Smart Audit Contracts

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Abstract

This Systematic Literature Review (SLR) explores the integration of smart contracts and blockchain technology into auditing practices, synthesizing findings from 16 peer-reviewed articles published between 2018 and 2025. The review aims to analyze the adoption, impact, and challenges of smart contract-based auditing systems, focusing on key technological innovations such as blockchain, artificial intelligence (AI), and machine learning. These technologies offer significant improvements in audit efficiency, transparency, and security by automating processes, enhancing vulnerability detection, and ensuring real-time reporting. While the potential of smart contract-based audits is substantial, challenges such as complexity in smart contract code, scalability issues, and security vulnerabilities remain. The review identifies these barriers and suggests future research directions, including the development of hybrid blockchain models, further integration of AI-driven tools, and addressing legal frameworks for decentralized audits. The findings underscore the transformative potential of smart contracts in modernizing audit practices, particularly in industries like finance, healthcare, and government services, where data integrity, transparency, and fraud prevention are crucial. This review contributes to the consolidation of existing knowledge, offering practical insights for the implementation of smart contract-based auditing systems. It also highlights the need for further research to address the challenges and explore the full potential of blockchain and smart contracts in the auditing field. By highlighting the existing gaps and opportunities, this review paves the way for the future development of more efficient, secure, and transparent auditing systems across industries.

***Keywords**:* Smart Contract Auditing, Blockchain Technology, Machine Learning, AI in Auditing, Decentralized Auditing Systems.

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Introduction

The rapid advancement of blockchain technology and smart contracts has sparked significant changes in various fields, particularly in the auditing sector. In recent years, auditing has faced increasing demands for greater efficiency, transparency, and security, which traditional methods struggle to meet. Smart contracts, self-executing contracts where the terms of the agreement are directly written into code, offer the potential to revolutionize auditing practices by automating and securing the audit process. With these technologies, auditing can be more transparent, timely, and free from human error or [1].

This systematic literature review (SLR) titled "Smart Audit Contracts" aims to provide a comprehensive overview of the current research surrounding the use of blockchain-based smart contracts in auditing. The review synthesizes findings from 16 selected journals, exploring their contributions to the integration of smart contracts into audit systems. These studies span a range of topics, including vulnerability detection, decentralized auditing, real-time reporting, and automation of contract audits. The review also examines how these smart contract solutions address challenges such as ensuring data integrity, preventing fraud, and improving audit efficiency, especially in multi-auditor scenarios.

The inclusion of machine learning, process mining, and neural networks alongside smart contracts in the auditing framework represents a critical development in the field. These technologies enhance the detection of vulnerabilities, automate audit procedures, and improve auditing quality by ensuring that transactions and contract executions align with expected behaviors. This review will provide a summary of the methodologies, findings, and implications of these studies, highlighting the transformative potential of smart contracts in modernizing audit practices and addressing current shortcomings in the auditing industry [2].

Moreover, the adoption of blockchain and smart contracts has the potential to create a more secure and transparent auditing environment, where real-time data analysis and automated audit mechanisms reduce the time and cost of traditional auditing methods. As demonstrated in several case studies, the integration of private smart contracts for sensitive sectors, such as donation systems, allows for secure auditing while maintaining privacy and compliance with data protection regulations. This shift towards decentralization is set to fundamentally change the role of auditors and strengthen trust in the auditing process [3]; [4].

This paper presents a Systematic Literature Review (SLR) of 16 peer-reviewed articles published between 2018 and 2025, focusing on the adoption, impact, and challenges of smart audit contracts. The review seeks to answer the following research questions:

1. What are the key dependent and independent variables studied in smart audit contract research?
2. How do technological innovations such as blockchain, machine learning, and process mining influence audit quality and efficiency in decentralized environments?
3. What are the observed benefits, limitations, and future directions of smart contract-based auditing systems?

This study highlights research gaps, provides suggestions for future studies, and consolidates knowledge in the subject of smart audit contracts by methodically examining pertinent academic articles. It draws attention to the revolutionary possibilities of incorporating smart contracts into auditing procedures, especially in terms of enhancing efficiency, automation, security, and transparency. The results also highlight the value of technical

advancements like artificial intelligence (AI), machine learning, and process mining in tackling conventional auditing issues like fraud prevention, vulnerability identification, and the requirement for real-time reporting. This study gives readers a thorough grasp of how these technologies are changing auditing procedures and includes suggestions for real-world implementations in a range of sectors, such as government services, healthcare, and finance.

Literature Review

The concept of smart contracts has emerged as a transformative force in various industries, particularly in auditing. Smart contracts are self-executing contracts where the terms of the agreement are directly written into code and executed automatically when predefined conditions are met. The integration of smart contracts into the auditing process offers the potential for greater efficiency, transparency, and security, as highlighted in several studies reviewed in this paper. This literature review examines the key developments, challenges, and contributions from the selected journals, focusing on the adoption, impact, and challenges of smart audit contracts in the auditing sector.

