A Comprehensive Review of Big Data's Role in Risk Management and Security: A Bibliometric Approach

[1]Muthohirin
[1] Faculty of Economics and Business, Gadjah Mada University
[1]muthohirin@mail.ugm.ac.id

ABSTRACT

This study conducted a literature review on the role of big data in risk management and security. The researchers used bibliometric methods to analyze 114 articles from Scopus-indexed journals. The findings revealed a steady increase in publications since 2005, peaking in 2022. The field's most influential journals were Procedia Computer Science and IEEE Access. Several authors were recognized as key influencers, including Babar M, Chang V, He X, Li Z, Li Y, Liu S, and Saxby S. Notably, China, India, and the United States were prominent in publications related to big data in risk management and security. Based on the thematic map generated by the research, future studies are recommended to focus on privacy design, data security systems, data privacy, information management, and risk assessment. This research contributes to understanding the application of big data in risk and security management and offers directions for future research.

  Keywords   : Big Data; Risk Management; Security.

I. INTRODUCTION

Currently, almost all organizations in the world have integrated digital technology into various processes. Apart from providing efficiency, brightness, and accuracy in the delivery of products and services, this technology also allows information collection (Dicuonzo et al., 2019). The information collected, known as big data, is invaluable in helping organizations develop customer-focused business models. Almeida (2017), argues that risk assessment can effectively utilize big data technology, considering the importance of data in the contemporary era.

Big data is essential in risk management, allowing organizations to collect, store, evaluate, and utilize data from various sources. The approach applied in big data analysis strategies has facilitated many organizations in detecting, assessing, reducing, monitoring, and reporting various types of risks that could disrupt the continuity of their operations (Shabbir & Gardezi, 2020). There has been an increase in scholarship on big data, and several valuable reviews have appeared (Abbasi et al., 2016; Akter & Wamba, 2016), but none focuses explicitly on the accounting literature and finance, especially risk management and security. Most

businesses use big data strategically to create products for customers and change their thinking about data and products, leading to increased business value and monetization (Frizzo-Barker et al., 2016). Therefore, how this is applied to accounting and finance, especially risk and security, is an area of interest for academia and industry.

Big data technology has become widespread in enterprises and is quickly becoming an essential tool for ensuring technical security. Based on big data technology, more and more companies are adopting risk management practices recently. Using big data enables continuous improvement in risk control systems and building strong and sustainable systems (Choi et al., 2018). Compared with traditional technology, big data has added more dimensions and relevance analysis in Enterprise risk control and management (Wang et al., 2023). On the other hand, big data is widely applied in the internet sector to carry sensitive user personal data. After cleaning the source data, this data is adopted mainly in different business systems called access. Because these personal data are vulnerable and valuable, the security construction of big data platforms has become urgent for enterprise information security construction and risk management (Syafrudin et al., 2018).

In the Management Information Systems (MIS) literature, discussion of the risks associated with big data focuses on the risks to reputation, privacy, and society when data from various sources is reused to support decision-making (Clarke, 2016). Although these risks are essential in finance and business risk management, risks related to big data, especially risk management, still need to be studied in depth (Cockcroft & Russell, 2018). Specifically, Clarke (2016) examines situations where data is collected for one purpose but used for another, which can threaten privacy and damage an organization's reputation. The impact of misuse of big data is especially felt in security and privacy, and it presents significant costs from security breaches (Cockcroft & Russell, 2018). Therefore, the importance of literature related to risk management or risk analysis is to ensure the integrity, availability, confidentiality, and control of information assets in the Company and to determine existing risks and their intensity. Thus, it can select targeted security protection measures and reduce risks so that risks can reach acceptable levels (Zio, 2018). Literature discussing the role of big data in accounting and finance, especially risk management and security, is currently a growing concern. Although significant attention has been paid to the role of

big data in operations management (Choi et al., 2018), the use of big data in retail operations (Fisher & Raman, 2018). Interestingly, although the fields of accounting and finance have traditionally been involved in extensive data analysis, the actual utilization of big data and its analysis techniques in these disciplines is still at a very early stage. On the other hand, Shabbir & Gardezi (2020), argue that applying big data analytics in risk management has enabled organizations to identify critical data, supporting the development of more appropriate and effective risk management strategies. A study by Tang & Karim, (2017), also supports the use of big data technology in organizational risk management by asserting that this approach allows managers to make more accurate and data-based decisions.

Thus, a need remains to study specific deep themes and interrelationships in this domain, paving the way for a more comprehensive understanding and future research directions. Therefore, this research aims to perform a bibliometric analysis to identify and close this gap by offering insights into recent advances, emerging trends, and potential paths for future research in enterprise risk and security management analysis based on the role of big data. Bibliometric analysis can be carried out to examine areas not touched by

previous research in terms of themes and relationships between themes that authors in various countries have developed. Various articles and conference proceedings were reviewed from the Scopus database to produce a comprehensive investigation.

Based on the problems described above, the research questions are as follows:

RQ1: Which authors and journals have studied the application of big data in risk management and security analysis? This question is significant as it helps in identifying the key contributors and the most influential sources of knowledge in this field.

RQ2: What are the main research themes, which countries contribute the most to scientific production, and what keywords are commonly used in studying big data in risk and security management?

RQ3: What are big data's conceptual structure, intellectual structure, and social structure in risk and security management?

RQ4: What are the main ideas in big data studies in risk and security management in the most cited articles, as well as future research recommendations?

