	1144
Authors of single-authored docs	41
AUTHORS COLLABORATION	
Single-authored docs	42
Co-Authors per Doc	3,29
International co-authorships %	36,84
DOCUMENT TYPES	
Article	377

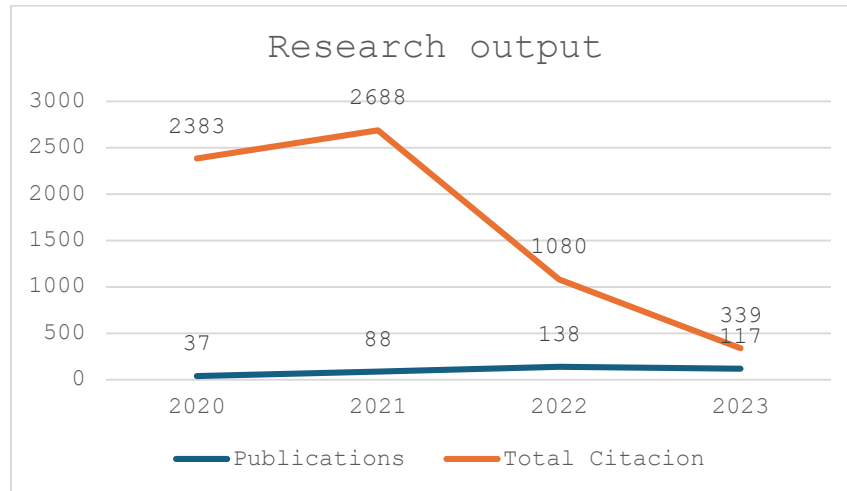


Figure 2: Number of publications and citations

Journal distribution and analysis of journal citations together Table 2 presents a comprehensive overview of the performance of the ten leading journals and the total citations collected over the specified period. Articles featured in the top 10 journals accounted for 27% of the sample. Citations assess the relative importance of a journal within its field and the rate at which articles are cited in a given period (Sharma & Lawrence, 2014). Alternatively, the H-index also measures the visibility of a group of articles, including publications and citations (Egghe & Rousseau, 2008). Based on the number of publications, the Journal of Risk Research, Journal of Risk and Financial Management, and Risks have been ranked as the top three journals.

Table 2: Performance of 10 leading journals

The Highest Contribution to the Journal						
Source	H	G	m	TC	NP	Subject categories
Journal Of Risk Research	9	22	2,25	501	22	Regulation and management risk
Risks	6	7	2	80	20	The risk field from various disciplines
Journal Of Risk and Financial Management	5	11	1,25	149	21	Finance, reporting, risk measurement
Technological Forecasting and Social Change	5	6	1,667	553	6	Social and technological forecasting
Industrial Management and Data Systems	4	6	1,333	52	6	Operation and information system
International Journal of Emerging Markets	4	7	2	51	7	Economics, Finance management
International Journal of Logistics Management	4	5	2	100	5	Logistic management
Journal Of Business Research	4	4	2	122	4	Buyer behavior, marketing, risk
Journal Of Cleaner Production	4	6	1,333	132	6	Sustainability, cleaner production
Academy Of Strategic Management Journal	3	4	0,75	16	4	Strategic management, leadership

The journal Technological Forecasting and Social Change holds the highest total citations, with 553 citations. In contrast, the Journal of Risk Research has received the highest h-index measure of 9. Overall, it can be argued that the h-index rankings of academic journals effectively capture the caliber of the articles they disseminate, regardless of their contribution to the sample size based on the number of publications.

Author analysis and co-authorship

This article presents an overview of the findings of the top 10 authors who have investigated the impact of the pandemic on risk management, as highlighted in Table 3. As reflected in the number of publications, the author's contribution made up 8.9% of the sample, underlining the sizable distribution of the sample size among 1144 authors. In particular, Ivanov D significantly contributed to literature, having written five publications within the specified time frame. Although the author's h-index based on sample size was between 2 and 5, Ivanov D received the highest citation, followed by Van Hoek R and Birkel H.