2.1 Blockchain and Smart Contracts in Auditing

The integration of blockchain technology into auditing through smart contracts has garnered significant attention for its potential to enhance transparency and reduce fraud. Blockchain, being a decentralized ledger system, ensures the integrity and traceability of transactions, which is vital in the auditing process. According to [1], blockchain's inherent security features, such as immutability and transparency, provide a reliable foundation for smart contract auditing. Blockchain-based auditing systems are designed to automate and validate audit trails, ensuring that all transactions are correctly recorded and traceable, thereby improving the overall reliability of the audit process.

The use of smart contracts within the blockchain ecosystem offers the ability to automate complex audit procedures, enabling real-time auditing and reducing human error. For example, smart contracts can automatically enforce compliance checks, trigger audit activities, and generate reports without manual intervention, making the auditing process faster, more efficient, and less prone to fraud [5]. Blockchain-based systems also help reduce the need for third-party auditors, as the system can validate transactions and smart contract executions independently.

2.2 Technological Innovations: AI, Machine Learning, and Process Mining

Several studies have explored the role of machine learning, artificial intelligence (AI), and process mining techniques in enhancing smart contract audits. Machine learning algorithms are increasingly being employed to identify vulnerabilities in smart contract code [6], enabling auditors to detect potential flaws early in the process. AI can also be integrated into smart contracts to improve their decision-making capabilities, allowing the contract to autonomously adjust based on data inputs, which further enhances auditing efficiency [7].

Moreover, process mining techniques have been used in conjunction with blockchain and smart contracts to analyze historical transaction data and identify discrepancies or irregularities in the contract execution process. [4] show how process mining helps auditors by mapping out the execution of smart contracts, allowing them to visually trace the sequence of actions and verify whether they align with the expected contract terms. The combination of blockchain and

process mining provides a powerful toolset for conducting audits with greater accuracy and reliability.

2.3 Security and Privacy in Smart Contract Audits

One of the primary challenges in smart contract-based auditing is ensuring security and privacy. While blockchain technology offers a secure transaction environment, smart contracts themselves are not immune to vulnerabilities. Machine learning and neural networks are being leveraged to improve the detection of these vulnerabilities [2]. The application of AI algorithms in auditing smart contracts can help identify anomalies in the contract's behavior that could signify security risks.

Furthermore, privacy concerns in auditing systems are addressed through private smart contracts, which provide an added layer of confidentiality for sensitive data. Propose an approach using private smart contracts to secure donation systems, ensuring both audit transparency and data privacy. These mechanisms are particularly relevant in industries such as healthcare and finance, where confidentiality is paramount, yet audit transparency cannot be compromised.

2.4 Challenges and Limitations in Implementing Smart Contract Auditing

Despite the significant advancements made in smart contract auditing systems, several challenges remain in their implementation. One major challenge is the complexity of smart contract code, which often requires specialized knowledge to develop and audit effectively. Studies by [8] and [9] highlight the difficulty in identifying flaws in complex contracts, as traditional auditing tools may not be sufficient to detect subtle vulnerabilities in code.

Another challenge is the scalability of blockchain systems, particularly when auditing large volumes of transactions across multiple platforms. Ensuring that blockchain-based auditing systems can handle the vast amounts of data generated in real-time auditing scenarios remains an ongoing concern. Jain & Tripath [6] emphasize the need for scalable systems that can efficiently process large-scale smart contract transactions without compromising performance.

Additionally, the legal and regulatory framework surrounding smart contract auditing is still in its infancy. Although blockchain offers a high level of security and transparency, questions about legal compliance, contract enforcement, and audit accountability in decentralized systems are yet to be fully addressed [10]. These issues need to be resolved to ensure the widespread adoption and acceptance of smart contract auditing systems across industries.

2.5 Future Directions

Looking ahead, the future of smart contract auditing lies in improving automation, security, and interoperability. Future research may focus on integrating advanced AI and machine learning algorithms to further automate vulnerability detection and enhance audit procedures. Moreover, the adoption of hybrid blockchain models (combining both private and public blockchains) could address scalability and privacy concerns while maintaining transparency.

As blockchain and smart contract technology continue to evolve, the legal and regulatory challenges must be addressed to ensure that smart contract audits are both legally enforceable and compliant with international standards. This includes establishing standards for audit trails and contract enforcement in smart contract systems.

The SLR methodology for this study will follow the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework, which offers systematic guidance for preparing and presenting review findings such as the phases of eligibility, identification, screening, and final synthesis [11].