II. RESEARCH METHOD

This research is included in literature review research that uses bibliometric analysis methodology. Bibliometric analysis investigates and maps material published in journals in various scientific fields. According to Aria & Cuccurullo (2017), bibliometric analysis uses statistical and mathematical methodologies to study trends in literature that are still within the scope of one domain. The bibliometric analysis method is used in this research because it has the advantage of seeing developments, trends, and publication patterns in a scientific discipline. In addition, a bibliometric analysis approach will describe underlying conceptual, intellectual, and social trends. Data for this bibliometric analysis were obtained from journal papers published in the Scopus database. Among existing scientist citation databases, this database is the most widely used (Strozzi et al., 2017), with 60% wider coverage than that provided by Web of Science and Google Scholar (Zhao & Strotmann, 2015). Figure 1 explains how the documents on which the bibliometric analysis was based were selected.
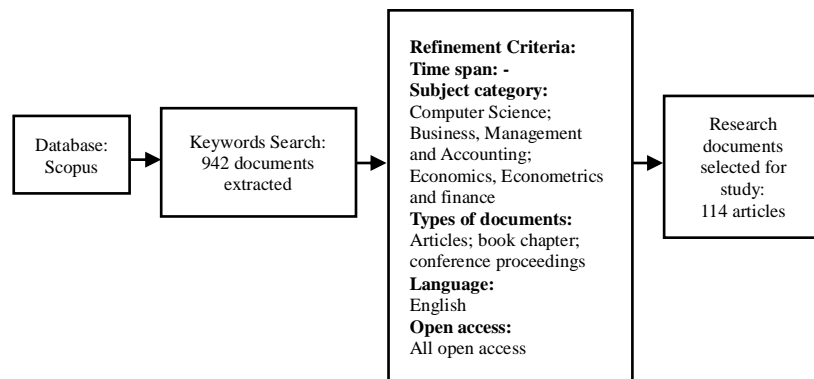

Figure 1
Document Selection Flowchart for Bibliometric Analysis

The documents to be studied are selected by searching using an appropriate combination of keywords. The data was then analyzed using R Studio software. Based on Figure 1, the base selection is obtained in CSV format from the Scopus database with the following details:

- Selection date: June 24, 2024.
- Period: Unlimited to provide a comprehensive picture.
- Keywords for search strategy: The keywords "big data", "risk management", and "security" were used to identify research papers. A total of 942 documents were generated using keyword and string: " (TITLE-ABS-KEY (big AND data) AND TITLE-ABS-KEY (risk AND management) AND TITLE-ABS-KEY (security))"
- Document types: journal articles and conference papers.
- Selection of subject categories: The selected subject categories were narrowed down to several topics, namely the role of big data in risk and security management within the scope of Computer Science; Business, Management, and Accounting; Economics, Econometrics, and Finance; The result was 424 documents.
- Language selection and document access: Language filter "English" and document access filter "All Open Access"

are used. The final data set is 114 documents, which will be imported into Biblioshiny in "CSV" format for further processing.

The data analysis technique in this research uses two stages of analysis, which consist of descriptive analysis and network analysis. Descriptive analysis aims to explore annual scientific production, authors, sources, and documents. Then, network analysis is carried out for knowledge mapping through visualization, including co-occurrence networks, thematic maps, and collaborative world maps. The two data analyses are depicted graphically in Figure 2.
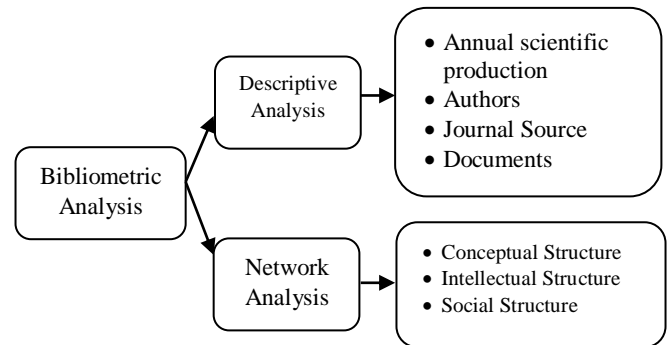

Figure 2.
Bibliometric Analysis

III. RESULTS AND DISCUSSION

Descriptive Analysis

Bibliometric analysis in R-Studio using Biblioshiny produces results that are highly relevant to the field. These results, presented in the form of tables, figures, and mapping, cover a variety of information, such as document main information,

annual scientific production, sources, titles, author interactions, relevant sources, influential sources, source dynamics, contributing countries, dominant keywords, conceptual structure, intellectual structure, and social structure.

Table 1. Main Document Information

Description	Results
Timespan	2005:2024
Sources (Journals, Books, etc)	75
Documents	114
Annual Growth Rate %	10,78
Document Average Age	4,1
Average citations per doc	23,78
References	0
Keywords Plus (ID)	867
Author's Keywords (DE)	459
Authors	387
Authors of single-authored docs	16
Single-authored docs	16
Co-Authors per Doc	3,53
International co-authorships %	25,44
Article	85
conference paper	29

Table 1 shows a comprehensive perspective of the bibliometric results of 114 documents selected from the Scopus database using a systematic search query. These documents were found in 75 sources with an average citation score of 4,1. These data indicate that significant research has been conducted with the active participation of researchers.
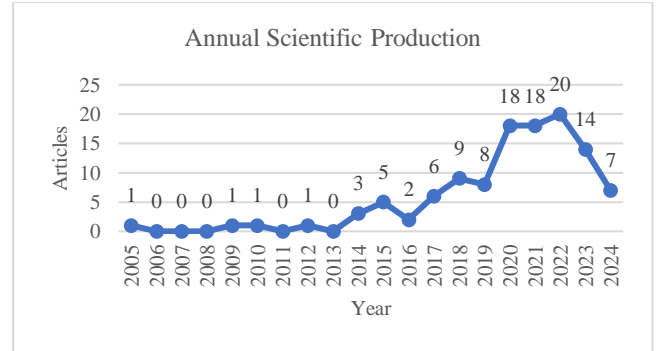