Table 3: The Highest Contribution of the Author

Authors	H	G	M	TC	NP
IVANOV D	5	5	1,25	1922	5
VAN HOEK R	4	5	1,333	70	5
BIRKEL H	3	3	1,5	67	3
GEBHARDT M	3	3	1,5	67	3
KIM J	3	3	1	60	3
KOPYTO M	3	3	1,5	67	3
LEE JS	3	3	1	37	3
SPIESKE A	3	3	1,5	67	3
MONEY Y	3	3	1,5	12	4
AGRAWAL R	2	2	1	39	2

Figure 3 shows 12 clusters (node=33; minimum edge=1), with the largest clusters with gray bubbles. The authors included in the gray bubble are Gebhardt M and Birkel H. The gray group published five important articles about the management risk supply chain in COVID-19 (Gebhardt et al., 2022). Figure 3 shows the relationship between the red and green groups, mainly through Majumdar A and Kumar A connecting with Gunasekaran A and Akunkar P. The red group researches COVID-19 pandemic risk in health, and the green group researches supply chain risk mitigation in Covid 19. The database does not consider linking the remaining groups to other groups. Of course, collaboration networks are based solely on co-authorship.

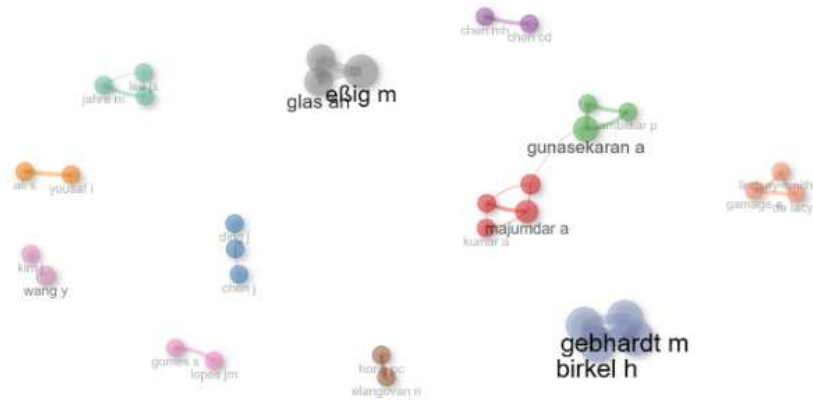


Figure 3: Collaboration network

Regional Contribution and Cooperation Analysis

Table 4 presents the regional contributions made by the researchers, as evidenced by the corresponding corresponding authors' addresses. The United States (47), China (35), and India (18) are the three countries that excel in this domain. Scientific works from these regions account for almost a third (26.3%) of the total articles. The following countries are Germany (17) and the United Kingdom (15), while the remaining countries offer to contribute 7 to 13 articles. Table 3 shows that most of the countries represented in this study are from Europe (4), Asia (3), America (1), and Australia, except for Africa. In addition, the results show that developing European countries make the majority of the research contribution. Furthermore, publications with authors from one country (SCP) and publications with authors from different countries (MCP) are shown in Table 4. The authors and co-authorship analysis revealed that authors from one country wrote more papers than others. The MCP ratio is a metric that measures international cooperation.

Table 4: Authorship regional contributions

Country	documents	SCP	MCP	Freq	MCP_Ratio
USA	47	25	22	0,124	0,468
CHINA	35	17	18	0,092	0,514
INDIA	18	12	6	0,047	0,333
GERMANY	17	11	6	0,045	0,353
UNITED KINGDOM	15	7	8	0,039	0,533
AUSTRALIA	13	8	5	0,034	0,385
INDONESIAN	9	6	3	0,024	0,333
FRANCE	8	3	5	0,021	0,625
ITALY	7	5	2	0,018	0,286

The map-based network in Figure 4 displays collaboration among nine regions, as defined by the corresponding author's address. The centrality of the UK, Australia, and America was higher, indicating their significant role in building international collaborations with other countries in the network. India has a low level of collaboration but still contributes to joint research. China is a country that has great potential for research collaboration, especially in research related to COVID-19.



