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RESEARCH

# Blockchain use in Auditing: Advantages and Challenges in Transaction Verification

## Uso de Blockchain en la Auditoría: Ventajas y Desafíos en la Verificación de Transacciones

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## Abstract

Financial auditing faces constant challenges in the verification and assurance of accounting information. Blockchain has emerged as a technology with the potential to transform these processes, offering greater transparency, security and traceability in records. However, its implementation faces technological, economic and regulatory barriers that hinder its widespread adoption. The objective of this study is to analyze the feasibility of blockchain in auditing, identifying its benefits and limitations, as well as the key factors that influence its adoption. Through a qualitative methodological approach, based on a systematic literature review and the analysis of real use cases, aspects such as scalability, interoperability and implementation costs are examined. The findings suggest that, although blockchain can improve efficiency and reliability in auditing, its adoption requires regulatory adjustments and professional training. It is concluded that regulatory evolution and the development of specific standards will be key to its integration in the accounting and financial sphere.

**Keywords:** Blockchain, financial auditing, technology, regulation, transparency.

**JEL Codes:** M41, M42

## Resumen

La auditoría financiera enfrenta desafíos constantes en la verificación y aseguramiento de la información contable. Blockchain ha emergido como una tecnología con el potencial de transformar estos procesos, ofreciendo mayor transparencia, seguridad y trazabilidad en los registros. Sin embargo, su implementación enfrenta barreras tecnológicas, económicas y regulatorias que dificultan su adopción generalizada. El objetivo de este estudio es analizar la viabilidad de blockchain en auditoría, identificando sus beneficios y limitaciones, así como los factores clave que influyen en su adopción. A través de un enfoque metodológico cualitativo, basado en una revisión sistemática de literatura y el análisis de casos de uso reales, se examinan aspectos como la escalabilidad, interoperabilidad y costos de implementación. Los hallazgos sugieren que, aunque blockchain puede mejorar la eficiencia y confiabilidad en auditoría, su adopción requiere ajustes regulatorios y capacitación profesional. Se concluye que la evolución normativa y el desarrollo de estándares específicos serán clave para su integración en el ámbito contable y financiero.

**Palabras clave:** Blockchain, auditoría financiera, tecnología, regulación, transparencia.

**Códigos JEL:** M41, M42

## Introduction

In an environment where the digitalization of accounting and financial processes is increasingly relevant, auditing faces the challenge of adapting to emerging technologies that improve efficiency, transparency, and security of information. In this context, blockchain has emerged as an emerging technology with the potential to transform how financial transactions are verified and recorded. Blockchain is a distributed ledger technology that allows for the secure, transparent, and immutable storage of information. Its application in financial auditing could revolutionize the way data is verified, reducing the need for intermediaries and enhancing the reliability of records.

This study analyzes the feasibility of adopting blockchain in financial auditing, identifying the main benefits that this technology can offer, as well as the limitations and challenges that must be overcome for its effective integration. Based on a literature review and analysis of implementation experiences, key aspects such as information security, interoperability with traditional accounting systems, and the costs associated with its application are explored.

The objective of this research is to provide a comprehensive view of the impact of blockchain in auditing, contributing to the academic and professional debate on its usefulness in verifying financial statements. It also aims to generate knowledge that can be used by auditing firms, regulators, and academics interested in the evolution of auditing practices in the digital age. Throughout the analysis, the main technological, economic, and regulatory barriers that could limit its adoption are highlighted, as well as the opportunities that this technology offers to strengthen the reliability and traceability of accounting information.

To address this topic, the study is structured as follows: first, a theoretical review of the fundamentals of blockchain and its applications in auditing is presented. Then, the regulations and standards that govern its use in the accounting and financial sectors are analyzed. Next, the main challenges in its implementation are identified, considering technological, regulatory, and economic aspects. In the methodological section, the research approach and the sources used are described. Then, the findings are presented and discussed, evaluating their impact on financial auditing. Finally, conclusions and recommendations are provided, highlighting the implications of blockchain technology for the future of auditing.

