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BIBLIOMETRIC ANALYSIS OF ANTICIPATING DIGITAL FINANCIAL REPORT FRAUD USING VOSVIEWER

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ABSTRACT

Purpose: *The purpose of this study was to determine the development of research on anticipating digital financial reporting fraud using bibliometric analysis on the VOSviewer application version 1.6.20.*

Methodology/approach: *The research method used is a qualitative method with a thematic analysis approach.*

Findings: *The results of the study showed that the development of research on anticipating digital financial reporting fraud from 2019-2024 experienced significant annual fluctuations. In the last year, there has been a marked increase in the number of publications. The most publications in 2024 and the smallest in 2020, consisting of 11 clusters with 173 keyword items with the most publications in Heliyon and Procedia Computer Science. Technologies such as blockchain, big data analytics, and artificial intelligence are identified as important tools in detecting and preventing fraud.*

Practical implications: *The results of this study can be used as a guide for companies and academics in developing digital strategies to improve financial monitoring and transparency systems.*

Originality/value: *To the best of the researcher's knowledge, this study is the first study to examine the development of digital financial reporting fraud anticipation research with bibliometric analysis of Scopus indexed publications in 2019–2024*

Keywords: *Bibliometric Analysis; Digital Fraud Anticipations; Financial Statement; VOSviewer*

ABSTRAK

Tujuan penelitian: Tujuan dari penelitian ini adalah untuk mengetahui perkembangan penelitian mengenai antisipasi kecurangan laporan keuangan secara digital dengan menggunakan analisis bibliometrik pada aplikasi VOSviewer versi 1.6.20

Metode/pendekatan: Metode penelitian yang digunakan adalah metode kualitatif dengan pendekatan analisis tematik

Hasil: Hasil penelitian didapatkan bahwa perkembangan penelitian mengenai antisipasi kecurangan laporan keuangan secara digital dari tahun 2019-2024 mengalami fluktuasi tahunan yang signifikan. Pada tahun terakhir, terdapat peningkatan yang mencolok dalam jumlah publikasi tersebut. Publikasi terbanyak pada tahun 2024 dan terkecil pada tahun 2020, terdiri dari 11 cluster dengan 284 item kata kunci dengan publikasi terbanyak pada Heliyon dan Procedia Computer Science. Teknologi seperti blockchain, big data analytics, dan kecerdasan buatan diidentifikasi sebagai alat penting dalam mendeteksi dan mencegah kecurangan.

Implikasi praktik: Hasil penelitian ini dapat digunakan sebagai panduan bagi perusahaan dan akademisi dalam mengembangkan strategi digital untuk meningkatkan sistem pengawasan dan transparansi keuangan

Orisinalitas/kebaharuan: Sepanjang pengetahuan peneliti, penelitian ini merupakan penelitian pertama yang mengkaji perkembangan penelitian antisipasi kecurangan laporan keuangan secara digital dengan analisis bibliometrik pada publikasi terindeks Scopus tahun 2019–2024

Kata kunci: Analisis Bibliometrik; Antisipasi Penipuan Digital; Laporan Keuangan; VOSviewer

INTRODUCTION

Digitalization has brought about major changes in various sectors of life, both in business, information technology, and daily life. The digitalization process refers to the integration of digital technology into almost every aspect of operational activities, which has enabled companies and organizations to significantly increase efficiency, innovation, and performance (Monge & Soriano, 2023). Technologies such as the internet, big data, artificial intelligence (AI), and blockchain systems have opened up new opportunities for organizations to improve operational efficiency, accelerate data-based decision-making, and

create added value through innovation in business models (Qasim & Kharbat, 2020). Digital transformation not only provides significant benefits in improving operational efficiency, accelerating data-based decision-making, and creating innovation in business models, but also contributes to efforts to detect and prevent illegal practices such as fraud (Donning et al., 2019).

Fraud is an illegal act carried out by individuals or groups to harm organizations or other parties in various ways, such as data falsification, identity theft, and financial statement fraud (Rahman & Anwar, 2014). Fraud can cause significant losses to companies, both in terms of finances, reputation, and public trust. Among the various types of fraud that exist, financial statement fraud is one of the most detrimental, because it can cause the loss of integrity and reliability of information used by stakeholders in making economic decisions. The Association of Certified Fraud Examiners (ACFE) classifies fraud into three main categories: asset misappropriation, financial statement fraud, and corruption (Dorris, 2020). Of the three, although financial statement fraud is a rarer case, the losses are much greater than other fraud categories.