Research Methodology

This study follows the methodology of a Systematic Literature Review (SLR) to examine the adoption, impact, and challenges of smart audit contracts as evidenced by 16 peer-reviewed articles published between 2018 and 2025. The review aims to consolidate existing knowledge, identify research gaps, and explore future directions in the field of smart contract-based auditing systems. The following methodology outlines the process of selection, data collection, and analysis for the SLR, with a focus on peer-reviewed Q1 to Q4 journals indexed in databases such as Google Scholar.

To ensure comprehensive coverage of the topic, the search process was designed to identify relevant studies from reputable academic sources. The following steps were undertaken:

a) Keywords: The search terms used were designed to capture the various dimensions of smart contract auditing, blockchain technology, and their integration with auditing practices. The keywords included:
    1) "Smart contract auditing"
    2) "Blockchain-based audit systems"
    3) "Automated auditing with smart contracts"

These keywords were selected based on their relevance to the core concepts of smart contracts, blockchain technology, auditing, and the integration of AI and machine learning, ensuring that the review captures all significant advances in this field.

a) Databases: The studies were sourced from Google Scholar and included journals from the Q1 to Q4 categories to ensure the inclusion of high-quality, peer-reviewed research. These journals were selected based on their impact factors and academic standing. The following databases and repositories were primarily searched:
    1) Google Scholar
    2) Scopus
    3) SpringerLink
    4) Elsevier ScienceDirect
    5) Wiley Online Library
    6) IEEE Xplore

The inclusion and exclusion criteria were applied rigorously to ensure the review focused on high-quality and relevant studies. The criteria for selecting the 16 journals are outlined below:

Inclusion Criteria:

a) Publication Date: The review only includes studies published between 2018 and 2025 to ensure that the research reflects the latest developments in smart contract auditing.
b) Peer-reviewed Journals: Only articles from reputable, peer-reviewed academic journals indexed in databases such as Google Scholar, Scopus, and IEEE Xplore were considered. These journals must have been classified as Q1, Q2, Q3, or Q4 in relevant fields such as blockchain technology, auditing, and information systems.

Exclusion Criteria:

a) Non-peer-reviewed Articles: Articles not published in peer-reviewed journals, such as conference papers, white papers, or research reports, were excluded.
b) Irrelevant Topics: Studies unrelated to smart contract-based auditing systems, blockchain technology, or auditing (e.g., articles focusing solely on non-financial applications of smart contracts) were excluded.

The process of study selection was performed in multiple stages:

1. Initial Search: Using the defined search terms, a comprehensive search was conducted across databases such as Google Scholar. This initial search returned a large number of articles.
2. Screening: The titles and abstracts of the retrieved articles were screened to assess their relevance. Articles that did not focus on smart contract-based auditing systems or blockchain technology were excluded at this stage.
3. Full-text Review: The remaining articles were retrieved, and their full texts were reviewed to assess their methodological rigor, focus on blockchain and smart contract auditing, and relevance to the review's research questions. This process ensured that only studies meeting the inclusion criteria were included.

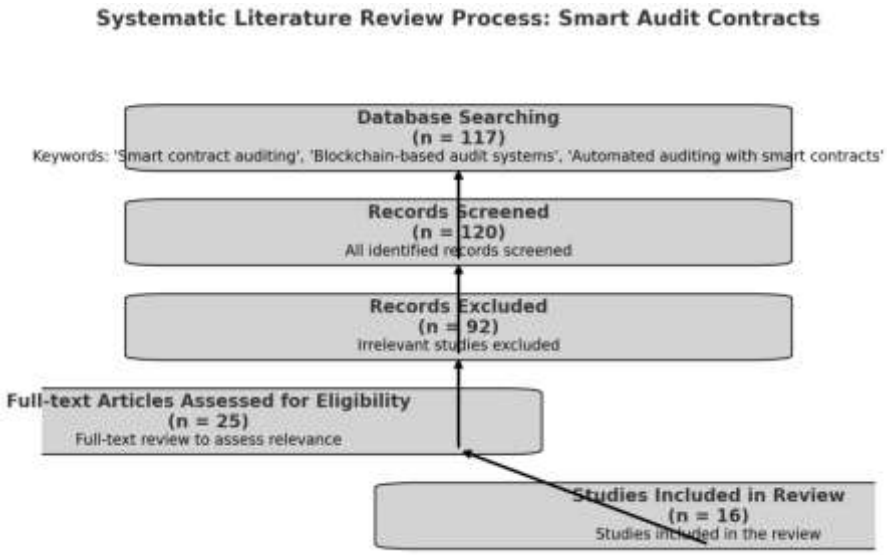
Data Extraction: Data was extracted from the selected articles, including the following information: Year of publication, Authors, Title, Research objectives, Key dependent and independent variables, Methodology (e.g., experimental, conceptual, case study), Findings and conclusions.