Figure 3
Annual Scientific Production

Based on the results of bibliometric analysis of journal articles indexed by Scopus, it can be seen that the research trend on the application of big data in risk and security management tends to increase. This can be seen in Figure 3, which depicts the current stage of information dissemination and research on big data in risk and security management. Research began to develop in 2005 and will continue to increase until it reaches its peak between 2020 and 2022 (18 to 20 articles). Research on big data in the future will become a positive trend to help meet various company needs, so this trend tends to increase.

IDC (2015) estimates that the big data technology and services market will grow at a compound annual growth rate of 23.1% over the 2014-2019 period, with annual spending reaching $48.6 billion in 2019. Gartner (2015), estimates that 4.9 billion connected objects will be used in 2015, up 30% from 2014, and will reach 25 billion in 2020. To meet the growing need for big data storage and processing.
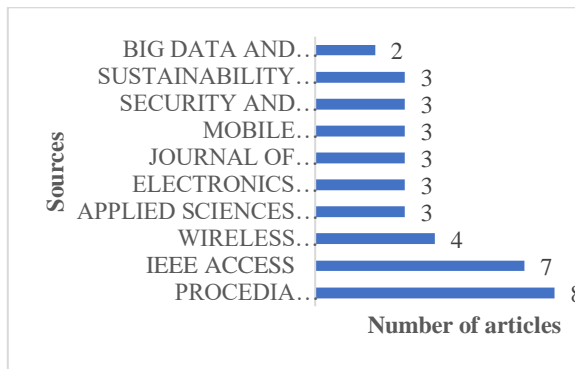
Figure 4
Most Relevant Sources

Figure 4 shows the number of journal articles on applying big data in risk and security management. The most relevant sources found by the top three include Procedia Computer Science, with eight articles discussing multi-layer big data for security issues, big data as a service and application for the banking sector, risk management in computing, security governance challenges in the significant data era, and digital transformation. This was followed by IEEE Access publishing seven articles discussing risk management using big data, data security schemes, digital risk assessment frameworks, and data sharing protocols to minimize security and privacy risks of cloud storage in the Big Data Era. Wireless Communications and Mobile Computing with four articles. Meanwhile, Applied Sciences (Switzerland), Electronics (Switzerland), Journal of Global Information Management, Mobile Information Systems, Security And Communication Networks, Sustainability (Switzerland), each with three articles, and finally, Big Data and Society with two articles.
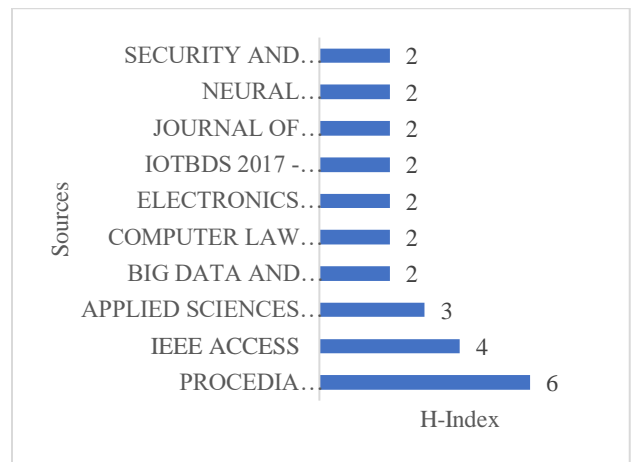

Figure 5
10 Most Influential Sources

Bibliometric analysis also helps determine how much journal sources influence scientific progress. Figure 5 illustrates the ten most prominent scientific publications in the research field based on the h-index. The h-index is a metric that assesses the relative quality of a journal based on its citation impact and productivity (Ingale & Paluri, 2022). Figure 5 shows that Procedia Computer Science has the most significant influence, with an h-index of 6, followed by IEEE Access with an h-index of 4, and Applied Sciences (Switzerland) with an h-index of 3.
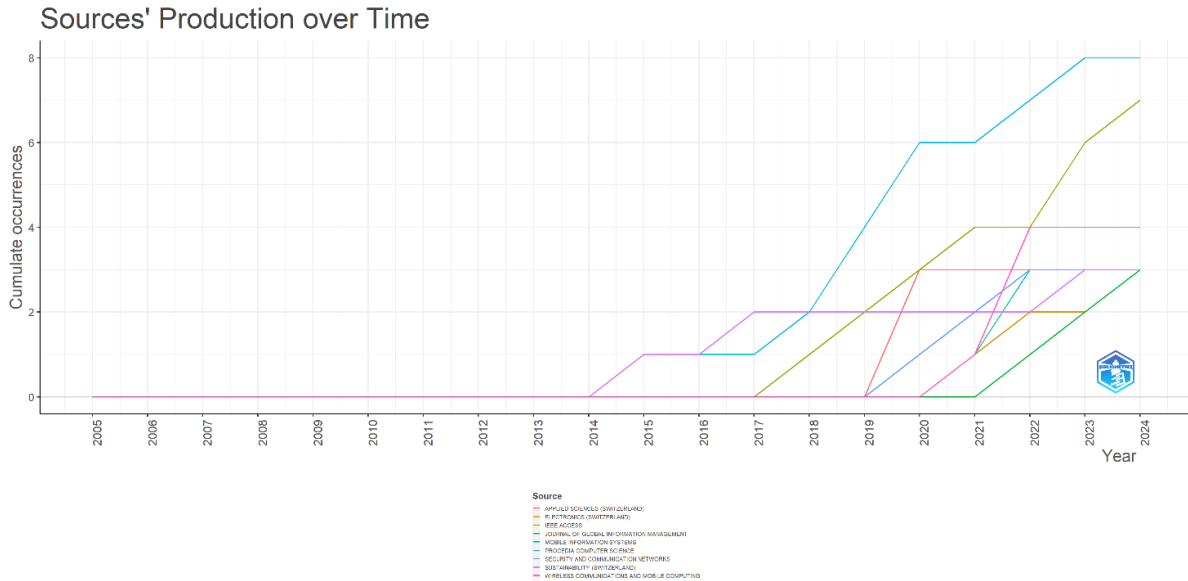
Sources' Production over Time