Financial statement fraud involves the act of manipulating or presenting false information in financial statements to deceive parties who rely on the information, such as investors, creditors, and auditors. The sustainability of this problem encourages the need for more serious efforts to prevent and identify fraud in financial statements, especially amidst the increasing complexity and volume of data. Fraud in financial statements can be recognized from inaccuracies or manipulation in the presentation of financial information that should be trusted by various parties (Sudarwanto & Kharisma, 2022). To overcome this challenge, digitalization plays a very important role in strengthening the company's internal control system. By using more sophisticated information technology, companies can improve control procedures and monitor financial transactions more effectively. Internal control systems supported by digital technology can reduce the chances of fraud by introducing tighter controls, such as segregation of duties, transaction authorization, and automatic reconciliation, which are more efficient than manual controls (Fadlilah et al., 2024).

Technologies such as data mining, big data analytics, and blockchain have been shown to provide effective solutions in detecting and preventing financial reporting fraud. Previous studies have shown that these technologies can increase transparency and provide more accurate analysis in identifying potential fraud (Gupta & Singh Gill, 2012; Madhuri et al., 2021; Hakim et al., 2024). Moreover, big data allows accountants to analyze large volumes of data in real-time to produce more accurate and evidence-based reports (Sun et al., 2024). AI supports the automation of routine processes, such as data entry and identification of anomalies in financial reports, thereby increasing efficiency and reducing the risk of human error (Antwi et al., 2024). Meanwhile, the implementation of a blockchain-based system with decentralized and immutable transaction recording ensures higher transparency and security in financial reporting, thereby preventing data manipulation (Castonguay & Smith, 2020; Luna et al., 2024; Roszkowska, 2020).

However, although the application of digital technology offers great potential in anticipating financial reporting fraud, there are still many challenges in its implementation. One of them is how to identify and understand technology adoption patterns in various organizations and industries (Manager & Practice, 2022). The problem of uneven technology adoption in various sectors and organizations, as well as issues related to data protection and privacy (Qasim & Kharbat, 2020). Therefore, anticipating financial reporting fraud digitally is very

important in organizations because it has a number of benefits and important roles in maintaining integrity, transparency, and operational sustainability.

From several benefits and roles of technology and the diversity of topics above, it shows that research related to anticipating financial reporting fraud can still be explored and analyzed further. Therefore, researchers are interested in conducting research by mapping the development of research on anticipating financial reporting fraud digitally. In addition, the distribution of research related to anticipating financial reporting fraud is very diverse and has not been properly mapped so that its development is not clearly known.

Technologies such as data mining, big data analytics, and blockchain have been shown to provide effective solutions in detecting and preventing financial statement fraud. Previous studies have shown that these technologies can increase transparency and provide more accurate analysis in identifying potential fraud Gupta (2023); Madhuri, (2021); Hakim et al (2024). Furthermore, the implementation of blockchain-based systems, with their ability to ensure full transparency and prevent data manipulation, has been identified as a promising alternative in preventing financial statement fraud (Luna et al., 2024).

This study aims to review the latest research developments on the application of digital technology in preventing financial reporting fraud by focusing on studies that have been published in the last five years, namely from 2019 to 2024. Research published in the last five years provides a more accurate picture of current trends and technology applications that are more relevant to current conditions (Mikalef et al., 2020; Chen et al., 2020). In addition, with the development of digitalization and the increasing risk of more complex and sophisticated fraud, the latest technology provides more effective and appropriate solutions. The latest literature will reflect how the latest technology can address the problems arising from the digital transformation in the financial sector (Agorbia-atta, 2024). Therefore, to gain a better understanding of the latest solutions that can be implemented in the real world, it is important to focus on the latest literature.

