



A New Era of Audit by Blockchain Technology: Continuous Auditing

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Abstract. Blockchain technology has caused significant disruption across numerous industrial sectors, with accounting and auditing being among the most impacted fields. This study undertakes a systematic literature review (SLR) following PRISMA guidelines to thoroughly explore the current landscape and potential future advancements of continuous auditing through blockchain integration. By systematically analyzing a wide array of sources from academic journals, articles, and related publications, this research identifies pivotal trends, prevailing practices, and emerging opportunities associated with blockchain's incorporation into continuous auditing methodologies. The review highlights how blockchain can transform traditional audit processes by providing real-time access to immutable financial records, enhancing data integrity, and reducing manual audit tasks. Furthermore, this study addresses the challenges organizations face when adopting blockchain, including technological infrastructure and the need for specialized expertise. As this technology continues to mature, its integration into auditing practices will likely redefine industry standards and elevate the role of auditors in ensuring financial accountability.

Keywords: Continuous Audit, Real-time audit, Auditor, Blockchain, Systematic Literature Review

1 Introduction

Blockchain, a distributed ledger technology, is expected to revolutionize the accounting and auditing profession [1]. The emergence of blockchain technology has brought significant implications for the accounting world, especially for auditors. This technology offers a new way to record, process, and store transactions and financial information, with the potential to reshape the business ecosystem [2]. Blockchain technology has brought revolutionary changes to the field of accounting, offering a more transparent, efficient, and secure way to handle financial data. Blockchain allows the recording of transactions in a decentralized and encrypted digital ledger, making each entry almost immutable and always traceable. This reduces the risk of errors and fraud, as any change or addition must be approved by every user in the blockchain network.

Globally, auditors are increasingly considering the use of blockchain technology to enhance their audit processes and improve the reliability and transparency of financial reporting [3]. In auditing, blockchain simplifies the transaction verification process, as auditors can access consistent and reliable records in real-time. Moreover, the implementation of smart contracts within blockchain enables the automation of many financial processes, from payments to reporting, reducing manual workload and improving operational efficiency.

Continuous auditing through blockchain technology represents a transformative shift in the auditing profession, promising enhanced efficiency, transparency, and security. The integration of blockchain allows for real-time access to transaction records, enabling auditors to perform continuous audits rather than relying on traditional sampling methods. Furthermore, the immutable nature of blockchain ensures that once data is recorded, it cannot be altered, thus providing a reliable source of truth for auditors [4]. As a result, auditors will need to adapt their skill sets to include a deep understanding of blockchain technology and its underlying code [5].

Looking ahead, the role of auditors is expected to evolve significantly as they embrace blockchain technology. The potential for real-time auditing and the automation of workflows through smart contracts could lead to the development of new advisory services and blockchain will enhance audit effectiveness and reporting [6]. Moreover, the adoption of blockchain is anticipated to enhance the overall quality of audits by providing a more comprehensive view of financial transactions and reducing the time required for audits [7]. However, this transition is not without challenges. Auditors must navigate the complexities of blockchain systems and ensure compliance with existing auditing standards [8]. The future of auditing in a blockchain-enabled environment will likely require continuous education and adaptation, as auditors strive to maintain their relevance in a rapidly changing technological landscape [9].

2 Literature Review

2.1 Blockchain Technology

Blockchain is a system in which transaction records stored in blocks are maintained on multiple computers connected to a peer-to-peer network that uses algorithms to verify transactions [10]. This technology, known for its reliability in recording transactions in a decentralized and transparent manner, has attracted considerable attention in the auditing and accounting world. It offers the potential for significant transformation in how audits are conducted, particularly with the ability to provide cryptographically secure and immutable transaction records. Blockchain technology presents new opportunities to safeguard sensitive accounting information, leading to a transformation in traditional accounting practices. It offers a decentralized structure that fosters trust among market participants, enhances the quality of external reporting information, and reduces information asymmetry between companies and investors [11].

Blockchain has three key characteristics that make it unique and reliable. First, the data in the blockchain is distributed and synchronized among all participants, ensuring fair and transparent participation. Second, the consensus process in the

network ensures that each transaction is validated and approved by all participants before being added to the blockchain, guaranteeing data integrity. Finally, the immutability of blockchain ensures that once a transaction is confirmed, it cannot be altered, providing a high level of security and trust in the stored data. Blockchain consists of three main types: public, private, and consortium. A public blockchain is open to anyone without access restrictions, allowing participation or exit from the network at any time without disrupting the entire network, and often offers economic incentives for mining. In contrast, a private blockchain requires permission to join and is used by companies that wish to protect their internal information, restricting access to invited participants only. Lastly, a consortium blockchain involves multiple organizations in its management, with access rights and permissions determined by administrators, allowing private channels and consensus protocols only among trusted nodes, thus enabling more complex corporate behavior.

2.2 Blockchain in Auditing

Blockchain technology is expected to have a significant impact on the accounting and auditing profession [1]. The use of blockchain in audits offers several key advantages, such as increased transparency in transaction tracking, immutable records, and the potential for real-time auditing [12]. These benefits can reduce the risk of data manipulation and enhance the integrity of financial reporting. Blockchain can improve the quality of audits by utilizing financial and non-financial data more efficiently, thereby reducing the expectation gap between auditors, financial users, and regulators [5]. Additionally, smart contracts, which are integrated protocols in blockchain, automate the execution of contracts based on predefined conditions, becoming an essential element in the application of blockchain in audits. Further studies by Gauthier and Brender examine the impact of blockchain on auditing standards, suggesting that these standards need to be adjusted to accommodate the use of blockchain [8]. This is crucial to ensure that auditing techniques remain relevant and effective in the digital era. Nezhyva et al. argue that blockchain can modernize accounting and auditing systems by introducing more efficient and secure methods of data management and verification [13]. This technology provides a transparent, real-time, and auditable accounting ecosystem that has the potential to significantly change the way audits are conducted [14]. Blockchain allows every transaction to be securely recorded in an immutable block, thus reducing the risk of fraud and increasing trust in the audited data. The implementation of blockchain in auditing can also accelerate the data verification process, as all information is available in real-time and can be easily accessed by auditors. In the coming years, blockchain is expected to enhance accounting processes through the adoption of triple-entry accounting and smart contracts [15].