Figure 6
Source dynamics

Figure 6 explains the cumulative increase in incidence in each journal from 2015 to 2024. Procedia Computer Science was the first journal to publish research on the impact of big data analytics in 2015, followed by Sustainability (Switzerland) publishing research on risk management practices. The Procedia Computer Science journal has eight articles exploring the role of big data in risk and security management until 2023. In addition, the IEEE Access journal will publish around seven articles 2024 related to data security management, privacy risks, and risk management using big data.

It is supported that the worldwide social media analytics market is proliferating from $1.6 billion in 2015 to around $5.4 billion in 2020, with an annual growth rate of 27.6%. This growth is due to

sophisticated analytics and an increase in the number of social media users. Social media analysis focuses on sentiment analysis and social network analysis. Social media analysis supports social media content mining, usage mining, and structure mining activities in big data (ReportsnReports, 2016).
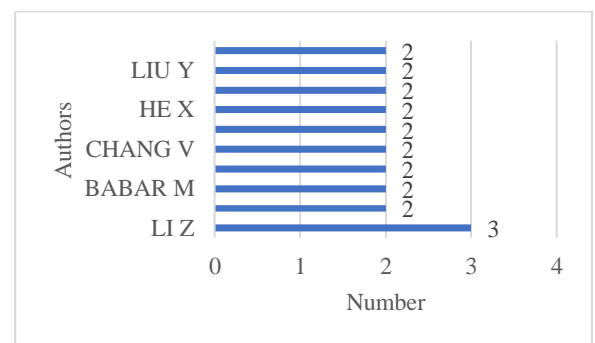

Figure 7
Most Relevant Authors

Figure 7 shows that "Most relevant authors" refers to authors who have contributed significantly to

8

a particular field or topic. The following are the ten most relevant authors based on bibliometric analysis who have published publications regarding the role of big data in risk management and corporate security. Based on this, we summarize the most relevant authors, including Li Z, Al Garni, Babar M, Chang C, Chang V, Chen J, He X, Liu Y, and Saxby S.
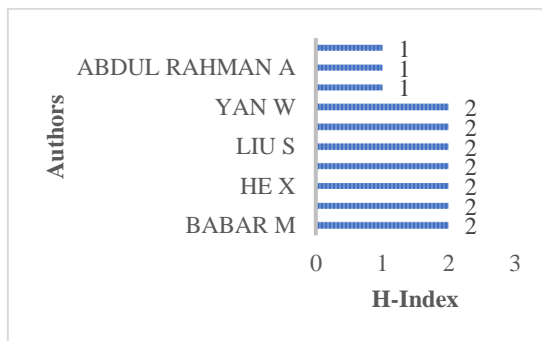

Figure 8
Authors Impact

Author impact based on the H-Index is a variant of the H-index that distributes the citations each publication receives among its authors. This can help to identify the most influential authors in a particular source and to evaluate the impact of their research results, especially regarding big data in risk management and security. The following are the ten most influential authors based on the H-Index. Based on Figure 8, it can be concluded that Babar M, Chang V, He X, Li Z, Liu S, Saxby S, and Yan W each have an h-index of 2. Meanwhile, Abdel Fattah M, Abdul Rahman A, and Acebes A each have an h-index of 1.

Figure 9
WordCloud

Figure 9 shows a WordCloud, which is a visual depiction of the frequency of words in a document, with the size of the terms representing their frequency. The term "big data" appears 46 times in the document, followed by "information management" and "risk assessment," each appearing 26 times, "risk management" appearing 22 times, "network security" appears 13 times, and "data privacy" and "security of data" each appeared 12 times. Research using big data in risk management and corporate security has experienced significant growth since 2015 (see Figure 6). Initially, big data was used for information management and risk evaluation. However, as it developed, its use was related to risk management and network security, gradually expanding to company data privacy and security.

Network Analysis

Data visualization using network analysis was used to assess the number of clusters that appeared, the number of occurrences and

relationships between different units of analysis, the overall strength of the year, and the number of citations. Network analysis will produce three types of structural knowledge: conceptual, intellectual, and social. Co-occurrence networks that use conceptual structures describe interactions between themes, subjects, and trends.