The use of bibliometric analysis methods with VOSviewer software allows researchers to identify trends, patterns, and gaps in related literature, as well as provide insights into the most relevant topics in the context of digital technology and fraud prevention (Valle et al., 2024). This study has important theoretical and practical contributions. Theoretically, this study will compile and summarize existing knowledge on the relationship between digitalization and financial reporting fraud prevention, and identify factors that influence technology adoption in this context. Practically, the results of this study are expected to provide applicable insights for practitioners in the fields of finance and accounting to develop and implement more effective strategies in preventing fraud through digital technology.

This study has important theoretical and practical contributions. Theoretically, this study will compile and summarize existing knowledge on the relationship between digitalization and financial reporting fraud prevention, and identify factors that influence technology adoption in this context. Practically, the results of this study are expected to provide applicable insights for practitioners in the financial sector.

METHOD

The research method used in this study is a qualitative method with a bibliometric analysis approach. This study aims to understand the phenomenon of digital financial reporting fraud anticipation by identifying research trends and relationships between various concepts related to this topic. The phenomenon of digital financial reporting fraud is now increasingly becoming a global issue that is receiving great attention, both from regulators, academics,

and industry. In the past five years, new policies and technologies focused on fraud prevention have developed, and there has been a significant increase in awareness of the importance of financial reporting integrity in the digital era (Jiang et al., 2022). Therefore, by focusing on the literature of the past five years, this study will provide more up-to-date and relevant insights into global issues that are receiving great attention and the solutions faced today.

The bibliometric analysis approach was chosen because it is able to provide an overview of current and recent research development trends related to the topic of financial reporting fraud in the context of digitalization. Bibliometrics allows mapping of existing literature, as well as identifying relationships between authors, keywords, and frequently discussed subjects (Sarjana, 2022). By analyzing scientific publications, bibliometric analysis can identify the most researched topics, concepts that appear consistently, and relationships between elements in the relevant literature. In the context of research on digital financial reporting fraud, this analysis provides important insights into current research directions, including innovations in the technologies used to detect and prevent fraud.

Meanwhile, data analysis in this study uses thematic analysis methods. This approach will help in detecting and analyzing the main themes contained in relevant publications, as well as giving meaning to these themes. The themes in question are structurally meaningful data units, which will be used to provide a deeper understanding of how digital financial reporting fraud anticipation has been studied in various scientific publications.

The data used in this study are secondary data based on Scopus data, obtained through the Publish or Perish (PoP) application, emerald publishing and sciencedirect.com to conduct a search for relevant literature. The selection of publishers and databases in this study was based on several fundamental considerations due to the quality and reputation in publishing scientific articles related to the fields of management, finance and technology. Scientific articles can represent research relevant to this topic because they have a collection of scientific articles that focus on the development of theory and practice in the fields of digital technology, finance and audit. In addition, these sources offer access to journals that have gone through a rigorous peer review process, thus ensuring the reliability and quality of the data used in the study.

The steps in the bibliometric-based assessment have been adopted from (Alfawareh & Al-Kofahi, 2024) which consist of five stages to systematically identify, analyze and visualize bibliometric data. The first stage is to determine research questions that describe what has been achieved in the study. The second stage is to design research using bibliometric techniques. The third stage is to design the research collection by determining keywords that are relevant to the research topic based on the article title, abstract and keywords. The fourth stage is to apply the methodology and software, namely Mendeley, VOSviewer and Harzing's Publish or Perish to obtain and process data. The fifth stage is to analyze the results by presenting the research results, conclusions and recommendations for future research.

In addition, the data extraction steps can be explained into four stages, namely: Step 1: Searching for papers in the Scopus database through the Harzing's Publish or Perish application and the emerald publishing and sciencedirect.com websites. Searching using filters based on article title, abstract, and keywords: "Digital Prevention Financial Fraud" which found 2,678 documents into 56 documents discussing the anticipation of digital financial reporting fraud and relevant studies in the form of journal articles. In ensuring its eligibility and credibility, the journal article was then checked on the Scimago website. Step 2: The paper was exported to RIS Excel format from mendeley data. The data consists

of bibliographic information, citation information, keywords, abstracts, and references. Step 3: : RIS Excel file uploaded to VOSviewer software**.** Step 4: Bibliometric Analysis**.**

The data extraction stage in this study resulted in 56 articles indexed by Scopus in the period 2019 to 2024 that were ready to be analyzed. To analyze the data, researchers will use two main techniques: thematic analysis and bibliometric analysis with the help of VOSviewer software. Thematic Analysis will be used to identify the main themes that appear in the selected articles. These themes will provide an understanding of the trends-topics that are often discussed in the context of preventing digital financial reporting fraud. Researchers will categorize themes based on conceptual similarities, approaches used, and key findings from each article. Bibliometric Analysis with VOSviewer is carried out to map and visualize the relationships between keywords, authors, and institutions involved in this topic.