The final dataset comprised 16 studies that were used to address the research questions and provide a comprehensive understanding of the current state of smart audit contracts.

The selected studies were synthesized to address the three key research questions:

1. Key Dependent and Independent Variables: The dependent variables such as audit efficiency, audit quality, data integrity, and vulnerability detection were identified across the studies. Independent variables like blockchain technology, smart contracts, and machine learning were analyzed to understand their impact on auditing processes.
2. Technological Innovations: The influence of innovations such as AI, blockchain, and in-memory systems on auditing efficiency was analyzed, with a focus on how these technologies enhance vulnerability detection, audit automation, and real-time reporting.
3. Benefits, Limitations, and Future Directions: The benefits of using smart contracts in auditing, including improved transparency, cost-efficiency, and reduced fraud, were compared with the limitations such as scalability issues, security concerns, and regulatory challenges. Future research directions, such as hybrid blockchain models and AI integration, were also discussed.

Data items extracted from each article were summarized as follows: year of publication, authors, country and research setting, type of data and methodological approach, key research variables, "Smart contract auditing", "Blockchain-based audit systems", "Automated auditing with smart contracts". The stages of the systematic literature review are comprehensively illustrated in Figure 1.



Results and Discussion

The systematic analysis of 15 selected journal articles reveals a multidimensional understanding of how cloud computing is integrated into modern auditing practices. The qualitative synthesis focuses on identifying common research themes, variables, technologies, and implications derived from each study. The findings are grouped thematically to reflect major contributions to the field of cloud-based auditing.

4.1 Dominant Research Themes and Variable Patterns

The review identifies six dominant themes based on dependent variables observed in the literature: audit performance, audit security and privacy, audit transparency and reporting, data integrity, fraud detection, and auditor perception and technology adoption.

- Audit performance (n=3) is the most frequently examined outcome, with studies showing how cloud-based systems—especially those incorporating AI and in-memory databases—enhance the accuracy, efficiency, and responsiveness of audit processes [16].

a. Audit security and privacy (n=4) also receive significant attention. Several studies employ privacy-preserving audit protocols and blockchain-based verification to address concerns of unauthorized access and data manipulation.
b. Audit transparency and reporting (n=2) focuses on how AI and cloud integration improve the traceability and clarity of audit findings.
c. Data integrity (n=1) is supported by identity-based schemes that validate records in cloud environments, particularly in transportation and logistics contexts.
d. Fraud detection (n=1) is addressed in financial sectors where cloud-based audit systems enable proactive monitoring and fraud risk identification.
e. Auditor perception and adoption (n=2) highlight behavioral and institutional perspectives, suggesting growing trust in cloud auditing and its strategic role in digital transformation.

4.2 Technological Innovations and Integration

The synthesis shows that cloud-based auditing is rarely implemented in isolation; instead, it is deeply intertwined with other emerging technologies:

a. Blockchain is utilized in six of the studies to ensure audit traceability, tamper-proof records, and trustless verification.

b. Artificial Intelligence (AI) plays a crucial role in risk assessment, automated reporting, and anomaly detection, especially when combined with cloud infrastructure.
c. Public auditing protocols and identity-based schemes are employed to protect data privacy while enabling third-party audits.
d. IoT environments and ERP systems are also identified as domains where cloud auditing is applied, indicating the versatility of its adoption across industries.

4.3 Sectoral Application and Use Cases

The reviewed studies span multiple industries, including:

a. Finance
b. Healthcare
c. Maritime logistics
d. Public administration and governance.

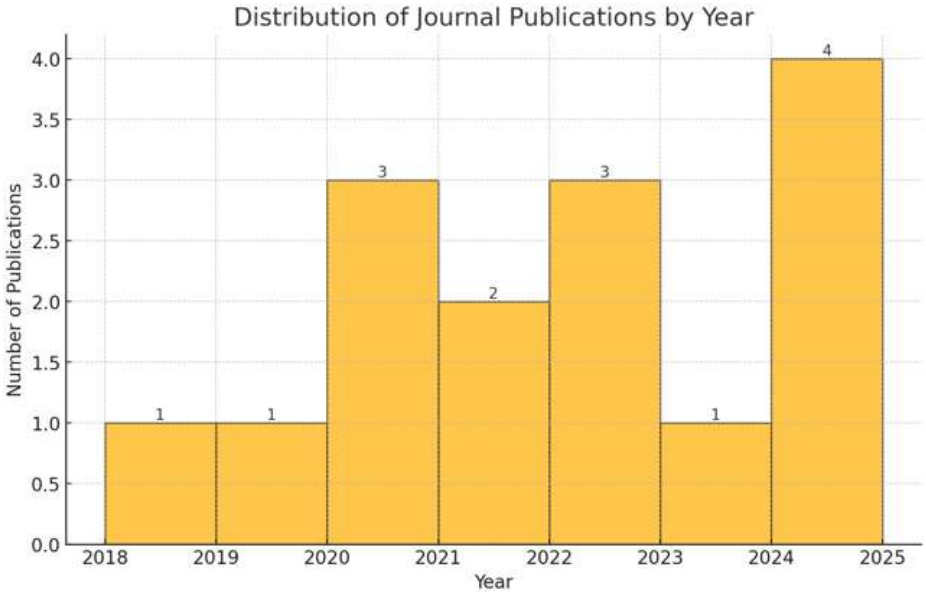
This diversity of application suggests that cloud-based auditing is not confined to a specific sector but is adaptable to varied organizational needs, provided proper frameworks and privacy controls are in place.