Figure 10
Co-occurrence Network

Figure 10 visually presents the co-occurrence network of author keyword analysis, a key outcome of our research using the Bibliometric software algorithm. This visual representation is particularly intriguing as it reveals six clusters, each representing distinct keywords or themes. These clusters, identified by their unique colors (red, blue, green, purple, orange, and brown), are further detailed in the following table 2:

Table 2
Description of co-occurrence network

Cluster 1 (Red)	Cluster 2 (Blue)	Cluster 3 (Green)
big data; information management; data analytics	network security; data privacy; computer security; cloud computing;	risk assessment; risk management; security of data;

Cluster 1 (Red)	Cluster 2 (Blue)	Cluster 3 (Green)
internet of things; artificial intelligence; digital storage; security systems; edge computing; human resource management; malware; data handling; health risks; access control; distributed computer; systems; internet; managers; problem solving; supply chain management.	cyber security; cybersecurity; security; authentication; computer crime privacy.	decision making; information security managements; information systems; information use; crime; finance; computer architecture; disasters; privacy by design; risk analysis; risk perception; security risks

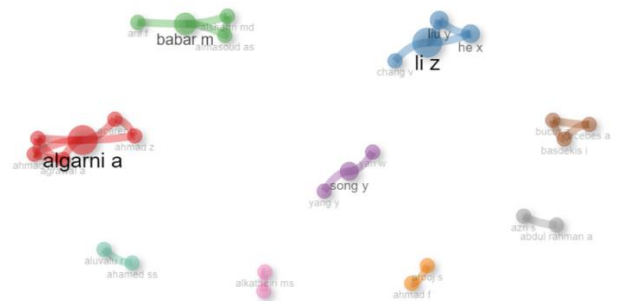| Cluster 4 (Purple)	Cluster 5 & 6 (Orange and Brown)	
Blockchain	Machine learning	

Figure 11
Authors Collaboration Network

Social structure analysis uses networks and graphs to identify social structure. Nodes (such as author, country of origin, institution, or publication source) characterize the network structure, and ties or relationships between the nodes indicate relevant interactions. As illustrated in Figure 11, authors Algarni, A carer, Agrawal, and Ahmad have the most connections in

social networks, followed by Li Z, Chang V, He x, Liu Y, and other author partnerships.
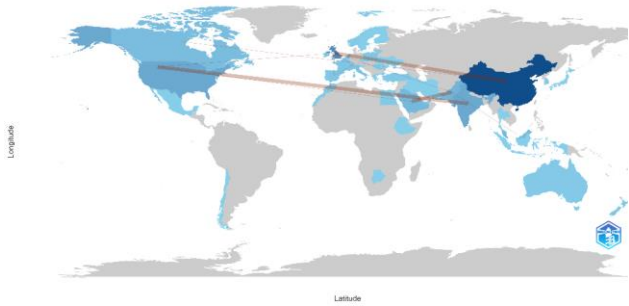

Figure 12
Country Collaboration Map

Based on Figure 12, it shows an analysis of author collaboration between countries from a regional perspective. Based on the results of bibliometric analysis, it can be concluded that Chinese researchers dominate cross-country scientific collaboration by collaborating with Canada, India, the Netherlands, Norway, Poland, Switzerland, and England. It shows that China

launched a pilot policy called the National Comprehensive Big Data Pilot Zone in 10 provinces and 57 cities in two rounds in 2015 and 2016. This policy encourages pilot regions to open up public data, build big data centers, and reform extensive data systems, which results in an exogenous increase in local extensive data stocks (Feng et al., 2024). This is followed by India and the United States collaborating well with other countries.

Literature Review of the Most Cited Articles

We conducted a theoretical review of the ten most cited articles in this case. Information regarding the topics and types of literature reviewed is shown in Figure 13 below.
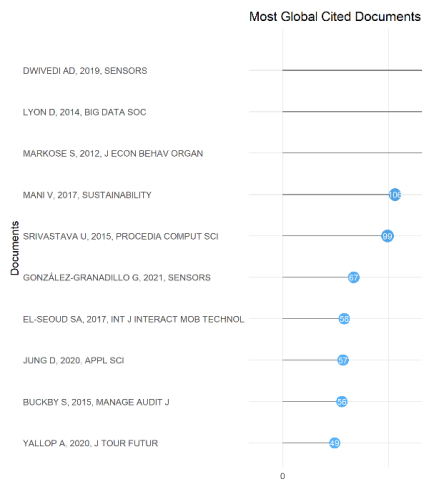

Figure 13
Most Global Cited Documents

11

Based on Figure 13 above, the ten journal articles that will be reviewed have several topics, including Dwivedi et al. (2019), "Application of blockchain in maintaining data privacy". This article explains that the medical care field increasingly relies on IoT wearable technology to improve the efficiency of diagnosis and treatment. While providing significant benefits, this technology also faces severe privacy and security risks associated with transferring and recording medical data. Blockchain technology provides secure management and analysis of medical big data. The proposed solution uses a blockchain modified for IoT, offering additional security and privacy by leveraging advanced cryptographic primitives.

Lyon (2014) states that using Big Data strengthens the trend of specific surveillance, monitoring, and information collection activities related to information technology and networks, thereby engaging in new dynamic configurations. Big Data also qualitatively changes monitoring and information-gathering practices, with an emphasis on the consequences.

Mani et al (2017), The use of big data analytics to forecast business trends is increasingly popular among professionals. On the other hand, supply chain risk management is very important because it helps companies reduce internal and external threats. This research aims to explore the application of big data analytics in mitigating supply chain social risks and to show how such mitigation can help achieve environmental, economic and social sustainability. This research shows that big data analytics can help companies predict and reduce various social risks in the supply chain, such as workforce safety, fuel consumption monitoring, and vehicle safety.