Blockchain offers higher transparency, which can increase trust between auditors and auditees. With an immutable audit trail, auditors can conduct more accurate audits, while auditees can be more confident that their financial statements are processed transparently [16]. However, auditees who have not adopted blockchain technology may face disadvantages, as their financial records may not be transparent or easily verifiable, leading to increased scrutiny and potentially higher audit costs due to the additional work required by auditors to validate their data [17].

Nonetheless, full adoption of blockchain in the audit sector is likely to occur far in the future, given the existing technical, regulatory, and human resource readiness challenges that need to be addressed before this technology can be fully implemented.

The application of blockchain in audits also faces several challenges. White et al. note that auditors need to understand blockchain technology and assess the risks associated with its use [18]. This requires auditors to develop new knowledge and skills in understanding blockchain and how it works. Yi et al. highlight the need for auditors to adapt to evolving technology and acquire the knowledge and skills necessary to effectively audit blockchain-based systems [19]. Continuous professional training and development are required to ensure that auditors remain up-to-date with the latest developments in this technology and can apply best practices in their work. Adequate resources and support need to be provided to help auditors in this adaptation process. By doing so, auditors can fully leverage the potential of blockchain to enhance audit quality and efficiency while maintaining the integrity and reliability of financial statements.

In the future, traditional audit activities such as reconciling ledgers and providing evidence of ownership may be eliminated or minimized. Thanks to the distributed nature of blockchain and its ability to retrieve real-time information, auditors can perform continuous audits. By using business rules, auditors can create scenarios to test violation cases and observe how business logic handles them, in addition to running normal business operations. To do this, auditors must understand the business rules and terms outlined in smart contracts.

2.3 Smart Contract

A smart contract is a computer program that automatically executes, controls, or documents events and actions according to the terms of a pre-agreed contract or agreement. Smart contracts utilize blockchain technology to ensure that contracts are executed securely, transparently, and without third-party intervention [20]. This idea was first introduced by Nick Szabo in 1994, who used a vending machine as an example because it is designed to accept certain inputs and provide outputs based on pre-determined rules. So, if a customer inserts a specific amount of money and selects a product, the vending machine will dispense the product as long as it is available and the amount of money inserted is equal to or greater than the product price.

In the context of accounting and auditing, smart contracts have significant implications. They can automate accounting measurements by implementing smart audit procedures and allow transactions to be recorded autonomously according to agreed-upon terms [1]. Smart contracts on the blockchain can enhance audit data analysis, provide near real-time audit reporting, and improve the quality and transparency of audits [21] [22]. Smart contracts ensure that all conditions in a transaction are met before execution, reducing the risk of errors and fraud [23]. Smart contracts automate transaction and audit processes by executing pre-programmed conditions without the need for human intervention. This can be particularly beneficial in the audit context, where time-consuming manual verification processes can be replaced by automatic execution and real-time recording.

2.4 Continuous Auditing

Continuous auditing is the future of audit, this involves leveraging advanced technology to automate audit activities consistently, allowing for the testing of controls, risk analysis, identification of exceptions or anomalies, pattern analysis, and trend review. It is anticipated that this approach will evolve to incorporate artificial intelligence and blockchain, creating a unified ecosystem that enhances assurance [24]. Continuous auditing facilitated by blockchain minimizes the need for manual data extraction and the time-consuming tasks associated with audit preparation [1]. This advancement not only streamlines the audit process but also enhances accuracy, allowing auditors to focus on more strategic aspects of their work. For CPA firms, having strong connections to blockchain technology simplifies the process for auditors to gather audit evidence and deliver assurance services, all while ensuring the confidentiality and security of their data [25]. Furthermore, the integration of blockchain creates a more transparent environment, where audit trails are easily traceable, thereby boosting stakeholder confidence in the audit results. As these technologies continue to evolve, they will likely redefine traditional auditing practices, leading to more efficient and effective audit outcomes.

3 Research Method

Systematic Literature Review has been proven as a thorough methodology for review studies [26], by using this approach, we attempt to analyze the associated literature on the continuous auditing and implications for auditors in the present and in the future. Searches are carried out using Watase UAKE, results were found using Scopus Database. We looked at research articles, literature review articles, conference papers, and proceeding papers, which were available scholarly. Next, we followed the Preferred Reporting Items for Systematic review and Meta-Analyses (PRISMA) guidelines. PRISMA provides evidence-backed components that aid authors in refining the presentation of systematic reviews and meta-analyses, serving as a foundation [27].

We adopted the Systematic Literature Review (SLR) method outlined by Harsono et al., which involves a structured process comprising the following stages: formulating Research Questions, Identification, Screening, Eligibility and Inclusion, and Reporting [28]. By carefully adhering to this systematic approach, we aim to maintain transparency and impartiality in the selection and assessment of pertinent articles, thereby strengthening the rigor and reliability of our research.