Figure 4: Countries Collaboration

Analysis of Citations and Co-Citations

Table 5 illustrates the top ten articles that collected the most citations in the domain. Due to the limited time frame of the study, the most frequently cited article in the sample is "Predicting the impacts of epidemic outbreaks on global supply chains: A simulation-based analysis on the coronavirus outbreak (COVID-19/SARS-CoV-2) case" (Ivanov, 2020), with an aggregate of 1189 citations. This study uses a simulation-based methodology to assess and predict the impact of the epidemic outbreak on global supply chain performance. In the article by Ivanov (2021), which ranks second in the most cited rank, his findings are about the concept of a supply chain digital model that enables disruption risk management and resilience in the Industry 4.0 era. Skare's third most cited paper (2021) is "Impact of COVID-19 on the travel and tourism industry". This article describes how the pandemic has changed consumer behavior, disrupted supply chains, and affected tourism. In this era of uncertainty, adaptation and innovation are key to overcoming the challenges faced by the industry.

Table 5: Articles with top contributions

Author	DOI	TC	TC/Year
(Ivanov, 2020)	10.1016/j.tre.2020.101922	1189	297,25
(Ivanov & Dolgui, 2021)	10.1080/09537287.2020.1768450	437	145,67
(Škare et al., 2021)	10.1016/j.techfore.2020.120469	387	129,00
(El Baz & Ruel, 2021)	10.1016/j.ijpe.2020.107972	336	112,00
(Ivanov & Das, 2020)	10.1504/IJISM.2020.107780	258	64,50
(Wong & Jensen, 2022)	10.1080/13669877.2020.1756386	162	40,50
(Kumar et al., 2021)	10.1016/j.techfore.2021.120643	118	39,33

(Villacé-Molinero et al., 2021)	10.1016/j.tourman.2021.104324	116	38,67
(Nygren & Olofsson, 2022)	10.1080/13669877.2020.1756382	113	28,25
(Yang et al., 2021)	10.1080/00207543.2020.1856958	97	32,33

Source: Authors' creation

Co-occurrence and Clustering of Keywords

To determine research trends on COVID-19 and risk management, Biblioshiny carried out a diverse approach to keyword analysis. Like the (Chen & Wu 2017) study, keyword co-emergence analysis helps ascertain research hotspots. Figure 5 shows the emergence of the dominant keyword. Nodes are labeled based on network thresholds, and node size describes the frequency of common occurrences. Links also show co-occurrence relationships between keywords. The top 5 keywords with the highest co-occurrence frequency are 'Covid-19 (86)', 'risk assessment (79)', 'risk management (57)', 'decision making (25)', 'risks management (22)' and supply chain (22). These five keywords also correspond to the relationship between word cloud analysis made from the main keyword (figure 6).