## 1. Theoretical Development and Literature Review

### 1.1 Basic Concepts of Blockchain

Blockchain is an emerging technology that enables the creation of distributed and secure digital records without the need for a central authority. Its structure is based on a chain of blocks, where each block contains a set of transactions that are validated and then cryptographically linked to the previous block, forming a chronological and immutable sequence. Each block includes a unique identifier (hash), generated from the information contained in the block itself and the hash of the previous block, ensuring the continuity and integrity of the chain. "The generation of the hash uses cryptographic algorithms such as SHA-256 in networks like Bitcoin, which ensures that any modification in a block would alter its hash and make any attempt at manipulation evident" (Narayanan et al., 2016, p.88). This characteristic of immutability is one of the main advantages of blockchain, as it ensures that once a transaction is recorded, it cannot be modified or deleted, guaranteeing the integrity of the information. Although blockchain introduces significant improvement in data security and transparency, its classification as a "disruptive innovation" remains a subject of debate, as it does not necessarily meet all the criteria established for that term in the academic literature.

One of the main advantages of blockchain is its decentralization and transparency. Unlike traditional data storage systems, where information is managed from a central server, in blockchain, the information is distributed across multiple nodes in the network. This reduces the dependance on a central entity and decreases the risks associated with single points of failure. "Moreover, since all recorded transactions can be verified by network participants, trust in the system's integrity is strengthened" (Tapscott & Tapscott, 2016, p. 46). However, it is important to differentiate between decentralization and distribution. A distributed system divides the workload across several nodes, but it does not necessarily eliminate centralized control. "In contrast, a decentralized system, like

blockchain, does not depend on a single authority for the validation and storage of transactions, which allows greater autonomy in the network" (Crosby et al., 2016, p. 15).

Blockchain should not be confused with other technological models, such as open-source systems, which allows software modification by any user, or open data systems, which allow software modification by any user, or open data systems, which provide public access to information without restrictions. Although they may share principles of transparency and collaboration, blockchain is distinguished by its cryptographic architecture and its consensus mechanism to validate transactions without requiring trust between parties. "Moreover, distributed computer systems process information across multiple connected nodes, but this does not necessarily mean they are decentralized, as they may still depend on a central authority for management" (Tapscott & Tapscott, 2016, p. 47). "Moreover, as a distributed technology, blockchain provides greater transparency, as all recorded transactions can be verified by network participants, increasing trust in the system" (Peters & Panayi, 2016, p. 255). However, not all blockchain implementations are entirely open; in private and consortium blockchains, access to information may be restricted to certain participants, reducing transparency compared to public blockchains. Security is another fundamental characteristic of blockchain. It employs advanced cryptographic techniques to ensure that transactions are secure, and data is accessible only to those with the appropriate permissions. Each block contains a unique code (hash) generated through cryptographic algorithms such as SHA-256 in networks like Bitcoin, linking it immutably to the previous block. "This means that any attempt to manipulate a block's data would change its hash and break the chain, making any alteration immediately detectable. Any attempt to manipulate the data of a block would change the block's code, making any alteration evident, thus making the system highly resistant to fraud" (Crosby et al., 2016, p. 10).

There are several types of blockchain, which can be classified based on access and control:

- Public Blockchain: In this type of blockchain, anyone can join the network, validate transactions, and participate in the consensus process. This model is used by cryptocurrencies such as Bitcoin. "Its structure is entirely decentralized, meaning that no entity has exclusive control over the network, and decisions are made through consensus protocols such as Proof of Work (PoW) or Proof of Stake (PoS). Full decentralization is one of its main characteristics, as there is no central authority governing the network" (Dai & Vasarhelyi, 2017, p. 5).
- Private Blockchain: Unlike public blockchain, this type is restricted to a specific group of participants. Organizations may use private blockchain to securely manage internal transactions without relying on a public network. "Transactions and data access are controlled by a central organization, ensuring greater privacy but limiting decentralization. This model is commonly used in corporate environments where security and access control are essential" (Peters & Panayi, 2016, p. 245).
- Consortium Blockchain: This type of blockchain is controlled by a group of organizations rather than a single entity, combining characteristics of both public and private blockchains. "Access is restricted to approved participants, but consensus and decision-making are shared among consortium members. This model is ideal for industries where multiple entities require shared control, such as the financial sector and supply chain management, enabling greater collaboration without compromising data privacy" (Tapscott & Tapscott, 2016, p. 45).