3.1 Formulating Research Question

The Research Question represents the central inquiry that the study seeks to address throughout the research process. It should be clearly defined, specific, and aligned with the established research topic to ensure relevance and focus. Serving as a guiding framework, the Research Question directs the overall research approach and forms the foundation for developing hypotheses or research objectives to be explored and analyzed. In this study, the Research Question aims to investigate the current

academic landscape of continuous auditing facilitated by blockchain technology and to evaluate its potential impact on the evolution of future auditing practices, providing insights into emerging trends and challenges in this field.

3.2 Identification

The next phase of our systematic review process involved an extensive identification phase. In this stage, we thoroughly searched selected databases using carefully crafted keywords and queries developed during the Research Question phase. The goal was to gather a wide range of articles relevant to our research focus. We took great care to ensure that the search captured all potential studies that could contribute to answering our research question, thus laying a strong foundation for the subsequent stages.

3.3 Screening

After compiling a significant pool of articles during the Identification stage, we moved into the critical Screening phase. Here, we meticulously evaluated each article by reviewing its metadata, including the title, theme, journal name, and abstract. This step involved a rigorous assessment to ensure that each article aligned with our research objectives and addressed the core focus of our study. The Screening phase was crucial for narrowing down the list of potential articles, filtering out irrelevant content, and honing in on studies that had the greatest potential to inform our research.

3.4 Eligibility and Inclusion

Following the careful screening process, we advanced to the Eligibility and Inclusion phase, where we applied more stringent criteria to each remaining article. During this stage, we conducted an in-depth evaluation of the articles to determine their compatibility with our inclusion criteria. Only those that met all the necessary requirements were selected for inclusion in our review. This phase was a pivotal moment in the process, as it refined the list to ensure that only the most relevant and high-quality articles were included in the analysis.

3.5 Reporting

The final stage of our systematic review was the Reporting phase. At this point, we focused on synthesizing and summarizing the insights derived from the selected articles. This stage involved crafting a comprehensive report that captures the key findings of our systematic review. The aim was to present the results in a clear, accessible, and informative manner, ensuring that the knowledge gained from the review could be effectively communicated to both academic and professional audiences.

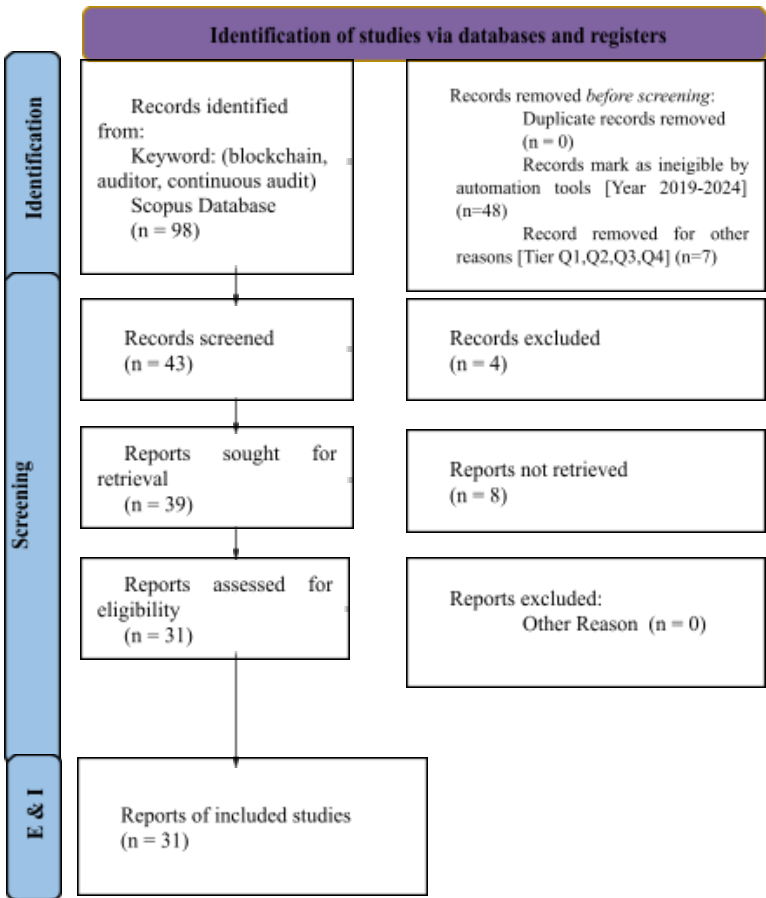


Fig. 1. Adopted Search Methodology

4 Results

This section presents an in-depth analysis of the raw bibliometric data that was collected and outlines the methodology used for the analysis. The primary objective here is to address the central research question: "What is the latest academic advancement in research on continuous auditing by blockchain, and what are its implications for the future of audit?" Through this examination, we aim to identify key trends and emerging themes, providing a comprehensive understanding of how blockchain technology is shaping the evolution of auditing. Searches are carried out using Watase UAKE, results were found using Scopus Databases with keywords

“blockchain”, “auditor”, and “continuous audit”. We looked at research articles, literature review articles, conference papers, and proceeding papers, which were available scholarly. Next, we followed the Preferred Reporting Items for Systematic review and Meta-Analyses (PRISMA) guidelines. PRISMA provides evidence-backed components that aid authors in refining the presentation of systematic reviews and meta-analyses, serving as a foundation. This search resulted in 98 relevant articles.

The articles were assessed based on inclusion and exclusion criteria, with a focus on publications from the years 2019 to 2024. The evaluation was proceed to removing duplicate entries (0 articles), excluding articles published outside 2019-2024 (48 articles), and filtering out those not ranked in Q1, Q2, Q3, or Q4 according to the Scopus database (7 articles). The remaining 43 articles were evaluated during the screening process. Initial assessment was conducted based on the titles and keywords. Articles that did not align with the objectives of the study, totaling 4, were excluded from the screening process. The last stage, 8 articles were excluded because after conducting comprehensive reading the articles did not align with the objectives of the study. This process resulted in 31 articles (see Appendix) being included in the study after the screening process, which will then proceed to metadata analysis.