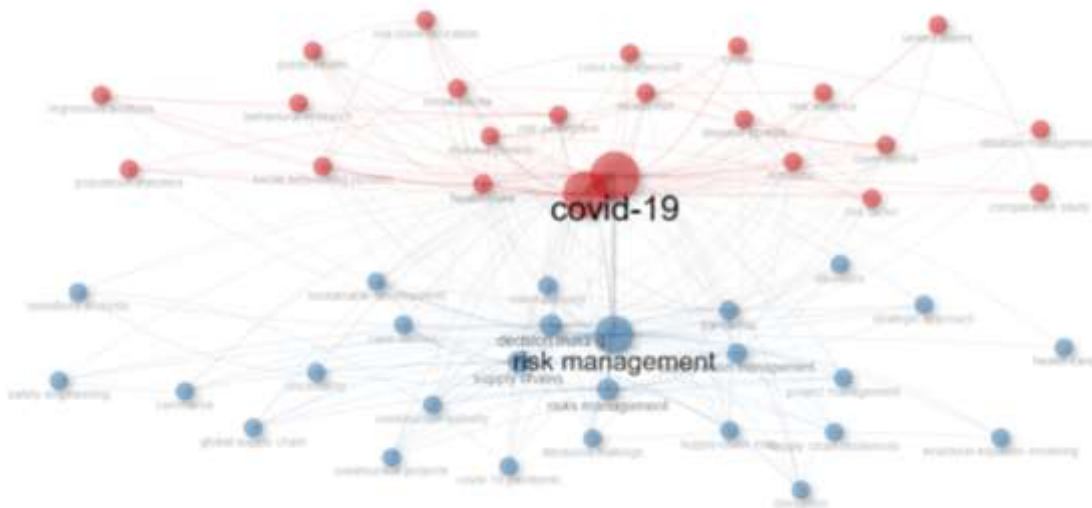


Figure 5: Co-occurrence Network



Figure 6: Wordcloud

Keyword Grouping and Timeline View

Keyword grouping and timeline view are done through biblioshiny to identify the main research areas of the domain and their evolution over the research period. Conducting keyword grouping and timeline view analysis can reveal key research domains within a particular field and the behaviors in which these domains have evolved. Keyword grouping categorizes keywords or related terms by analyzing their common occurrence patterns in the published literature. Applying these techniques facilitates identifying thematic groups or research topics that stand out within a particular field. By examining these groups, one can better understand the main areas of research that the researchers have concentrated on. Alternatively, the timeline view emphasizes the development of the investigation theme and grouping over time. This entails monitoring various research areas' emergence, expansion, decline, and change within a domain. In 2023, the keywords "project management," "supply chain resilience," and "decision making" are

the most widely used. In 2022, the most widely used keywords are COVID-19, risk assessment, and risk management. In 2021, other keywords were coronavirus, health risk, and risk factor. The temporal evolution of this keyword is shown in Figure 7.

The theme develops thematically over the study period, as shown in Figure 8. A sequence of magnitudes of various quantitative data information flows related to the main theme and indexing of content over time is referred to as excessive relationships. Figure 8 shows that between 2020 and 2022, studies on "coronavirus, risk management, risk assessment, health care, and digital storage have been conducted. In 2023, studies were conducted on behavioral research, COVID-19, risk analysis, females, project management, case studies, least square approximations, epidemics, and the COVID-19 pandemic.