To analyze the data, researchers will use two main techniques: thematic analysis and bibliometric analysis with the help of VOSviewer software (Sangal et al., 2024). Thematic Analysis will be used to identify the main themes that appear in the selected articles. These themes will provide an understanding of the trends that are often discussed in the context of digital financial reporting fraud prevention. Researchers will categorize themes based on similarities in concept, approaches used, and key findings from each article. Bibliometric Analysis with VOSviewer was conducted to map and visualize the relationships between keywords, authors, and institutions involved in this topic. By using VOSviewer, researchers will identify clusters or research groups that have close relationships (Mahya et al., 2023). This mapping will illustrate the development of research related to digital financial reporting fraud prevention, as well as map authors or institutions that have major contributions in this field.

The results of the study will be presented in narrative form outlining the main findings of the thematic analysis, as well as the results of bibliometric mapping that illustrates the development and relationships in digital financial reporting fraud prevention research. The researcher will also include graphic visualizations and network maps generated by VOSviewer to provide a clear picture of the development and trends of research in this field (Nazara et al., 2024). By using a bibliometric and thematic analysis approach, this study is expected to provide comprehensive insights into how digitalization is used to prevent financial reporting fraud, as well as provide an overview of trends and directions of research development in this field.

RESULT AND DISCUSSION

Based on the search results on the Scopus database, emerald publishing and sciencedirect.com shows that the development of research with the theme of Anticipating Digital Financial Report Fraud during the period 2019-2024 has increased significantly. The development of research increased sharply in the last year of 2024 as seen in Table 1 and Figure 1.

Table 1. Number of research development publications by year

Year of Publication	Total	%
2019	0	0.00
2020	1	1.79
2021	5	8.93
2022	10	17.86
2023	13	23.21
2024	27	48.21
Total	56	100

Source: processed by author (2024)

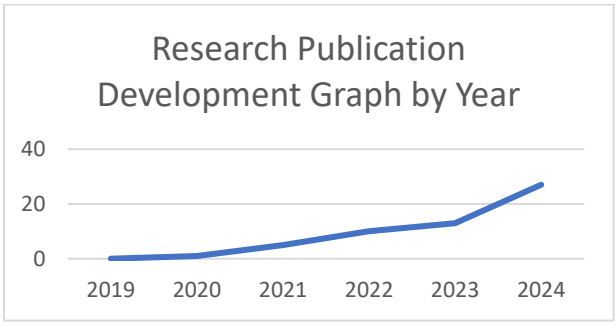


Figure 1. Graph of Research Publication Development by Year

Source: processed by author (2024)

Based on the data on the number of publications from 2019 to 2024, there is a significant increase in publication activity from year to year. The data on the number of publications from 2019 to 2024 shows a significant increasing trend in publication activity each year. In 2019, no publications were recorded, indicating that there was no activity in this field. The following year, namely 2020, there was one publication that participated 1.79% of the total, as the beginning of an increase in publication activity. This trend continued in 2021, where there was an increase to 5 publications. A significant increase was seen in 2022, when the number of publications reached 10 publications indicating a stronger push for research or publication in that year. The number of publications increased again in 2023 to 13 publications, indicating a consistent increase from year to year. 2024 was the peak of publication activity, with 27 publications or almost half of the total (48.21%). This data shows that from year to year, publication activity has increased significantly, especially in 2024. Overall, this trend reflects positive growth that may be influenced by various factors, such as policy support, increased resources, or institutional encouragement that encourages research. This shows that digital topics are attracting more researchers who are trying to explore the anticipation of potential digital financial reporting fraud. The more technology develops, the more the need for transparency and accuracy of financial information increases.