4.1 Bibliometric Analysis

Bibliometric analysis provides valuable insights into the academic landscape by evaluating the quantity, quality, and impact of research publications. Bibliometric analysis becomes a powerful method for synthesizing and understanding the academic landscape in specific subjects [29]. This first chart aims to assess the distribution of articles related to continuous auditing enabled by blockchain technology based on their Scopus ranking. The Scopus database classifies journals into quartiles (Q1, Q2, Q3, Q4) based on citation metrics and other relevant factors.

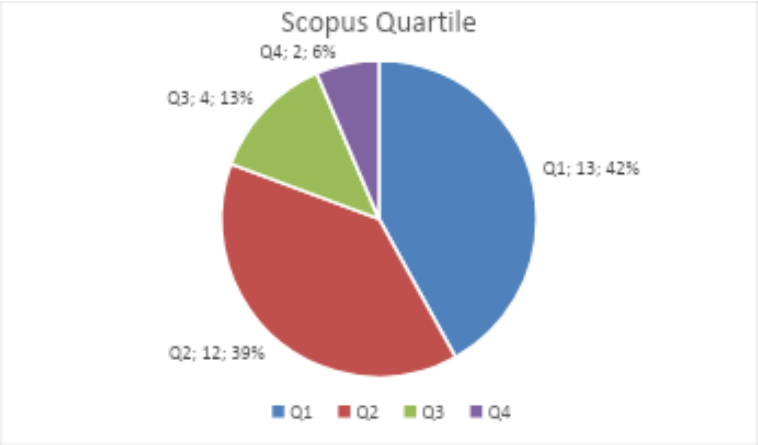


Fig. 2. Scopus Quartiles



Fig. 3. Publication Year

Based on Fig.2, total of 13 articles (Q1) and 12 articles (Q2) are published in the top two quartiles, making up the majority of the publications. This strong representation in high-ranking journals (25 out of 31 articles) indicates that most research on blockchain-enabled continuous auditing is being published in reputable, high-impact outlets. This suggests the academic community recognizes the significance and credibility of this topic, as higher-ranked journals typically have more rigorous peer-review processes and wider readership. While the fig. 3 shows a consistent increase in the number of publications from 2019 to 2022. Starting with 6 publications in 2019, the numbers gradually rose to 7 in 2020, then peaked at 8 publications in both 2021 and 2022. This pattern indicates a growing academic interest in blockchain technology’s potential role in auditing, as the field gained momentum over these years. Even though the numbers significantly decline in 2023, it may be too early to conclude whether the trend is reversing or if the decline will persist.

We present information about journal and publisher that published the selected articles in table 1. The data presented aims to assist future researchers in selecting the appropriate publishers for articles on similar themes by highlighting those that have already published a significant number of works on related topics. This information serves as a valuable reference for researchers seeking to target journals with a proven track record of disseminating research in the field, thereby increasing the likelihood of publication success. Top three publisher are Emerald Group Publishing Ltd., Elsevier, and Wiley Online Library.

Table 1. Journal and Publisher

No.	Journal	Publisher	Tier
1.	Journal of Emerging Technologies in Accounting	American Accounting Association	Q2
2.	WSEAS Transactions on Business and Economics	World Scientific and Engineering Academy and Society	Q4
3.	Journal of International Accounting, Auditing and Taxation	Elsevier	Q2
4.	Australian Accounting Review	Wiley Online Library	Q2
5.	Current Issues in auditing	American Accounting Association	Q3
6.	Meditari Accountancy Research	Emerald Group Publishing Ltd.	Q1
7.	Issues in Information Systems	International Association for Computer Information Systems	Q4
8.	International Journal of Accounting Information Systems	Elsevier	Q1
9.	Journal of Corporate Accounting and Finance	Wiley Online Library	Q2
10.	Journal of Emerging Technologies in Accounting	American Accounting Association	Q2
11.	Accounting Perspectives	Wiley Online Library	Q2
12.	IEEE Access	Institute of Electrical and Electronics Engineers Inc.	Q1
13.	Journal of Management Analytics	Taylor & Francis	Q1
14.	International Journal of Digital Accounting Research	Rutgers University	Q3
15.	International Journal of Intellectual Property Management	Inderscience	Q2
16.	Managerial auditing journal	Emerald Group Publishing Ltd.	Q1
17.	Accounting Perspectives	Wiley Online Library	Q2
18.	Journal of Organizational Change Management	Emerald Group Publishing Ltd.	Q2
19.	Meditari Accountancy Research	Emerald Group Publishing Ltd.	Q1
20.	Meditari Accountancy Research	Emerald Group Publishing Ltd.	Q1
21.	Journal of Organizational Change Management	Emerald Group Publishing Ltd.	Q1
22.	Revista de Contabilidad-Spanish Accounting Review	Elsevier	Q3
23.	Journal of Innovation Economics and Management	Superior De Boeck	Q2
24.	Journal of Economics Finance and Accounting	Online Academic Press	Q3
25.	International Journal of Accounting Information Systems	Elsevier	Q2
26.	Accounting, Auditing & Accountability Journal	Emerald Group Publishing Ltd.	Q1
27.	Journal of Financial Reporting and Accounting	Emerald Group Publishing Ltd.	Q2
28.	Meditari Accountancy Research	Emerald Group Publishing Ltd.	Q1
29.	Accounting, Auditing & Accountability Journal	Emerald Group Publishing Ltd.	Q1

No.	Journal	Publisher	Tier
30.	International Journal of Accounting Information System	Elsevier	Q1
31.	Total Quality Management & Business Excellence	Taylor & Francis	Q1

Table 2 shows top ten cited papers according to theme. Schmitz and Leoni have emerged as a seminal reference in the realm of blockchain technology and its implications for continuous auditing [1]. Their article, recognized for its comprehensive analysis and insights, has garnered significant attention and citation within the academic community, establishing it as a cornerstone in this evolving field. Their contribution to the literature not only enhances the understanding of blockchain's role in continuous auditing but also sets the stage for future research in this critical area.