### 1.2 Applications of Blockchain in Auditing

The adoption of blockchain in auditing has created new opportunities to enhance the accuracy and transparency of financial auditing processes. The main applications of this technology in the field of auditing include:

#### *1.2.1 Improved Transaction Traceability*

Blockchain enables the sequential and chronological recording of each transaction within a block. This facilitates the tracking and verification of financial data across the entire blockchain, enhancing transaction to traceability. "Each time a transaction is recorded, it is a cryptographically linked to the previous block, ensuring the integrity and accuracy of the information" (Dai & Vasarhelyi, 2017, p. 5). However, it is essential to distinguish between two main approaches to blockchain auditing. The

first refers to the integration of crypto assets into financial statements and their accounting audit. In this case, auditors must assess the valuation, classification, and control of these assets within the framework of Financial Reporting Standards (NIF) and International Standards on Auditing (ISA). The second approach involves using blockchain as a tool for auditing any type of asset, whether digital or traditional, ensuring the integrity of accounting records through an immutable and verifiable infrastructure.

*1.2.2 Reduction of Fraud and Manipulation of Accounting Data*

The immutability feature of blockchain, where once data is recorded, it cannot be altered, is crucial for fraud prevention. "As a contributed network, any attempt to modify a block in the chain will be immediately visible through a discrepancy in the block's code, altering auditors to potential manipulation of accounting data. This security measure increases confidence in the audited data and minimizes the risk of fraud, which is especially valuable in audits involving large volumes of financial transactions" (Crosby et al., 2016, p. 12)

*1.2.3 Transparency and Reliability in Financial Auditing*

"One of the greatest benefits of blockchain technology is the transparency it provides. Since blockchain operates as a distributed system, recorded transactions are accessible to all network participants in controlled and secure manner. This allows auditors to access up-to-date records in real time, ensuring that the information they review is accurate, complete, and tamper-proof" (Peters & Panayi, 2016, p. 255).

*1.2.4 Process Automation Through Smart Contracts*

Another significant application of blockchain in auditing is the use of smart contracts. These self-executing programs automate certain processes in financial transactions, such as verifying contractual conditions, processing invoice payments, and ensuring compliance with tax audits. "Smart contracts enhance auditing efficiency by reducing manual work and human intervention while ensuring that established conditions are met accurately and transparently" (Tapscott & Tapscott, 2016, p. 63).

*1.2.5 Increased Efficiency in Internal Auditing*

In internal auditing, blockchain has the potential to improve efficiency by automating and digitizing records. This reduces the need for manual audits and increases accuracy by providing a centralized, accessible, and up-to-date database. Additionally, blockchain enables automated audits through smart contracts, which can be programmed to perform real-time reviews and verifications. These tools help detect anomalies immediately, facilitating the auditing of large volumes of data without manual intervention, thereby reducing fraud risks and accounting manipulation. It is essential to recognize that blockchain is not limited to auditing crypto assets. It can also serve as a tool to improve the traceability and verification of traditional financial records. Its implementation allows auditors to ensure that financial statement data is accurate and that transactions are verifiable in real time, strengthening the reliability of financial information. "Companies can use blockchain to maintain a continuous record of all transactions and activities, enabling real-time internal auditing and early detection of potential issues before they become significant organizational risks" (Narayanan et al., 2016, p. 112).