Srivastava & Gopalkrishnan (2015), explained that the big data revolution in the 21st century significantly impacted banking institutions by revealing secret money movement patterns, preventing the risk of disasters and significant theft, and increasing understanding of consumer behavior. International banks are now increasingly leveraging data for sentiment analysis, product cross-selling, regulatory compliance management, reputation risk management, and financial crime detection. This research shows the success of big data analytics in improving spending pattern management, channel usage optimization, customer segmentation and profiling, and cross-product sales strategies based on customer profiles to improve their business performance.

González-Granadillo et al (2021), Security Information and Event Management (SIEM) systems

are crucial in fighting cyber attacks with a focus on prevention, detection, and response. Currently, SIEM integration with big data analytics is becoming a trend to increase efficiency in information security management, especially in the context of critical infrastructure.

El-Seoud et al (2017) state that big data is one of today's most important technologies. This term refers to data volume, velocity, variety, and validity that present management and analytical challenges for traditional data warehouses. Combining big data with analytics allows data processing from various sources to optimize decisions, business processes, and new business models. While cloud computing is ideal for running big data workloads, integrating the two poses challenges due to different design principles. Meanwhile, great concern over privacy and security issues is a significant obstacle for organizations and educational institutions when switching to the cloud.

Jung et al (2020), the standard disaster response system in South Korea still needs improvement, especially in preparing the response system to deal with natural disasters such as forest fires and cold/heat waves. This research proposes a new conceptual framework for an Intelligent Disaster Management System (IDSS) by leveraging big data from open APIs

and artificial intelligence algorithms to support faster and more accurate decision-making.

Buckby et al. (2015) state that communication of risk management (RM) practices is critical to good corporate governance. This research aims to contribute to the literature by investigating how companies disclose RM information in annual reports by the corporate governance framework.

Yallop & Seraphin (2020), examine the impact of big data and analytics technology, which will be very influential in the tourism and hospitality industry in the next five years. It covers the opportunities and risks that these technological advances present for tourism and hospitality organizations, emphasizing the importance of data governance and processes for effective and ethical data management. These results also encourage further research on industry data governance and data ethics. They suggest that tourism and hospitality organizations must expand their compliance-based data governance framework to one with more effective privacy and data ethics solutions to obtain a competitive advantage.
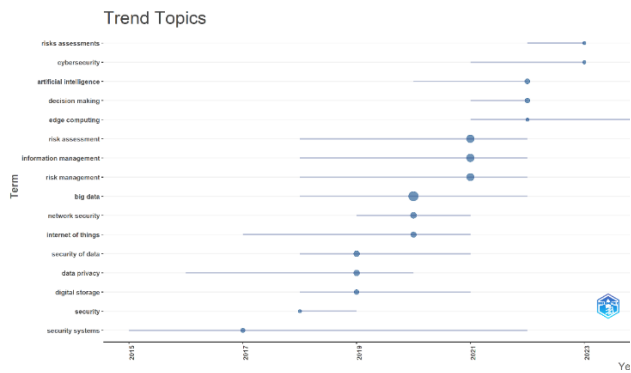
Figure 14
Trend Topics

Trend topics in bibliometric analysis involve identifying and analyzing themes that are emerging or prevalent in a particular field of study over a particular period. This analysis helps in understanding current areas of focus, tracking the development of new themes, and identifying potential research directions for future research. Using keywords in big data in risk and security management started in 2017 regarding security systems and then developed data privacy and data and network security. Weak security creates user resistance to big data adoption, which also causes financial losses and damage to the company's reputation. Confidential information can be accidentally transmitted to undesirable parties without proper security mechanisms. These security challenges can be overcome by building robust security management protocols and security solutions such as intrusion prevention and detection systems, encryption, and firewalls built into big data systems (Lee, 2017).

Big data technology is starting to be used in risk management, risk assessment, and decision-making. This shows that risk and security management is a topic that will continue to grow because it is deeply rooted in company business activities (Wang et al., 2023). This is supported by Mani et al (2017), using big data analytics to forecast business trends can help companies predict and reduce various social risks in the supply chain, such as workforce safety, and help companies reduce internal and external security threats. Apart from that, big data can predict the occurrence of disasters with an intelligent Disaster Management System (Jung et al., 2020). This is also supported by research by Jin & Wagman (2021), which shows that organizations that rely on extensive data analysis have an established risk management approach that prevents all external threats.
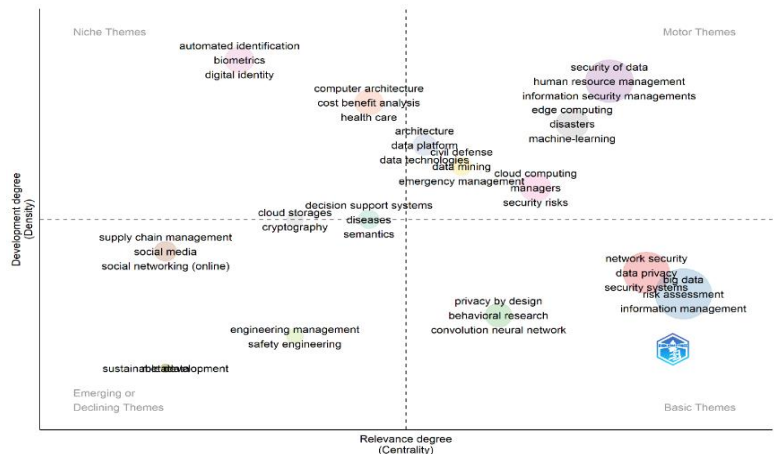
Potential Future Research Topics