Table 2. Top ten paper based on citation according theme

No	Cites	Authors	Year	Tier
1.	456	Schmitz & Leoni	2019	Q2
2.	386	Bonsón & Bednárová	2019	Q1
3.	332	Demirkan et al.	2020	Q1
4.	327	Liu et al.	2019	Q3
5.	299	Zhang et al.	2020	Q1
6.	282	Han et al.	2023	Q1
7.	224	Tiberius & Hirth	2019	Q2
8.	127	Garanina et al.	2022	Q1
9.	125	Bellucci et al.	2022	Q1
10.	123	Pimentel & Boulianne	2020	Q2

The accompanying geochart visually represents the geographical distribution of authors contributing to the literature on continuous auditing and blockchain technology. This data, derived from the countries of origin of the authors, provides valuable insights into the global landscape of research in this emerging field. By mapping the origins of the authors, we can observe trends and concentrations of scholarly activity across different regions. The geochart highlights countries that are leading in research output, showcasing their commitment to exploring the intersection of blockchain technology and auditing practices. For instance, countries with a high density of contributors like USA and some country in Europe like Spain and Italy are indicative of robust academic and professional communities that are actively engaging with these topics.

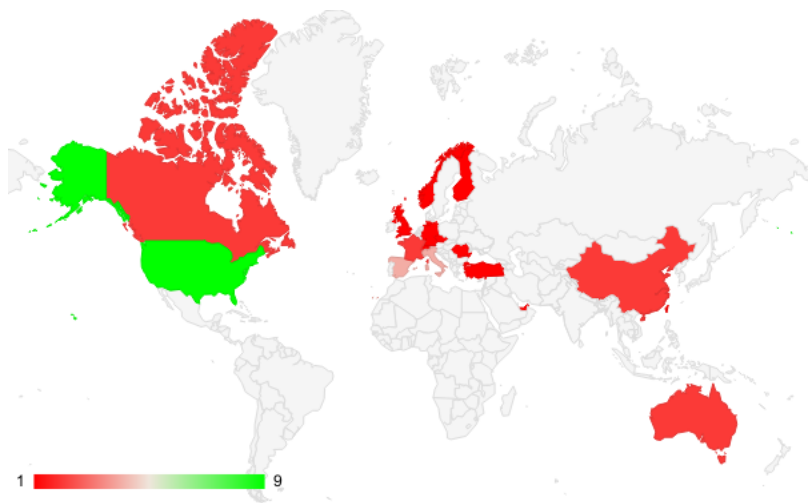


Fig. 4. Geochart of Author’s Country

4.2 Network Analysis

The network visualization presented in this section utilizes VOSviewer to illustrate the interconnectedness and relationships among key themes within the field of continuous auditing and blockchain technology. This graphical representation offers a comprehensive overview of how research entities interact and collaborate, revealing patterns and trends that contribute to the evolving landscape of knowledge in this domain.

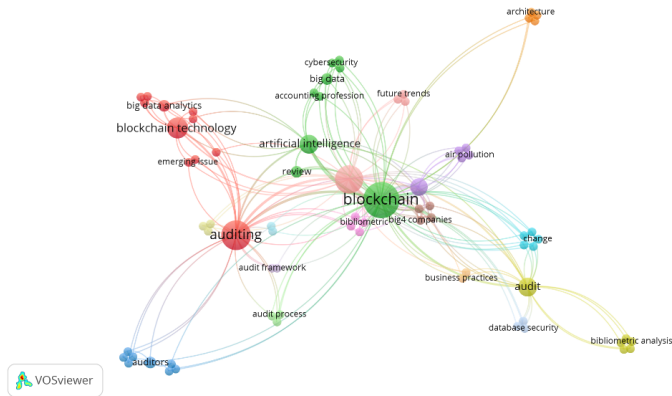


Fig. 5. Network Visualization of Keywords Co-occurrence

The analysis of keyword co-occurrence involves examining the keywords supplied by the authors to explore the relationships among the main themes within the studied area [30]. The analysis of keyword co-occurrence reveals a compelling narrative in the field of continuous auditing and blockchain technology. At the forefront, "blockchain" emerges as the most frequently co-occurring keyword, underscoring its central role in shaping the discourse around modern auditing practices. This dominance highlights the widespread recognition of blockchain as a transformative force, capable of enhancing transparency, security, and efficiency in the auditing process.

Following closely are keywords such as "auditing" and "accounting," which further emphasize the integration of blockchain within these traditional frameworks. The proximity of these terms suggests a growing interest in how blockchain can revolutionize auditing and accounting practices, offering new methodologies for verification and data management. This indicates a shift in the paradigm, as practitioners and researchers alike seek to understand the implications of blockchain technology on existing processes. Additionally, "blockchain technology" as a recurring phrase reinforces the notion that this is not merely a trend but a foundational shift in how financial data is managed and audited. The inclusion of "artificial intelligence" as a notable keyword introduces an exciting dimension to the conversation, suggesting that the intersection of these technologies may hold the key to further advancements in auditing practices. The combination of blockchain and artificial intelligence could lead to the development of intelligent systems capable of automating complex auditing tasks, thereby increasing efficiency and accuracy.