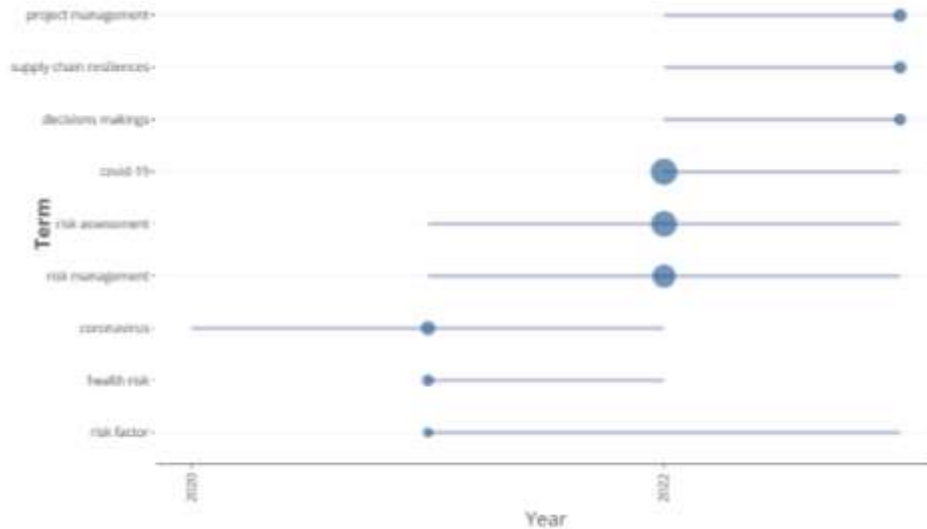


Figure 7: Trend topic

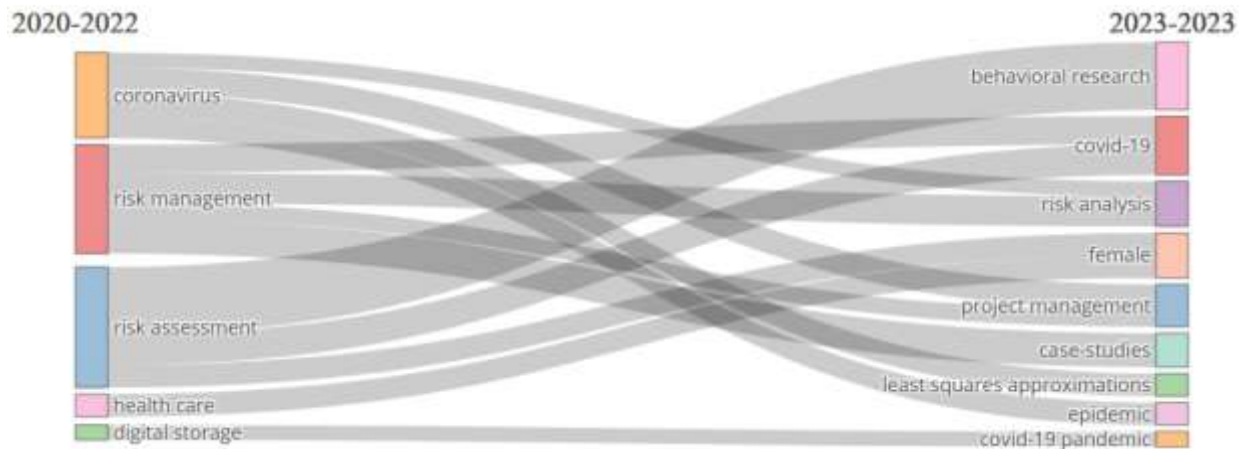


Figure 8: Thematic evolution

In Figure 10, thematic maps show various topics from a field of study. Here, centrality indicates the level of relevance of a field of study, and density indicates the level of development. In addition to the main topic of COVID-19 and risk management, the niche quadrant uses the term "expected shortfall, forecasting, technology adoption, economic impact, hotel industry, and information management." In contrast, the motor quadrant uses the terms "commerce, health risk, risk factor, and risk assessment." The emerging or declining themes quadrant includes supply chain operation, hazards, control strategies, mitigation, banking, performance assessment, and risk management strategies.

Three main clusters can be identified: the COVID-19 cluster, the risk management cluster, and the risk health cluster. The COVID-19 cluster is the largest cluster containing keywords such as 'covid-19, risk assessment, pandemic, disease control, etc. The risk management cluster contains the keywords decision-making, supply chain management, and global supply chain. Cluster health risks include risk perception, crisis management, social media, behavioral research, risk communication, and online networking.

The research that entered the COVID-19 cluster was carried out by (Glette-Iversen et al., 2023), which discussed how governments worldwide are overcoming risks related to the coronavirus and COVID-19 disease. The countries studied are Norway, the United Kingdom, the United States, and Sweden. (Rendón et al., 2023) state that the liquidity injection measures implemented in response to the COVID-19 pandemic led to a significant increase in portfolio risk in the banking system in Colombia. (Lee & Song, 2023) proposes a new research approach to revive the Belt and Road Initiative (BRI) momentum in the transition period

towards the post-COVID-19 era from the perspective of China's economy. Research by (Zahry et al., 2023) examines the communication aspect of risk management during the COVID-19 pandemic by examining whether governors' tweets differ based on political party, gender, and crisis phase. Peker et al. (2023) argue that disaster risk management (DRM) is an important approach to reducing the impact of global disasters, such as pandemics. Reineholm et al. (2023) provide an overview of how managers in different sectors of the labor market in Sweden are acting during a pandemic by dealing with crises in real time and how these experiences can be used for retrospective learning, as well as the implications of changes to risk management in the future. (Liu et al. (2023) Maritime Supply Chain Resilience (MSCR) Management focuses on customer needs during the COVID-19 pandemic. Xu et al. (2023) researched and compared risk factors faced by the construction industry before and during the pandemic to help understand the dynamic risk transformation.