**1.3 Regulations and Standards Related to Blockchain in Auditing**

The regulatory framework in Mexico concerning the use of blockchain in the financial sector is constantly evolving. "The Law to Regulate Financial Technology Institutions (Fintech Law), published in 2018, represents the primary regulatory framework governing the use of digital technologies in the financial sector, including the supervision of virtual assets and blockchain-based platforms" (H. Congreso de la Unión, 2024, p. 1-74). This law establishes guidelines for financial institutions operating with distributed ledger technology (DLT), allowing the incorporation of innovative models within a regulated framework. Although the Fintech Law does not explicitly mention the use of blockchain in auditing, it regulates key aspects related to its application. "First, it defines virtual assets and establishes that only authorized financial institutions can offer services related to them under the supervision of the Bank of Mexico (Banxico)" (Banco de México, 2019). "Second, it imposes strict anti-money laundering (AML) and counter-terrorism financing (CTF) requirements,

where blockchain plays a fundamental role in ensuring transaction traceability and transparency" (H. Congreso de la Unión, 2024, p. 16-17).

Since the enactment of the Fintech Law, several secondary provisions have been issued to regulate the operation of technology platforms in the financial sector:

- Regulations of the National Banking and Securities Commission (CNBV): "Establishes guidelines for the supervision and operation of financial entities using blockchain in digital asset management" (Comisión Nacional Bancaria y de Valores, 2021, p. 34).
- Criteria of the Bank of Mexico (Banxico): "Determines the conditions for authorizing platforms that operate with virtual assets, prioritizing financial stability" (Banco de México, 2020, p. 4-7).
- Regulations of the Ministry of Finance and Public Credit (SHCP): "Regulates the application of blockchain technology in financial processes to ensure compliance with international transparency standards" (H. Congreso de la Unión, 2024, p. 1).

Furthermore, the Fintech Law has driven amendments to other key financial sector regulations, directly impacting the auditing of companies using blockchain:

- Law on Credit Institutions: "Establishes new supervision mechanisms for entities operating with digital technologies, including blockchain platforms" (H. Congreso de la Unión, 2024, p. 1-232).
- Securities Market Law: "Incorporates provisions for regulating blockchain-based crowdfunding platforms under CNBV supervision" (H. Congreso de la Unión, 2024, p. 1-319).
- Bank of Mexico Law: "Grants Banxico authority to regulate the use of virtual assets in the financial system and ensure its stability" (Banco de México, 2020, p. 4-7).

The integration of blockchain in auditing presents regulatory and legal challenges, requiring adaptations to existing standards, such as the International Standards on Auditing (ISA) and Financial Reporting Standards (NIF), to ensure compatibility with fundamental auditing principles. The goal is to guarantee the integrity, confidentiality, and availability of information within a decentralized and distributed environment. ISAs must include specific guidelines for verifying blockchain-recorded transactions, considering their immutability and the potential for real-time audits. Similarly, NIFs must address the accounting recognition of digital assets and the proper auditing methods to ensure compliance with international financial standards.

### *1.3.1 Adaptation of International Standards on Auditing (ISA)*

ISAs, which serve as global guidelines for auditors, must be adapted to incorporate blockchain-related considerations, such as blockchain verification and smart contract validation. "For example, auditors must be able to verify that transactions recorded on the blockchain are accurate, complete, and unaltered" (Sikka, 2009, p. 1). "Moreover, auditing blockchain-based systems requires new verification techniques and control testing procedures that go beyond traditional accounting record reviews. As blockchain becomes a key tool in auditing, ISAs must also provide specific guidance on using technology for evaluating internal controls and collecting audit evidence, ensuring that information quality and reliability are not compromised" (Coyne & McMickle, 2017, p. 104).

### *1.3.2 Normas de Información Financiera (NIF)*

Regarding Financial Reporting Standard (NIF), the adoption of blockchain necessitates a review of the regulations governing the presentation and evaluation of financial statements. The NIF must recognize that blockchain not only enables the traceability of crypto assets but also facilitates their auditing without requiring conversion to traditional assets. "The auditing of cryptocurrencies and tokens must be addressed within the framework of the NIF, establishing clear criteria for their valuation, recognition, and control" (Gavilán et al., 2021, p. 1). It is essential to develop clear guidelines on how to account for transactions and assets recorded on a blockchain, particularly when they involve smart contracts or cryptocurrencies. Additionally, the NIF should provide a framework for recognizing assets and recording revenue in blockchain environment, given that this technology can reshape the perception of assets and the valuation of financial transactions. "In particular, the classification and valuation of cryptocurrencies and digital assets require a precise interpretation within the context of the NIF, which is currently not entirely clear" (Deloitte, 2021, p. 7).