Meanwhile the keywords "continuous auditing" has connection to big data analytics and internet-related technologies as shown in fig. 6. Big data analytics emerges as a crucial component in the realm of continuous auditing. The ability to process vast amounts of financial data in real time allows auditors to derive valuable insights and enhance decision-making. By leveraging advanced analytical tools,

auditors can identify trends, anomalies, and patterns that would otherwise remain hidden in traditional audit methodologies. This synergy between continuous auditing and big data analytics fosters a more proactive approach to risk management and compliance, enabling organizations to respond swiftly to emerging challenges. Furthermore, the connection between continuous auditing and internet-related technologies underscores the importance of digital transformation in the auditing landscape. As businesses increasingly rely on online platforms and digital transactions, the need for continuous auditing practices becomes more pronounced.

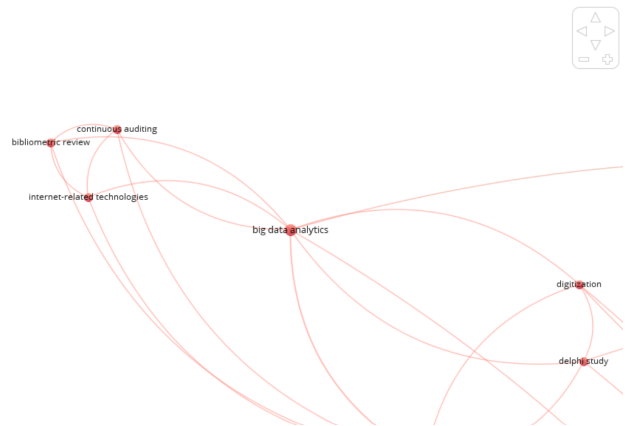


Fig. 6. Network Visualization of Keywords Continuous Auditing

5 Results

The main purpose of this study is to investigate the current academic landscape of continuous auditing facilitated by blockchain technology and to evaluate its potential impact on the evolution of future auditing practices. This exploration not only sheds light on the existing body of knowledge but also highlights how blockchain's unique attributes are poised to reshape the audit profession. As we move forward, it becomes crucial to understand how these technological advancements will influence audit methodologies, processes, and the role of auditors themselves.

5.1 Current state

Continuous auditing, which leverages advanced technology, automates audit tasks such as control testing, risk analysis, and exception identification, while analyzing patterns and reviewing trends [31] remains a key concept from the previous decade [32]. The current state of continuous auditing enabled by blockchain technology reveals several key developments and trends that are transforming the audit profession:

Real-Time Data Access and Transparency. Blockchain's ability to provide real-time access to transaction data is a game-changer for continuous auditing [1] [18]. Auditors can now verify and analyze financial transactions as they occur, significantly reducing the reliance on historical data and year-end audits. Blockchain technology provides near real-time notifications, visualizes document flows, and verifies terms and contracts in real-time [8] [25] offering significant improvements to the audit process [33].

Enhanced Data Integrity. One of the key advantages of blockchain technology in auditing is its ability to significantly enhance data integrity through its core features like decentralization, immutability, and completeness. These characteristics collectively create a robust framework for continuous auditing, eliminating the need for traditional sample-based auditing methods. This comprehensive approach not only improves the strength and reliability of audit evidence but also enhances the overall efficiency and effectiveness of the audit process [34].

By providing a secure, tamper-proof, and transparent ledger, blockchain reduces the risks of data manipulation and fraud, allowing auditors to focus on more strategic tasks, such as analyzing trends and assessing potential risks. The ability to access and verify every transaction in real time also allows for quicker detection of discrepancies and irregularities, leading to more timely interventions. As a result, blockchain's integration into continuous auditing represents a transformative shift towards more accurate, efficient, and reliable auditing practices that can meet the increasing demands for transparency and accountability in modern financial systems.

Reduction of Manual Processes. Traditional accounting processes are often prone to human error, particularly during tasks that require reconciliation of data. These errors may include principal errors, duplication, incomplete records, and misaligned periods, all of which can result from the manual handling of large amounts of data. Advanced automation, coupled with blockchain technology, has the potential to greatly reduce these risks by streamlining the reconciliation process and ensuring that records are accurate and up-to-date at all times [30] [35]. By automating repetitive and standardized processes, such as reconciling accounts, conducting observations and inquiries, and performing external confirmations, blockchain can significantly cut down on the time auditors spend on these labor-intensive tasks. In addition to saving time, this automation leads to improved efficiency, greater effectiveness, and higher reliability in auditing procedures [6]. This shift allows auditors to focus on more critical tasks, such as analyzing financial trends and offering strategic insights, while still maintaining the integrity and accuracy of the audit.

Smart Contracts for Automated Audits. Despite the significant technological advancements that blockchain and smart contracts bring to the auditing process, current methods still fall short of providing a fully secure and continuous flow of data and information throughout the audit lifecycle. According to Bonsón & Bednárová,

while blockchain enables real-time access to transactional records and smart contracts can automate many of the routine audit functions, these systems are not yet fully capable of addressing all the complexities inherent in financial reporting and auditing [36]. One major limitation is the integration of blockchain with traditional accounting systems, which often results in gaps or delays in the data flow. Additionally, while smart contracts can execute predefined conditions automatically, they still require careful design and validation to ensure accuracy and compliance with audit standards. Furthermore, current auditing practices have not yet fully adapted to these technologies, making it difficult to achieve a truly seamless and continuous audit process. Until these challenges are addressed, blockchain and smart contracts will remain a promising but not yet fully realized solution for automating and securing audits in real time.