4.4 Identified Research Gaps

Despite the encouraging findings, several gaps remain:

a) A lack of large-scale empirical studies measuring performance before and after cloud adoption.
b) Limited research on legal, regulatory, and ethical implications of automated audit systems.
c) Few longitudinal studies that examine long-term effects of cloud-based audit deployment on organizational compliance behavior.

These findings are further structured in the PRISMA flow diagram (Figure 1) and expanded upon in the following subsections.



In addition, the 16 chosen papers underwent a qualitative synthesis, as indicated in Table 1.

No	Year	Author	Title	Country & Sample	Purpose
1	2018	Rozario, A. M., & Vasarhelyi, M. A.	Auditing with Smart Contracts	USA; Conceptual paper on the impact of smart contracts on auditing	To explore the potential of blockchain-based smart contracts to revolutionize the auditing process, offering near real-time audit reporting, improved audit quality, and data analytics automation
2	2020	Coyne, E. & McMickle, P. L.	On the Impact of Smart Contracts on Auditing	USA; Conceptual study based on literature analysis and framework development	To investigate how smart contracts affect the auditing function, including the potential automation of audit procedures and the evolving role of auditors in blockchain-based digital environments.
3	2022	Awan, I., Tariq, M. A., & Akhunzada, A.	Dredas: Decentralized, Reliable, and Efficient Remote Outsourced Data Auditing System	International (Authors from Pakistan, UAE, and UK); System design and experimental evaluation	To propose and evaluate DREDAS, a decentralized auditing system based on blockchain and smart contracts that ensures data integrity and verifiability in outsourced cloud storage environments.
4	2021	Wu, F., Li, S., Sun, Y., Du, R., & Zhang, Y.	Smart Contract Vulnerability Analysis and Security Audit	China; Technical review with categorization of vulnerabilities and survey of tools	To provide a comprehensive overview of smart contract vulnerabilities, present classifications of these issues, and evaluate current automated security auditing tools used for detecting and

					preventing vulnerabilities in smart contracts.
5	2023	Wang, C., Liu, X., Li, H., Di, X., Cong, L., Zhang, S., & Qi, H.	Smart contract-based integrity audit method for IoT	China; Experimental evaluation and proposal of a smart contract framework for IoT auditing	To propose a decentralized auditing scheme using smart contracts for integrity verification in the Industrial Internet of Things (IIoT). This framework leverages Ethereum blockchain to improve data security, privacy, and auditing efficiency while removing the reliance on a third-party auditor (TPA).
6	2019	Corradini, F., Marcantoni, F., Morichetta, A., Polini, A., Re, B., & Sampaolo, M.	Enabling Auditing of Smart Contracts Through Process Mining	Italy; Case study on Ethereum-based application "RotoHive" with process mining techniques	To propose a methodology using process mining to audit Ethereum-based smart contracts by analyzing transaction sequences and ensuring they align with expected behaviors, improving auditing efficiency and effectiveness.
7	2024	Jain, A., & Tripathy, S.	SmartAudit: Smart Contract Vulnerability Detection Using Transfer Learning	Singapore; Experimental study presented at the International Symposium on Security and Privacy in Social Networks and Big Data	To propose "SmartAudit", a framework that leverages transfer learning to detect vulnerabilities in Ethereum smart contracts, aiming to improve the accuracy and efficiency of security audits in