No	Journal	Rating (Scimago)	Total
1	Journal of King Saud University - Computer and Information Sciences	Q1	1
2	Intelligent Systems with Applications	Q1	1
3	Journal of Financial Crime	Q1	3
4	Journal of Asian Business and Economic Studies	Q1	1
5	Journal of Applied Accounting Research	Q1	1
6	Accounting, Auditing and Accountability Journal	Q1	1
7	International Journal of Operations and Production Management	Q1	1
8	Journal of Management	Q1	1
9	Journal of Open Innovation: Technology, Market, and Complexity	Q1	1
10	Accounting, Auditing and Accountability Journal	Q1	1

Table 2. Top 10 core journal rankings in publications on anticipating digital financial reporting fraud

Source: processed by author (2024)

From the data in Table 2, it can be seen that these journals have high rankings in scimago. Most of the journals included in the list have a Q1 ranking, indicating the high quality and scientific impact of the research published in the journal. The position of journals such as the Journal of King Saud University - Computer and Information Sciences, Technological Forecasting and Social Change, and Journal of Management as Q1 rankings indicates that research related to digital financial fraud detection and anticipation is a relevant topic and is often studied in publications that have a broad impact. These journals were selected by researchers because of the strict selection and review process, so that the published research has high credibility in providing new insights in the field of digital-based financial fraud prevention.

Furthermore, these journals have a strong editorial reputation by involving expert editors and reviewers in the fields of forensic accounting, information technology, and risk management. The strict review process and involvement of leading experts ensure that every study published in these journals has gone through a rigorous evaluation, thereby increasing the quality and credibility of the research results produced. In terms of topics, this research covers journals in various disciplines, such as computer science, finance, accounting, management, and public policy. This diversity shows that the published research findings are relevant in various fields, reflecting the openness and cross-disciplinary values that may be the focus of existing research.

Bibliometric Map of the Development of Research on Anticipating Digital Financial Report Fraud Based on Keywords From the search results through the Scopus database on the Publish on Perish application, 56 top documents were obtained on the development of research results on anticipating digital financial report fraud. Bibliometric analysis with VOSviewer on the theme of anticipating digital financial report fraud was carried out to identify the main keywords that often appear in related research. Keywords were analyzed from the title, abstract, and publication material of relevant journals, with a focus on the theme of digital fraud detection in financial reports, while unrelated themes were excluded.

The visualization results using the co-word map produce three main types of displays, namely network visualization, overlay visualization, and density visualization. These three displays show the development of research related to anticipating digital financial reporting fraud. In this visualization, the research field is divided into 11 clusters with a total of 284 links connecting 79 main items. Each item in the map shows a strong relationship to each other, indicating a close relationship between the main concepts and topics in digital financial reporting fraud research. Network visualization displays structural relationships between topics, overlay visualization shows changes in topics over time, and density visualization illustrates the most dense research areas in the keyword map. These results are displayed in more detail through the following tables and figures:

Cluster	Total Items	Topic Concept
First	12	*Anomaly detection, bibliometry, cyber attack, cyber forensics, cyber risk, cyber security, deep learning, financial system, it adoption, malware detection, outlier detection, systematic literature review*
Second	12	*Accounting, affordance, auditing, blockchain, digital currencies, financial crime, fraud, national blockchain infrastructure, regulation, review, smart contracts, sociomateriality*

Third	11	*Big data abalysis, chain of custody, cyber incident, cybercrime investigation, data collection and revovery, digital forensic, genetic algorithms, pattern recognition, rule-based reasoning, volatile memory*
Fourth	9	*Accountability, artificial knowledge, business processes, business strategies, cognitive innovators, digitalization, resilience theory, sustainable development goals, sustainable performance*
Fifth	7	*Big data, digital identity, financial management, high resolution imaging algorithm, information security, network trust, voice assistance*
Sixth	5	*Accounting information, artificial intelligence, internal control, large language model, sustainability reporting*
Seventh	5	*Customer service, fintech, innovation, robo-advisor, service robot*
Eight	5	*Cybersecurity, digital banking, fraud detection, phishing attacks, security measures*
Ninth	5	*Digital ledger, distributed ledger technology, procurement, purchasing, sourcing*
Tenth	4	*Bibliometric analysis, central bank digital currency, electronic payments, financial digital transformation*
Eleventh	4	*Automatic financial audit, Chinese corporate fraud, farud early warning, machine learning*