Audit of the Full Population. Traditional auditing often relies on sampling due to the sheer volume of data, but blockchain enables auditors to audit the entire dataset. This shift from sampling to full-population auditing provides a more comprehensive and accurate audit. Leading audit firms believe that continuous auditing facilitated by blockchain will make it easier to detect fraud through real-time audit trails, reducing the need for classical sampling methods [3].

Challenges in Professional Standards. As robotic process automation (RPA) technology facilitates real-time and continuous audits, auditors must be flexible and adaptive to new audit procedures while processing real-time risk data [37]. For instance, continuous auditing made possible by blockchain technology could reduce labor-intensive and time-consuming audit activities, such as manual data extraction and preparation, allowing accountants and auditors to focus on more value-added tasks like strategic consulting, detailed analysis, and data mining [1]. Big 4 audit firms, published several reports focusing on blockchain use, highlighting those accountants, and auditors' activities will be significantly affected by BT adoption [6]. Although blockchain won't replace auditors' professional judgment, it will streamline audit processes by reducing time spent on standardized tasks like reconciliation, inspections, and confirmations, enhancing audit efficiency and reliability [38]. To fully utilize blockchain for continuous auditing, organizations must record all transactions on the blockchain, giving auditors a more comprehensive understanding of their client businesses [39].

5.2 The Future of Continuous Auditing

The integration of blockchain technology into auditing practices is poised to revolutionize the field, shifting from traditional methodologies to more efficient, transparent, and automated systems. Blockchain technology and smart contracts have already demonstrated their potential to automate and enhance auditing processes. For example, Dai et al. highlight the use of blockchain and smart contracts to verify crowdsourced data, enabling continuous audits of government official performance in environmental protection [23]. This kind of real-time audit through decentralized verification eliminates reliance on conventional auditing tools, such as sampling and

manual confirmations, by providing immutable and transparent data. As such, blockchain's inherent features contribute to the emergence of a new generation of auditing, one based on continuous assurance.

However, despite these advancements, Zemánková points out that professional audit standards have yet to fully adapt to this shift [40]. This misalignment between traditional audit procedures and blockchain-enabled continuous auditing could pose challenges, especially in terms of audit judgment performance and the proper handling of audit files. The gap between technological progress and regulatory standards is a key area that will need to be addressed to facilitate widespread adoption of continuous auditing practices.

Looking to the future, continuous auditing will become a vital component of auditing practices [41]. Although experts' express uncertainty about whether these new technologies will replace auditors entirely, the consensus is that blockchain and automation will serve to augment human auditors by streamlining routine tasks, allowing them to focus on more complex, judgment-based aspects of the audit. This relief in labor-intensive processes, such as data extraction and audit preparation, is expected to transform the profession by reducing time-consuming tasks [42]. The potential for blockchain technology to enable real-time transaction verification will likely become a cornerstone of continuous audit practices. By relying on blockchain, firms can transition away from traditional year-end assessments to continuous evaluations throughout the year, offering near-instant verification of financial data [43] [44]. This shift is not only expected to improve the efficiency of audits but also to increase transparency, as real-time audits leave less room for manipulation or error.

Furthermore, smart contracts can establish a framework for continuous audit reports, providing authorized stakeholders with direct access to the audit results in real-time [45]. This new paradigm of automated, transparent auditing is likely to become a major trend in the profession. Fullana and Ruiz argue that blockchain will profoundly impact how information is collected, reported, and audited, enabling continuous, real-time insight into financial transactions [46]. Blockchain's ability to deliver immutable records and streamline audit tasks, such as account reconciliation and transaction verification, will push audit firms toward adopting continuous auditing solutions. Auditing organizations that are connected to blockchain technology will be able to monitor transactions in real-time, providing a deeper level of oversight and risk mitigation [47]. This development will significantly reduce reliance on historical data, placing a greater emphasis on up-to-date information and enabling firms to detect issues immediately [5].

Finally, as Dyball and Seethamraju conclude, blockchain may bring an end to traditional sampling methods in audits, allowing auditors to review every transaction within a given period, thereby strengthening the quality of audit evidence [17]. The use of technology in the audit profession encourages continuous auditing and monitoring in the audit profession and the utilisation of software tools in improving auditing [48]. The future of auditing will likely be defined by the ability to conduct comprehensive, real-time, and automated audits, powered by blockchain's secure and decentralized infrastructure.

5.3 The Challenges

The adoption of blockchain technology in continuous auditing presents several challenges for organizations. One significant hurdle is the need for employees who possess both the necessary technological infrastructure and advanced technical knowledge to manage and operate these systems effectively [49]. Without sufficient training and resources, companies may struggle to fully leverage the benefits of blockchain, potentially leading to inefficiencies and increased operational costs.

6 Results

This study has explored the current academic landscape of continuous auditing facilitated by blockchain technology through a systematic literature review (SLR). By analyzing various studies, we have demonstrated how blockchain is poised to revolutionize the auditing field, offering enhanced data integrity, real-time verification, and automation of manual processes. The integration of smart contracts and decentralized systems provides a framework for continuous auditing that is more transparent and efficient compared to traditional methods.

However, despite these advancements, there are significant challenges that must be addressed, including the readiness of professional audit standards and the need for adequate technological infrastructure and skilled personnel. The transition from traditional audit methods to blockchain-enabled continuous audits will require a reevaluation of existing procedures and substantial investments in training and technology. As this technology continues to mature, its integration into auditing practices will likely redefine industry standards and elevate the role of auditors in ensuring financial accountability. Future research should focus on addressing the barriers to adoption, refining audit standards, and exploring the broader implications of blockchain on the auditing profession. By doing so, the potential of blockchain in creating a more transparent, efficient, and reliable auditing process can be fully realized. This will unlock the full potential of blockchain, enabling a more transparent, efficient, and dependable auditing process.