*1.3.3 International Regulatory Standards and their Impact*

International regulatory authorities are also beginning to address the use of blockchain in auditing and accounting. "The International Auditing and Assurance Standards Board (IAASB), for example, is developing specific guidelines for adopting emerging technologies such as blockchain in auditing. These guidelines include the requirement for auditors to assess the controls and tests associated with blockchain usage, particularly concerning financial reporting and evidence collection" (Bonsón et al., 2019, p. 32). At the national level, countries like Mexico have begun exploring how to adapt their own accounting and auditing standards to integrate blockchain. "The National Banking and Securities Commission (CNBV) in Mexico has issued recommendations for implementing new technologies, urging companies and auditors to remain aware of the legal and tax implications of using blockchain, with particular attention to decentralized accounting systems and smart contracts" (Martínez et al., 2020, p. 12).

*1.3.4 Regulatory Challenges*

However, the adoption of blockchain in auditing also faces several regulatory challenges. The lack of standardized global legal framework for implementing blockchain and auditing in decentralized environments is one of the main obstacles. "The European Commission, for example, is assessing the implications of using blockchain in auditing, particularly regarding data protection and privacy, which poses challenges for financial audit regulations" (European Commission, 2020, p. 7). "Audit firms must adapt to this evolving regulatory landscape, ensuring that the use of blockchain complies with personal data protection and privacy requirements established by regulations such as the General Data Protection Regulation (GDPR) in the European Union" (Zafar, 2025, p. 2).

## 1.4 Challenges in the Implementation of Blockchain in Auditing

Despite the advancements that blockchain offers in terms of efficiency, transparency, and security, its implementation in auditing faces multiple challenges. Next, the main obstacles that audit firms and regulators must overcome to adopt this emerging technology are explored. To facilitate its integration, a roadmap is proposed in three phases. (1) Training awareness, where auditors acquire knowledge about blockchain and its impact on accounting audits. (2) Pilot projects, in which audit firms assess the feasibility and benefits of blockchain through specific test cases. (3) Gradual integration, combining hybrid records that leverage blockchain's advantages with traditional methods to ensure an efficient and secure transition.

*1.4.1 Costs and Technological Barriers*

One of the main challenges in implementing blockchain in auditing is the cost associated with adopting this technology. Establishing an adequate blockchain infrastructure may require significant investments in hardware, software, and, most importantly, staff training. According to Narayanan et al. (2016), "companies must invest in secure decentralized networks and platforms that enable the integration of blockchain with existing accounting systems, which implies a high initial cost" (p. 105). "Additionally, audit firms must train their staff in the use of the technology, a process that can be complex due to the necessary specialization in areas such as cryptography and smart contract programming. Despite the potential benefits, resistance to change and a lack adequate resources to manage this technological transition represent a significant barrier for many organizations, especially smaller ones" (Tapscott & Tapscott, 2016, p. 82).

*1.4.2 Resistance to Change in Audit Firms*

The adoption of new technologies always comes with resistance to change, and blockchain is no exception. Peters and Panayi (2016) "argue that many audit firms prefer to continue using traditional methods due to their familiarity and the perceived security of these processes. This resistance is partly due to uncertainty about how blockchain technology may alter existing workflows, as well as a lack of confidence in auditors' ability to manage decentralized systems" (p. 256). "Furthermore, the use of blockchain requires auditors to adopt new data verification and validation methodologies, which can be perceived as a significant challenge, especially for those accustomed to conventional auditing approaches" (Zafar, 2025, p. 7). In this context, audit firms must be willing to shift their approach and adopt technologies that enhance their performance, which may require a cultural transformation within the organization.