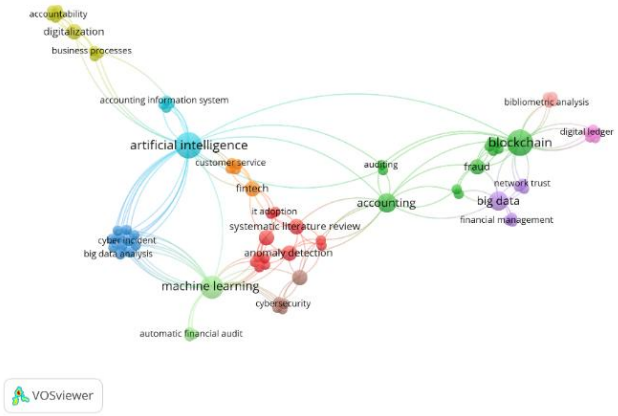
Table 3. Clusters in the development of research on anticipating digital financial reporting fraud

Source: processed by author (2024)

Cluster table analysis shows that research on anticipating digital financial reporting fraud is divided into several main topics, spread across 11 clusters with different focuses and concepts. The first cluster, which focuses on anomaly detection and cyber security, emphasizes the importance of identifying suspicious patterns and protecting against cyber threats in the financial system. In addition, clusters covering blockchain and smart contracts show that these technologies can increase transparency and prevent data manipulation in financial reports.

Research also focuses on aspects of digital forensics and cybercrime investigations, with topics such as digital forensics and pattern recognition helping to identify and analyze fraud that occurs in cyberspace (Holt et al., 2022). In addition, business sustainability and accountability emphasized in several clusters also show the importance of implementing ethical and transparent business principles in preventing fraud in the digital era. The latest technologies such as central bank digital currency (CBDC) and machine learning also support faster and more accurate fraud detection. (Radic et al., 2022; Thar, 2024). The development of this research shows that various technologies, from blockchain to artificial intelligence, play an important role in creating a safer and more transparent financial system. Efforts to prevent digital financial fraud involve not only technology, but also managerial principles that support sustainability and accountability in business.

Figure 2. Co-accuracy network visualization in the development of research on anticipating digital financial reporting fraud



Source: processed by author used VOSviewer (2024)

In the network visualization generated through VOSviewer in Figure 2 shows a complex pattern of relationships between keywords that often appear in research on anticipating digital financial reporting fraud. Keywords that often appear in the network visualization include "artificial intelligence", "machine learning", "blockchain", "digital forensics", "big data", "digitalization" and "big data analysis". These keywords reflect significant research trends and the use of digital techniques in detecting and preventing fraud in financial reporting.

The closeness between nodes and the thickness of the connecting lines between these keywords reflect the high level of relationship between concepts in this research. The larger the node, the more often the keyword is found in publications. For example, the strong relationship between "blockchain" and "digital forensics" shows that blockchain is often viewed as one of the reliable digital forensics solutions in detecting financial fraud. Likewise, the relationship between "artificial intelligence" and "big data analysis" indicates that artificial intelligence-based approaches and big data analysis often complement each other in detecting suspicious patterns.

Pattnaik et al (2024) in their research have an effective impact of the Artificial Intelligence approach to increase efficiency. This technology allows machines to perform tasks that usually require human intelligence, such as decision making, analysis, and prediction. AI is used to help detect and prevent fraud in a more efficient and accurate way, especially in financial systems that monitor transactions directly (Dunsin et al., 2024). If suspicious activity is found, the system will immediately alert the finance team to follow up.