Figure 15
Thematic Maps

The following explains the four types of quadrants used in thematic map analysis: niche themes, motor themes, declining or emerging themes, and basic themes. Niche themes are widely researched or currently developing themes, usually the focus of extensive research, but have a low level of relevance to a particular topic, according to Khare & Jain (2022). On the other hand, motor themes show themes that are developing, experiencing significant growth, and have a high level of relevance. While declining or emerging themes have a limited amount of research, widely researched themes play an important role in developing a topic. Basic themes include relevant but under-researched topics that indicate opportunities for further research in the future. This basic theme also reflects the main topics that still need to be studied in more depth. Figure 15 explains the map of current research themes on the role of big data in risk and security management; suggestions for future research can be seen in the basic themes. Based on this, the author's suggestions for future research are as follows:

- Future research can explore related privacy designs, other behavioral research, and convolution neural networks.

- Explore research on security systems, data privacy, and network security in big data, which still needs further research. The reason is that as big data technology develops, the extensive collection of personal data raises serious concerns for individuals, companies, and governments. Without addressing these issues, individuals may become apprehensive about data analysis and decide not to provide personal data that can be analyzed later (Lee, 2017).

- Big data research in corporate information management and risk assessment will be increasingly crucial for the industry. In the era of big data, database information system security risks show diverse trends, so this topic is still an important part to be explored further (Wang et al., 2023).

IV. CONCLUSION

This research examines 114 journal articles indexed by Scopus from 2005 to 2024, focusing on applying big data in risk and security management. The results of the bibliometric analysis show that the most relevant and influential journals regarding the role of big data in risk and security management are Procedia Computer Science and IEEE Access. Between 2005 and

2024, we summarize several writers, such as Babar M, Chang V, He X, Li Z, Li Y, Liu S, and Saxby S, who are influential and productive writers. China, India, and the United States are the countries most interested in this field, and there are many publications related to the role of big data in risk and security management.

The analysis results from 2005 to 2024 illustrate that the most significant theme or topic trends relate to big data in risk management and assessment, data privacy, and data and network security. Based on the results of the thematic map, recommendations for future research related to the role of big data are divided into three groups, namely (1) privacy design and behavioral research, (2) security system and data privacy, and (3) information management and risk assessment.

This research highlights the use of big data in risk and security management from the perspective of research topic trends and suggests potential themes for future researchers. This research provides valuable information for academics as a basis for subsequent research. It also emphasizes the importance of big data in companies' or organizations' ability to overcome company security and risk problems.

The limitation of this research is that it only uses the Scopus database, considering that many other database platforms can be used for data extraction for future research. The keywords we used in this study were selected based on the definitions of big data, risk management, security, and related literature and can be modified to cover more articles and publications related to this field. The bibliometric tools used in this study have methodological biases, so we must establish specific parameters and standards for researchers to use other systematic review techniques in the future. Future researchers can combine bibliometrics with content analysis to gain a more comprehensive and detailed picture of research trends.

V. ACKNOWLEDGMENT

VI. REFERENCES

Abbasi, A., Sarker, S., & Chiang, R. (2016). Big Data Research in Information Systems: Toward an Inclusive Research Agenda. *Journal of the Association for Information Systems*, *17*(2), I–XXXII. https://doi.org/10.17705/1jais.00423

Akter, S., & Wamba, S. F. (2016). Big data analytics in E-commerce: a systematic review and agenda for future research. *Electronic Markets*, *26*(2), 173–194. https://doi.org/10.1007/s12525-016-0219-0

Almeida, F. L. F. (2017). Benefits, challenges and tools of big data management. *Journal of Systems Integration (1804-2724)*, *8*(4).

Aria, M., & Cuccurullo, C. (2017). Bibliometrix: An R-tool for comprehensive science mapping analysis. *Journal of Informetrics*, *11*(4).

Buckby, S., Gallery, G., & Ma, J. (2015). An analysis of risk management disclosures: Australian evidence. *Managerial Auditing Journal*, *30*(8–9), 812–869. https://doi.org/10.1108/MAJ-09-2013-0934

Choi, T. M., Wallace, S. W., & Wang, Y. (2018). Big Data Analytics in Operations Management. *Production and Operations Management*, *27*(10), 1868–1883. https://doi.org/10.1111/poms.12838

Clarke, R. (2016). Big data, big risks. *Information Systems Journal*, *26*(1), 77–90. https://doi.org/10.1111/isj.12088

Cockcroft, S., & Russell, M. (2018). Big Data Opportunities for

Accounting and Finance Practice and Research. *Australian Accounting Review*, *28*(3), 323–333. https://doi.org/10.1111/auar.12218

Dicuonzo, G., Galeone, G., Zappimbulso, E., & Dell'Atti, V. (2019). Risk management 4.0: The role of big data analytics in the bank sector. *International Journal of Economics and Financial Issues*, *9*(6), 40–47.