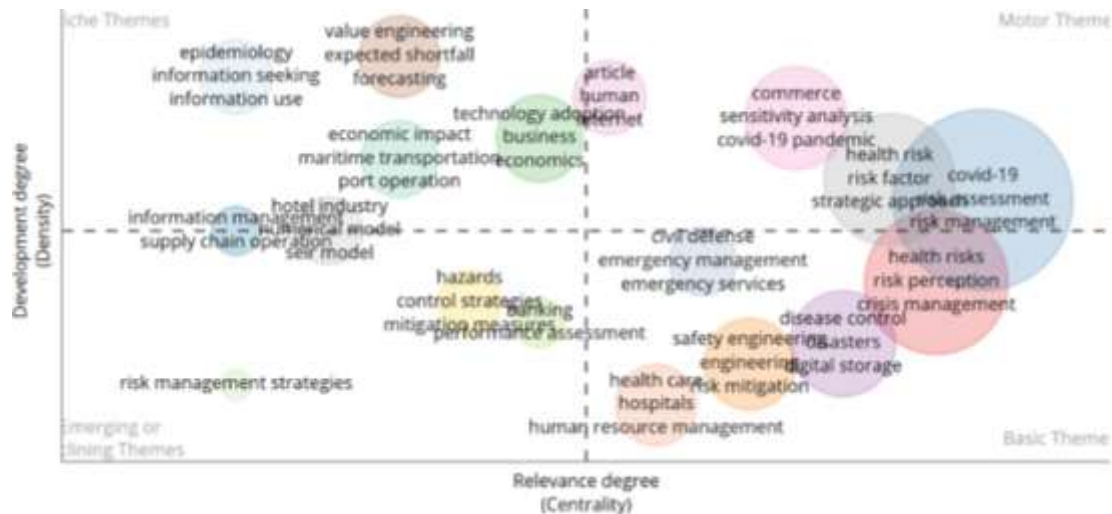


Figure 9: Thematic Map

The second cluster is risk management. The research included in this cluster is (Bi et al., 2023), who stated that the COVID-19 pandemic caused unexpected disruptions, such as frequent market changes and human labor limitations. A flexible, real-time manufacturing decision-making strategy is needed to stay competitive with a highly dynamic manufacturing environment. Dahmen (2023) explores how enterprise risk management (ERM) can develop resilience during the COVID-19 pandemic. The results highlight several key factors, including a culture of learning, strong system permeability, clear goals, solid leadership, and a culture of trust where employees feel safe and have the courage to take bold steps to overcome the crisis. Peng et al. (2023) show that risk management from upstream and downstream companies will affect each other, and cost investment in service risk management will benefit the entire Product Service Supply Chain (PSSC) network. Thus, the market demand for PSS can be increased by developing and improving diversified services. Klöckner et al. (2023) have identified five types of tactical responses to how companies respond to the COVID-19 crisis, namely operational, digitalization, financial, supportive, and organizational responses. Khanbaba and Ebrahimnejad (2023) state that supply chain risk management can reduce the effects of risk chains and disruptions based on risk response strategies. Duong et al. (2023) global supply chains face disruptions caused by various sources of inherent uncertainty, such as natural disasters, war and terrorism, external legal issues, economic and political instability, social and cultural dissatisfaction, and disease.

The third cluster is health risk; researchers in this cluster are (Priolo et al., 2023; Zahry et al., 2023), who examined how the format of information presentation about the COVID-19 mortality rate affects emotional reactions and risk perceptions. Zahry N.R. and McCluskey M (2023) show that the governor's tweets align with the CERC's communication goals to varying degrees. Research (Srinivasan et al., 2023) examines the role of social media communication initiated by companies through Twitter in reducing the negative impact of large-scale disruptions, such as the COVID-19 pandemic, on the company's stock value. Research (Deiva et al., 2022; Wu et al., 2022) highlights Twitter's significant role in real-time risk identification from online SC platforms such as "Supply Chain Dive," "Supply Chain Brain," and "Supply Chain Digest." Liu et al. (2022) proved that the local outbreak of COVID-19 does increase the risk of Internet public opinion, and the correlation analysis confirmed that the level of public opinion risk is positively correlated with the severity of the epidemic in the real world. Potential research questions for future research can be seen in Table 6.