The use of a big data analysis approach in research Gabrielli et al (2024) can help process and analyze large amounts of data quickly, allowing the identification of hidden patterns that are difficult to detect manually. The significant advantages provided by Big Data are also explained Alsadah and Al-Sartawi (2023) in forensic accounting affecting the effectiveness needed to conduct investigations. Pinto and Sobreiro (2022) use an anomaly detection approach to recognize unusual activity in financial statements. This technique often utilizes data-driven algorithms to detect signs of irregularities that could indicate fraud. Technologies such as machine learning are key tools in this approach because of their ability to analyze data in-depth and automatically (Sarker, 2023). The blockchain technology approach is also introduced Secinaro et al (2022) which is used as a transparent and immutable transaction recording system, thus minimizing the risk of data manipulation in financial processes. Meanwhile, smart contracts can be used to verify and allow transactions to be carried out

automatically only if certain conditions are met (Enayati et al., 2024). This helps reduce the risk of fraud by ensuring that all transactions are carried out according to established rules.

Furthermore, the clustering indicated by the colors of the nodes provides an overview of the main focus of digital fraud prevention research. Each cluster groups keywords based on major themes that show the diversity of approaches used in reserach in this area. This grouping not only shows current research trends, but also shows that digital technologies and advanced analytical methods are increasingly being used together to identify and prevent financial fraud more proactively and effectively.

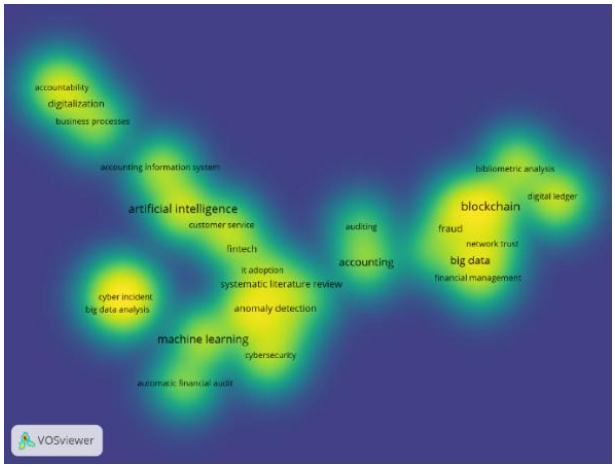


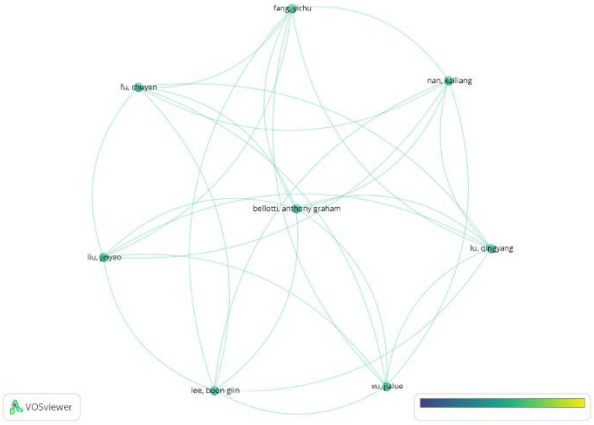
Figure 3. Co-accurance density visualization on the development of digital financial statement fraud anticipation research

Source: processed by author used VOSviewer (2024)

The results of the data analysis show a number of dominant themes and themes that are strongly related to preventing digital financial reporting fraud. In the visualization shown in Figure 3, the difference in color intensity in the cluster is an indicator that separates one topic group from another. This color variation makes it easier for researchers to group data to map, study, and analyze it in a more focused manner. The grouping of dominant themes aims to create a clear focus of study, so that relevant conclusions can be drawn. This classification also helps authors identify topics that are closely related to the main focus of the research, and ensures that the selected data supports the discussion so that it is not too broad or general.

In the density visualization, each node has a color that indicates the level of item density. The color scale starts from blue for low density, followed by green, to yellow for high density. The more and higher the weight of items in a node, the more yellow the color, while nodes with a lower number of items and weights tend to be blue. Figure 3 shows a density visualization for several frequently appearing keywords, such as "blockchain," "anomaly detection," "big data," and "cyber incident." The use of VOSviewer in this visualization reveals the distribution of research and the spread of knowledge in this field. In addition, based on Figure 3., it turns out that there are several topics in the article that have not been widely studied. Research topics that have not been widely studied are marked with inconspicuous colors and smaller font sizes. Some of them are related to auditing, automatic financial audit and digital ledger. Each item point has a color that depends on the density of the item at that time. This section is very useful for obtaining an overview of the general structure of the bibliometric map by paying attention to the part of the item that is considered important to analyze.