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Appendix

Article included in studies

No.	Authors	Year	Cite s	Title	Journal	Tier
1.	Dai et al.	2019	42	Utilizing blockchain and smart contracts to enable audit 4.0: From the perspective of accountability audit of air pollution control in China	Journal of Emerging Technologies in Accounting	Q2
2	Zemánková	2019	77	Artificial intelligence and blockchain in audit and accounting: Literature review	WSEAS Transactions on Business and Economics	Q4
3	Tiberius & Hirth	2019	224	Impacts of digitization on auditing: A Delphi study for Germany	Journal of International Accounting, Auditing and Taxation	Q2
4	Schmitz & Leoni	2019	456	Accounting and Auditing at the Time of Blockchain Technology: A Research Agenda	Australian Accounting Review	Q2
5	Liu et al.	2019	327	How will blockchain technology impact auditing	Current Issues in auditing	Q3

No	Authors	Year	Cite s	Title	Journal	Tier
				and accounting: Permissionless versus permissioned blockchain		
6	Bonsón & Bednárová	2019	386	Blockchain and its implications for accounting and auditing	Meditari Accountancy Research	Q1
7	Barandi et al.	2020	17	Impact Of Blockchain Technology On The Continuous Auditing: Mediating Role Of Transaction Cost Theory	Issues in Information Systems	Q4
8	Vincent et al.	2020	60	Blockchain architecture: A design that helps CPA firms leverage the technology	International Journal of Accounting Information Systems	Q1
9.	White et al.	2020	51	Blockchain security risk assessment and the auditor	Journal of Corporate Accounting and Finance	Q2
10.	Smith & Castonguay	2020	91	Blockchain and accounting governance: Emerging issues and considerations for accounting and assurance professionals	Journal of Emerging Technologies in Accounting	Q2
11.	Pimentel & Boulianne	2020	123	Blockchain in accounting research and practice: Current trends and future opportunities	Accounting Perspectives	Q2

No	Authors	Year	Cite s	Title	Journal	Tier
12.	Zhang et al.	2020	299	The impact of artificial intelligence and blockchain on the accounting profession	IEEE Access	Q1
13.	Demirkan et al.	2020	332	Blockchain technology in the future of business cyber security and accounting	Journal of Management Analytics	Q1
14.	Andrés & Lorca	2021	7	On the impact of smart contracts on auditing	International Journal of Digital Accounting Research	Q3
15.	Fullana & Ruiz	2021	100	Accounting information systems in the blockchain era	International Journal of Intellectual Property Management	Q2
16.	Gauthier & Brender	2021	52	How do the current auditing standards fit the emergent use of blockchain?	Managerial auditing journal	Q1
17.	Desplebin et al.	2021	64	To Be or Not to Be: Blockchain and the Future of Accounting and Auditing	Accounting Perspectives	Q2
18.	Maffei et al.	2021	67	Blockchain technology: uninvestigated issues emerging from an integrated view within accounting and auditing practices	Journal of Organizational Change Management	Q2

No.	Authors	Year	Cites	Title	Journal	Tier
19.	Ferri et al.	2020	109	Ascertaining auditors' intentions to use blockchain technology: evidence from the Big 4 accountancy firms in Italy	Meditari Accountancy Research	Q1
20.	Lamboglia et al.	2021	113	Exploring the relationship between audit and technology. A bibliometric analysis	Meditari Accountancy Research	Q1
21.	Tiron-Tudor et al.	2021	117	Managing change with and through blockchain in accountancy organizations: A systematic literature review	Journal of Organizational Change Management	Q1
22.	Mugwira	2022	5	Internet Related Technologies in the auditing profession: A WOS bibliometric review of the past three decades and conceptual structure mapping	Revista de Contabilidad-Spanish Accounting Review	Q3
23.	Elommal & Manita	2022	61	How Blockchain Innovation could affect the Audit Profession: A Qualitative Study	Journal of Innovation Economics and Management	Q2

No.	Authors	Year	Cite s	Title	Journal	Tier
24.	Gokoglan et al.	2022	18	Blockchain technology and its impact on audit activities	Journal of Economics Finance and Accounting	Q3
25.	Hsieh & Brennan	2022	23	Issues, risks, and challenges for auditing crypto asset transactions	International Journal of Accounting Information Systems	Q2
26.	Dyball & Seethamraju	2022	44	Client use of blockchain technology: exploring its (potential) impact on financial statement audits of Australian accounting firms	Accounting, Auditing & Accountability Journal	Q1
27.	Abdennadher et al.	2022	62	The effects of blockchain technology on the accounting and assurance profession in the UAE: an exploratory study	Journal of Financial Reporting and Accounting	Q2
28.	Bellucci et al.	2022	125	Blockchain in accounting practice and research: systematic literature review	Meditari Accountancy Research	Q1
29.	Garanina et al.	2022	127	Blockchain in accounting research: current trends and emerging topics	Accounting, Auditing & Accountability Journal	Q1

No.	Authors	Year	Cite s	Title	Journal	Tier
30.	Han et al.	2023	282	Accounting and auditing with blockchain technology and artificial Intelligence: A literature review	International Journal of Accounting Information System	Q1
31.	Huson et al.	2024	35	A bibliometric review of information technology, artificial intelligence, and blockchain on auditing	Total Quality Management & Business Excellence	Q1

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