Table 6: Potential Research Question for Future Research

Cluster COVID-19

1. How do different countries manage the risks associated with the COVID-19 pandemic?
2. How does the banking system face significant portfolio risks due to implementing liquidity injections in response to the COVID-19 pandemic?
3. What new research approaches can be proposed to revitalize the Belt and Road Initiative (BRI) during the transition period to the post-COVID-19 era, particularly from the economic perspective?
4. Do governors' tweets exhibit variations based on political party, gender, and crisis phase during the management of COVID-19 risks, as examined in the context of communication aspects?
5. How crucial is Disaster Risk Management (DRM) in reducing the global impact of disasters, such as pandemics?
6. In what ways did managers across various labor market sectors respond to the pandemic crisis in real-time, and how can these experiences inform retrospective learning and future risk management implications?
7. What customer-centric strategies were adopted in the Maritime Supply Chain Resilience (MSCR) management during the COVID-19 pandemic to ensure supply chain agility and continuity?
8. By comparing the risk factors faced by the construction industry before and during the pandemic, how can we better understand the dynamic risk transformations brought about by the global health crisis?

Cluster Management Risk

1. How can manufacturing firms develop flexible and real-time decision-making strategies to cope with the unexpected disruptions caused by the COVID-19 pandemic, including market changes and human labor constraints?
2. In what ways can Enterprise Risk Management (ERM) enhance organizational resilience during the COVID-19 pandemic, focusing on key factors such as a learning culture, strong system permeability, clear goals, robust leadership, and a culture of trust that empowers employees to take bold actions in crisis management?
3. What are the mutual impacts between upstream and downstream companies in managing risks, and how can investments in risk management services benefit the entire Product Service Supply Chain (PSSC) network by enhancing market demand through diverse service development and improvements?
4. How do companies tactically respond to the COVID-19 crisis through operational, digitalization, financial, support, and organizational strategies?
5. Can Supply Chain Risk Management mitigate cascaded risks and disruptions through effective risk response strategies?
6. What are the various sources of inherent uncertainty that disrupt current global supply chains, such as natural disasters, wars and terrorism, external legal issues, economic and political instability, social and cultural dissatisfactions, and diseases?

Cluster Health Risk

1. How does the presentation format of COVID-19 mortality rates influence emotional reactions and risk perceptions in their study on health risk communication?
 2. To what extent do governors' tweets on Twitter align with the communication goals of Crisis and Emergency Risk Communication (CERC), and how does the level of variation impact their effectiveness in risk communication?
 3. What role do social media communications initiated by companies on platforms like Twitter play in mitigating the adverse impacts of large-scale disruptions, such as the COVID-19 pandemic, on company stock values?
 4. How significant is the role of Twitter in real-time risk identification on online Supply Chain platforms like "Supply Chain Dive," "Supply Chain Brain," and "Supply Chain Digest"?
 5. In guiding post-COVID-19 supply chain strategies, what interrelated attributes are essential, emphasizing the importance of supply chain management and big data strategies amidst global concerns and academic uncertainties during the pandemic?
 6. How do local COVID-19 outbreaks contribute to increased public opinion risks on the Internet, and what is the confirmed correlation between public opinion risk levels and the severity of real-world epidemics in research on health risk and Internet discourse?
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CONCLUSION

During the research period, 1144 writers wrote 380 publications from 193 journals. When comparing the quantity of papers and citations obtained in 2023 to 2020, 2021, and 2022, it is evident that research is still expanding. Based on article contributions, the Journal of Risk Research, Risk and Financial Management, and Risks are pertinent periodicals. Of all the studies evaluating the effect of the COVID-19 pandemic on risk management, one-third (26.3%) were regional contributions from the US, China, and India. However, according to associated author addresses, none of the top ten contributing nations are in Africa. Predicting the Effects of Epidemic Outbreaks on Global Supply Chains: "A Simulation-based Analysis on the Coronavirus Outbreak (COVID-19/SARS-CoV-2) Case" by Ivanov (2020) is the most influential publication. Ivanov (5) is the author with the most significant number of papers and citations (1189). Most cluster studies concentrate on adopting technology, social media, supply chain, risk assessment, and decision-making. Creating backup plans and setting aside funds to buy cutting-edge technologies is one practical strategy for achieving high supply chain visibility and agility. The present article contributes, yet this research has

certain limitations. The Scopus database was the sole data source for data processing and collecting, and the study's exclusive focus was articles. Future research may consider utilizing different databases or combinations to broaden the coverage due to the potential omission of additional articles pertinent to the topic.

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