					smart contract systems.
8	2024	Xiao, M., Xu, Y., Li, Z., & Wan, H.	Advanced Security Auditing Methods for Solidity-Based Smart Contracts	China; Experimental evaluation of smart contract auditing methods for Solidity-based contracts	To propose advanced security auditing techniques specifically designed for Solidity-based smart contracts, with a focus on vulnerability detection and preventive measures.
9	2022	Li, T., & Hu, L.	Audit as You Go: A Smart Contract-Based Outsourced Data Integrity Auditing Scheme for Multiauditor Scenarios with One Person, One Vote	China; Experimental framework proposal for multiauditor scenarios	To propose a smart contract-based auditing scheme (Audit-as-You-Go) for ensuring data integrity in multiauditor scenarios with decentralized control and one person, one vote principles.
10	2020	Groce, A., Feist, J., Grieco, G., & Colburn, M.	What are the actual flaws in important smart contracts (and how can we find them)?	Malaysia; Experimental and survey-based analysis during FC 2020	To identify common flaws in important smart contracts through a combination of automated analysis tools and manual auditing, providing solutions for vulnerability detection.
11	2021	Andrés Suárez, J., & Lorca Fernández, P.	On the impact of smart contracts on auditing	Spain; Conceptual paper analyzing the role of smart contracts in auditing	To explore the impact of smart contracts on both external and internal auditing, focusing on their potential to improve audit transparency, efficiency, and mitigate risks.
12	2021	Chou, C. C., Hwang, N. C. R., Schneider, G. P., Wang,	Using smart contracts to establish decentralized	USA; Case study on using smart contracts for	To propose the use of smart contracts for decentralized accounting systems,

		T., Li, C. W., & Wei, W.	accounting contracts: An example of revenue recognition	decentralized accounting	focusing on automating and ensuring transparency in revenue recognition processes.
13	2020	Wang, H., Qin, H., Zhao, M., Wei, X., Shen, H., & Susilo, W.	Blockchain-based fair payment smart contract for public cloud storage auditing	China; Experimental evaluation of a blockchain-based payment auditing system	To propose a blockchain-based fair payment mechanism embedded in smart contracts for auditing public cloud storage, ensuring transparency, integrity, and fairness in payment and data verification processes.
14	2024	El Haddouti, S., Khaldoune, M., Ayache, M., & Ech-Cherif El Kettani, M. D.	Smart contracts auditing and multi-classification using machine learning algorithms: an efficient vulnerability detection in ethereum blockchain	Morocco; Experimental study on using machine learning for smart contract vulnerability detection	To apply machine learning algorithms for multi-classification in the auditing process of Ethereum smart contracts, aiming to improve vulnerability detection efficiency.
15	2025	Chen, D., Zhang, Y., Liu, M., Cheng, Q., & Li, H.	Research on Contract Audit Automation System Based on Neural Networks	International; Experimental framework proposal for contract auditing systems using neural networks	To develop an automated contract auditing system based on neural networks to improve the efficiency and accuracy of contract audits, especially in digital transactions.
16	2022	Li, M., Chen, Y., Zhu, L., Zhang, Z., Ni, J., Lal, C., & Conti, M.	Astraea: Anonymous and secure auditing based on private smart contracts for donation systems	International; Experimental framework for secure auditing in donation systems using private smart contracts	To propose Astraea, a decentralized and anonymous auditing scheme using private smart contracts for ensuring secure and transparent auditing in donation

					systems, ensuring privacy and security for donors and recipients.

Here is the table with Independent Variables (IV) added for each study from 1 to 16 based on the context:

No	Year	Author	Title	Dependent Variable (DV)	Independent Variable (IV)
1	2018	Rozario, A. M., & Vasarhelyi, M. A.	Auditing with Smart Contracts	Audit process efficiency, audit quality, real-time reporting	Blockchain-based smart contracts, auditing automation, data analytics
2	2020	Coyne, E., & McMickle, P. L.	On the Impact of Smart Contracts on Auditing	Auditing effectiveness, automation in auditing	Smart contracts, blockchain technology
3	2022	Awan, I., Tariq, M. A., & Akhunzada, A.	Dredas: Decentralized, Reliable, and Efficient Remote Outsourced Data Auditing System	Data integrity, system verifiability	Blockchain, smart contracts, outsourced cloud storage
4	2023	Wang, C., Liu, X., Li, H., Di, X., Cong, L., Zhang, S., & Qi, H.	Smart contract-based integrity audit method for IoT	Integrity verification in IIoT systems	Smart contracts, Ethereum blockchain, IoT systems
5	2019	Corradini, F., Marcantoni, F., Morichetta, A., Polini, A., Re, B., & Sampaolo, M.	Enabling Auditing of Smart Contracts Through Process Mining	Audit efficiency, transaction analysis accuracy	Process mining, smart contracts, Ethereum blockchain
6	2024	Jain, A., & Tripathy, S.	SmartAudit: Smart Contract Vulnerability Detection Using Transfer Learning	Vulnerability detection in smart contracts	Transfer learning, machine learning algorithms, smart contracts
7	2024	Xiao, M., Xu, Y., Li, Z., & Wan, H.	Advanced Security Auditing Methods for Solidity-Based Smart Contracts	Security of Solidity-based smart contracts	Security auditing methods, Solidity smart contracts, vulnerability detection
8	2022	Li, T., & Hu, L.	Audit as You Go: A Smart Contract-Based Outsourced Data Integrity	Data integrity, audit quality	Smart contracts, multiauditor scenarios, decentralized control