Figure 4. Everlay visualization co-authorship on the development of research on anticipating digital financial reporting fraud



Source: processed by author used VOSviewer (2024)

Data on the most active researchers in scientific publications on the theme of anticipating digital financial reporting fraud are presented in the form of an overlay visualization as seen in Figure 4. This visualization can be used to analyze journal publication trends over a certain period of time. There are eight authors who appear to be dominant in publishing research articles with publications that are most cited by other researchers. Bellotti and Anthony Graham appear to have the greatest weight compared to the other four researchers, indicating that many researchers cite their articles (Lu et al., 2023). Furthermore, nan and kailiang, lu and wingyang, xu and jialue, lee and boon giin, liu and jinyao, fu and chuyan, fang and yichu occupy the same position as researchers who cite their articles. (Leng et al., 2020; Lu et al., 2023). The eight authors shown have research results that are most cited by other researchers so that the resulting research can be used as a reference because it has a different topic so that it allows for novelty and this is in accordance with the development of science and technology that is currently happening.

Density and overlay visualizations show that some topics such as auditing, automatic financial audit and digital ledger are still under-recognized compared to popular themes such as blockchain, big data, or machine learning. This provides a great opportunity for researchers to explore these areas in more depth. Further research can focus on developing more efficient automated financial audit models and implementing digital ledgers in various financial contexts to improve reporting accuracy and transparency. In addition, research on aspects of digital ethics, public policy, and legal regulations related to new technologies in the financial system is still minimal. Further research can analyze the impact of digital technology ethics on digital-based accounting and auditing and how blockchain regulations in various countries can affect the effectiveness of anticipating financial fraud.

CONCLUSION

Based on search results from the Scopus database, Emerald publisher, and ScienceDirect, research on the theme of Anticipating Digital Financial Report Fraud between 2019 and 2024 showed a significant increase. A sharp increase occurred in 2024, as seen from the number of annual publications that increased consistently every year. The number of publications peaked at 27 publications in 2024, accounting for almost half of the total publications (48.21%). This study also revealed that the topic of anticipating digital financial report fraud has attracted attention from various fields of science. These fields include computer science, finance, accounting, management, and public policy. Several leading journals, such as the

Journal of King Saud University - Computer and Information Sciences and the Journal of Financial Crime, are the publication venues for this research and have a Q1 ranking in Scimago, reflecting high scientific quality and impact.

Bibliometric mapping conducted with VOSviewer shows that research on anticipating digital financial report fraud is divided into 11 main clusters. Each cluster has a different focus, such as anomaly detection, blockchain, digital forensics, and artificial intelligence and machine learning. New technologies, such as central bank digital currencies (CBDCs) and machine learning algorithms, play a key role in faster and more accurate fraud detection. In addition, the co-authorship visualization shows that there are eight researchers who dominate publications on the topic of anticipating digital financial reporting fraud. Several of these researchers have very high citation counts, indicating their significant influence and contribution to the development of research in this field. The increase in the number of publications and the involvement of key researchers reflects the positive growth driven by technological advances and the increasing awareness of the importance of transparency and accuracy of financial reporting in the digital era.

This study has several limitations that need to be considered. First, the results of bibliometric analysis are greatly influenced by the coverage and accessibility of data from the databases used, so that unregistered or poorly documented publications can introduce bias into the analysis and reduce the accuracy of research findings. Second, this study only covers the period 2019 to 2024, so the potential for long-term trends and changes in digital financial reporting fraud anticipation cannot be concluded comprehensively. In addition, the data coverage is limited to certain databases, namely Scopus, Emerald, and ScienceDirect, so the potential contribution of publications indexed in other databases such as IEEE Xplore or Web of Science has not been fully represented.

Further researchers are advised to combine bibliometric methods with qualitative analysis to provide a deeper understanding of this topic, for example by exploring specific case studies or the most effective fraud anticipation techniques. Future research can also extend the analysis period to observe long-term trends and identify new technological developments in financial fraud anticipation that may emerge after 2024. In addition, further research can expand the scope of the database to identify more publications from other relevant sources.

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