Dwivedi, A. D., Srivastava, G., Dhar, S., & Singh, R. (2019). A Decentralized Privacy-Preserving Healthcare Blockchain for IoT. *Sensors*, *19*(2), 326. https://doi.org/10.3390/s19020326

El-Seoud, S. A., El-Sofany, H. F., Abdelfattah, M. A. F., & Mohamed, R. (2017). Big Data and Cloud Computing: Trends and Challenges. *International Journal of Interactive Mobile Technologies (IJIM)*, *11*(2), 34. https://doi.org/10.3991/ijim.v11i2.6561

Feng, D., Zhang, Y., Lu, Y., & Duan, L. (2024). Big data and regional digital innovation: evidence from China. *Applied Economics Letters*, 1–7. https://doi.org/10.1080/13504851.2024.2339376

Fisher, M., & Raman, A. (2018). Using Data and Big Data in

Retailing. *Production and Operations Management*, *27*(9), 1665–1669. https://doi.org/10.1111/poms.12 846

Frizzo-Barker, J., Chow-White, P. A., Mozafari, M., & Ha, D. (2016). An empirical study of the rise of big data in business scholarship. *International Journal of Information Management*, *36*(3), 403–413. https://doi.org/10.1016/j.ijinfom gt.2016.01.006

Gartner. (2015). *Gartner says 6.4 billion connected things will be in use in 2016,up 30 percent from 2015*. http://www.gartner.com/newsro om/id/3165317

González-Granadillo, G., González-Zarzosa, S., & Diaz, R. (2021). Security Information and Event Management (SIEM): Analysis, Trends, and Usage in Critical Infrastructures. *Sensors*, *21*(14), 4759. https://doi.org/10.3390/s211447 59

IDC. (2015). *New IDC forecast sees worldwide big data technology and services market growing to $48.6 billion in 2019, driven by wide adoption across industries [Press Release]*. http://www.idc.com/getdoc.jsp? containerId=prUS40560115

Ingale, K. K., & Paluri, R. A. (2022). Financial literacy and financial behaviour: a bibliometric

analysis. *Review of Behavioral Finance*, *14*(1), 130–154. https://doi.org/10.1108/RBF-06-2020-0141

Jin, G. Z., & Wagman, L. (2021). Big data at the crossroads of antitrust and consumer protection. *Information Economics and Policy*, *54*, 100865.

Jung, D., Tuan, V. T., Tran, D. Q., Park, M., & Park, S. (2020). Conceptual framework of an intelligent decision support system for smart city disaster management. *Applied Sciences (Switzerland)*, *10*(2). https://doi.org/10.3390/app1002 0666

Khare, A., & Jain, R. (2022). Mapping the conceptual and intellectual structure of the consumer vulnerability field: A bibliometric analysis. *Journal of Business Research*, *150*, 567–584. https://doi.org/10.1016/j.jbusres. 2022.06.039

Lee, I. (2017). Big data: Dimensions, evolution, impacts, and challenges. *Business Horizons*, *60*(3), 293–303. https://doi.org/10.1016/j.bushor. 2017.01.004

Lyon, D. (2014). Surveillance, Snowden, and Big Data: Capacities, consequences, critique. *Big Data & Society*, *1*(2), 205395171454186.

https://doi.org/10.1177/2053951714541861

Mani, V., Delgado, C., Hazen, B. T., & Patel, P. (2017). Mitigating supply chain risk via sustainability using big data analytics: Evidence from the manufacturing supply chain. *Sustainability (Switzerland)*, *9*(4). https://doi.org/10.3390/su9040608

Noruzi, A. (2005). Google Scholar: The New Generation of Citation Indexes. *Libri*, *55*(4). https://doi.org/10.1515/LIBR.2005.170

ReportsnReports. (2016). *Social Media Analytics Market to Rise at 27.6% CAGR to 2020.* https://www.prnewswire.com/news-releases/social-media-analytics-market-to-rise-at-276-cagr-to-2020-568584751.html

Shabbir, M. Q., & Gardezi, S. B. W. (2020). Application of big data analytics and organizational performance: the mediating role of knowledge management practices. *Journal of Big Data*, *7*(1), 47.

Srivastava, U., & Gopalkrishnan, S. (2015). Impact of big data analytics on banking sector: Learning for Indian Banks. *Procedia Computer Science*, *50*, 643–652. https://doi.org/10.1016/j.procs.2015.04.098

Strozzi, F., Colicchia, C., Creazza, A., & Noè, C. (2017). Literature review on the 'Smart Factory' concept using bibliometric tools. *International Journal of Production Research*, *55*(22), 6572–6591. https://doi.org/10.1080/00207543.2017.1326643

Syafrudin, M., Alfian, G., Fitriyani, N. L., & Rhee, J. (2018). Performance Analysis of IoT-Based Sensor, Big Data Processing, and Machine Learning Model for Real-Time Monitoring System in Automotive Manufacturing. *Sensors*, *18*(9), 2946. https://doi.org/10.3390/s18092946

Tang, J. J., & Karim, K. E. (2017). Big Data in Business Analytics: Implications for the Audit Profession. *CPA Journal*, *87*(6).

Wang, Y., Xue, W., & Zhang, A. (2023). Application of Big Data Technology in Enterprise Information Security Management and Risk Assessment. *Journal of Global Information Management*, *31*(3). https://doi.org/10.4018/JGIM.324465

Yallop, A., & Seraphin, H. (2020). Big data and analytics in tourism and hospitality: opportunities and risks. *Journal of Tourism Futures*, *6*(3), 257–262.

https://doi.org/10.1108/JTF-10-2019-0108

Zhao, D., & Strotmann, A. (2015). Analysis and Visualization of Citation Networks. *Synthesis Lectures on Information Concepts, Retrieval, and Services*, *7*(1), 1–207. https://doi.org/10.2200/S00624 ED1V01Y201501ICR039

Zio, E. (2018). The future of risk assessment. *Reliability Engineering & System Safety*, *177*, 176–190. https://doi.org/10.1016/j.ress.20 18.04.020