			Auditing Scheme for Multiauditor Scenarios with One Person, One Vote		
9	2020	Groce, A., Feist, J., Grieco, G., & Colburn, M.	What are the actual flaws in important smart contracts (and how can we find them)?	Smart contract flaws, vulnerability detection	Smart contract analysis tools, automated auditing
10	2021	Andrés Suárez, J., & Lorca Fernández, P.	On the impact of smart contracts on auditing	Audit transparency, audit efficiency	Smart contracts, auditing methods, blockchain technology
11	2021	Chou, C. C., Hwang, N. C. R., Schneider, G. P., Wang, T., Li, C. W., & Wei, W.	Using smart contracts to establish decentralized accounting contracts: An example of revenue recognition	Revenue recognition accuracy, accounting transparency	Smart contracts, decentralized accounting, revenue recognition models
12	2020	Wang, H., Qin, H., Zhao, M., Wei, X., Shen, H., & Susilo, W.	Blockchain-based fair payment smart contract for public cloud storage auditing	Payment auditing efficiency, data verification	Blockchain-based payment mechanism, public cloud storage auditing
13	2024	El Haddouti, S., Khaldoune, M., Ayache, M., & Ech-Cherif El Kettani, M. D.	Smart contracts auditing and multi-classification using machine learning algorithms: an efficient vulnerability detection in ethereum blockchain	Vulnerability detection accuracy, auditing effectiveness	Machine learning algorithms, smart contracts, Ethereum blockchain
14	2025	Chen, D., Zhang, Y., Liu, M., Cheng, Q., & Li, H.	Research on Contract Audit Automation System Based on Neural Networks	Contract audit efficiency, auditing accuracy	Neural networks, contract auditing automation
15	2022	Li, M., Chen, Y., Zhu, L., Zhang, Z., Ni, J., Lal, C., & Conti, M.	Astraea: Anonymous and secure auditing based on private smart contracts for donation systems	Privacy, security in donation systems, auditing transparency	Private smart contracts, donation systems, secure auditing

16	2018	Rozario, A. M., & Vasarhelyi, M. A.	Auditing with Smart Contracts	Audit process efficiency, audit quality, real-time reporting	Blockchain-based smart contracts, auditing automation, data analytics

4.5 Summary of the Impact

Here is the table with a summary of the impact of independent variables (IV) on dependent variables (DV).

No	Dependent Variable Group	Dependent Variable (DV)	Independent Variables (IV)	Summary of Impact
1	Audit Efficiency & Quality	Audit process efficiency, audit quality, real-time reporting	Blockchain-based smart contracts, auditing automation, data analytics	Smart contracts and blockchain technology significantly improve audit efficiency and reporting quality, enabling real-time data analysis and reducing manual auditing tasks. The integration of automated systems helps streamline audit processes.
2	Automation in Auditing	Auditing effectiveness, automation in auditing	Smart contracts, blockchain technology	The automation of auditing tasks using smart contracts enhances the overall effectiveness of auditing by reducing human error and enhancing transparency. This approach also speeds up the process of audit completion.
3	Data Integrity & Verifiability	Data integrity, system verifiability	Blockchain, smart contracts, outsourced cloud storage	Decentralized auditing systems based on blockchain and smart contracts improve data integrity by ensuring transparency and verifiability, particularly in outsourced environments like cloud storage. The system reduces the reliance on third-party auditors.
4	Smart Contract Security	Security of smart contracts	Security auditing methods, smart contracts, vulnerability detection	The focus on security auditing of smart contracts through specialized techniques, such as vulnerability detection and machine learning, enhances the security and reliability of smart contracts deployed on blockchain systems.

5	Transaction Analysis & Accuracy	Transaction analysis accuracy, behavioral analysis	Process mining, smart contracts, Ethereum blockchain	Process mining techniques applied to blockchain and smart contracts help audit transaction sequences, ensuring they align with expected behaviors. This leads to higher accuracy in auditing and improved transaction analysis in blockchain applications.
6	Vulnerability Detection	Vulnerability detection in smart contracts	Machine learning algorithms, smart contracts	Machine learning algorithms, when applied to smart contracts, improve vulnerability detection efficiency. This significantly enhances security and reliability by identifying flaws and weaknesses in the contract code.
7	Revenue Recognition	Revenue recognition accuracy, accounting transparency	Smart contracts, decentralized accounting	Smart contracts enable accurate and transparent revenue recognition in decentralized accounting systems, reducing discrepancies and ensuring compliance with financial regulations.
8	Privacy & Security	Privacy, security in donation systems, auditing transparency	Private smart contracts, donation systems, secure auditing	Private smart contracts ensure privacy and security in donation systems, providing transparency and auditing capabilities while protecting sensitive data for both donors and recipients.
	Audit Transparency	Audit transparency, audit quality	Smart contracts, blockchain technology	The application of smart contracts in auditing enhances transparency, making it easier for auditors and stakeholders to track and verify transaction flows, leading to improved audit quality.
	Multiauditor Scenarios	Data integrity, audit quality	Smart contracts, multiauditor scenarios, decentralized control	In multiauditor scenarios, smart contracts improve audit quality by ensuring data integrity and enabling decentralized control, which aligns with the "one person, one vote" principle.
	Decentralized Auditing	Audit quality, auditing effectiveness	Decentralized control, smart	Decentralized auditing systems powered by smart contracts ensure that audits are

			contracts, blockchain	performed transparently and effectively, reducing the potential for fraud or manipulation by centralized authorities.
	Blockchain Efficiency	Payment auditing efficiency, data verification	Blockchain-based payment mechanism, public cloud storage auditing	Blockchain-based payment mechanisms embedded in smart contracts facilitate efficient payment auditing and data verification in public cloud storage, ensuring fairness and transparency.
	Machine Learning in Auditing	Auditing efficiency, vulnerability detection	Machine learning algorithms, Ethereum blockchain	The use of machine learning for vulnerability detection and auditing enhances the efficiency and effectiveness of smart contract audits by automating the detection of potential flaws in the contract code.
	Contract Audit Automation	Contract audit efficiency, auditing accuracy	Neural networks, contract auditing automation	Neural networks play a crucial role in automating contract audits, improving efficiency and accuracy by analyzing contract behavior and ensuring compliance with predefined rules.
	Donation System Auditing	Auditing transparency, privacy, security	Private smart contracts, donation systems, secure auditing	The Astraea framework ensures anonymous, secure, and transparent auditing for donation systems by using private smart contracts, thus maintaining privacy while ensuring effective audit tracking and compliance.
	Audit Efficiency & Quality	Audit process efficiency, audit quality, real-time reporting	Blockchain-based smart contracts, auditing automation, data analytics	Smart contracts and blockchain technology significantly improve audit efficiency and reporting quality, enabling real-time data analysis and reducing manual auditing tasks. The integration of automated systems helps streamline audit processes.

The integration of smart contracts, blockchain, and machine learning in the auditing process has led to significant improvements in efficiency, transparency, and security. By automating manual tasks, smart contracts streamline auditing workflows, enabling real-time

reporting and reducing human error. Blockchain technology enhances the accuracy and reliability of audits by ensuring data integrity and providing a transparent, decentralized framework for auditing without relying on third-party authorities.

In terms of security and vulnerability detection, machine learning and advanced auditing methods enhance the effectiveness of smart contracts, allowing for the early detection of vulnerabilities and flaws in contract code. This is particularly important in decentralized systems and IoT applications, where data verification and system integrity are critical. The use of private smart contracts ensures that sensitive information remains secure while still enabling robust auditing capabilities, such as in donation systems, where privacy is a major concern.

Additionally, smart contracts enable more efficient auditing in multiauditor scenarios, supporting decentralized control and promoting fairness in the audit process. The application of process mining techniques further supports auditing efforts by analyzing transaction sequences and ensuring they align with expected behaviors. These advancements not only enhance auditing practices in traditional settings but also optimize revenue recognition and financial auditing in decentralized environments, demonstrating the transformative potential of smart contracts in various industries.

Conclusion

This Systematic Literature Review (SLR) on Smart Audit Contracts highlights the transformative role of blockchain technology and smart contracts in modernizing auditing practices. The integration of AI, machine learning, and process mining enhances audit efficiency by automating procedures, detecting vulnerabilities, and ensuring real-time reporting. These innovations not only improve audit transparency but also reduce the reliance on third-party auditors, offering faster and more cost-effective auditing solutions.

Despite the promising potential, several challenges remain, particularly related to the complexity of smart contract code, security vulnerabilities, and scalability. While blockchain ensures secure and transparent environments, smart contracts themselves can be prone to errors and vulnerabilities in their code, requiring specialized knowledge for effective auditing. Additionally, scalability issues and the evolving legal and regulatory frameworks remain obstacles to broader adoption.

Future research should focus on addressing these challenges by developing hybrid blockchain models, enhancing AI-driven auditing tools, and creating comprehensive legal frameworks for smart contract audits. As these hurdles are overcome, smart contract auditing will continue to offer significant improvements in audit quality, efficiency, and security across various industries.

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