*1.4.3 Regulatory and Legal Challenges*

Another major challenge is the absence of a clear regulatory framework guiding the implementation

of blockchain in auditing. Crosby et al. (2016) "highlight that the lack of precise guidelines on the legal validation of transactions in blockchain and auditors' responsibilities regarding decentralized records generates uncertainty and legal risks" (p. 16-17). "In many countries, existing laws are not yet prepared to address decentralized accounting systems and smart contracts, which can hinder the practical adoption of blockchain technology in auditing. Globally, there are significant differences in cryptocurrency and digital asset regulations, further complicating the establishment of uniform standards for auditing blockchain-based systems. Legal standards that ensure the validity of records and transactions may not be easily applicable in decentralized environments, creating uncertainty for both audit firms and regulators" (Deloitte, 2021, p. 10). "In Mexico, the National Banking and Securities Commission (CNBV) has begun establishing guidelines for adopting new technologies, but there is still no clear legislation regulating the use of blockchain in auditing" (Martínez et al., 2020, p. 26).

*1.4.4 Interoperability and Scalability Challenges*

Another technical aspect to consider is the interoperability between different blockchain systems. "Blockchains systems from different providers are not always compatible with one another, which can complicate their integration into the existing technological platforms of companies and audit firms. Moreover, scalability concerns are crucial, as blockchain networks, particularly public ones, may experience bottlenecks when handling large transaction volumes" (Zafar, 2025, p. 3). "While more advanced blockchain networks are working on solutions to these issues, the widespread implementation of blockchain in auditing could face technical limitations due to network capacity constraints in efficiently processing large-scale transactions" (Tapscott & Tapscott, 2016, p. 87).

## 2. Methodology

The research on the implementation of blockchain in auditing is based on a methodological approach that combines theoretical and empirical perspectives to analyze the effects of this technology on the accounting profession. "A non-experimental design with an exploratory and descriptive scope was adopted", aiming to identify the impact of blockchain on auditing processes without manipulating any variables (Hernández et al., 2014, p. 104). The study relies on a document review of academic and professional literature, including scientific articles, reports from regulatory bodies, and case studies of companies that have implemented blockchain in auditing, such as Deloitte, PwC, and Ernst & Young.

The qualitative approach of the research allows for a thorough understanding of the implications of blockchain in auditing, analyzing opportunities, challenges, and regulatory aspects. "This approach is appropriate since the adoption of blockchain is still in its early stages in auditing, limiting the availability of generalizable quantitative data" (Guba & Lincoln, 1994, p. 113). Through the document review, information was gathered from reliable secondary sources, such as scientific articles published in indexed journals, reports from international bodies (International Federation of Accountants – IFAC, International Auditing and Assurance Standards Board – IAASB, National Banking and Securities Commission – CNBV), and "case studies of companies that have implemented blockchain in auditing" (Deloitte, 2021, p. 1-24). "Despite its qualitative nature, the research also includes an exploratory analysis of previous data, which helps contextualize trends and challenges associated with the implementation of blockchain auditing" (Yin, 2018, p. 75).

**2.1 Documents Review and Sources Used**

The research is based on a comprehensive document review that allows for an examination of the current state of blockchain usage in auditing through academically recognized sources. A systematic search strategy was employed in scientific databases such as Scopus, Web of Science, and Google Scholar, ensuring the inclusion of peer-reviewed articles and high-impact publications. The reviewed sources include three main types:

Scientific Articles: Study of the application of blockchain in financial auditing, its impact on transaction traceability, and data reliability.

Reports from Regulatory Bodies: Documents from entities like IFAC, IAASB, and CNBV analyzing the viability and regulation of blockchain in auditing.

Case Studies: Analysis of blockchain implementation in auditing firms and international companies such as Deloitte, PwC, and Ernst & Young.

The document review process was divided into two main phrases. First, inclusion and expulsion

criteria were defined to select relevant sources. Publications exploring the impact of blockchain on auditing, analyzing the viability and challenges of its implementation, and providing empirical evidence on its use were included. Studies with outdated information, unfounded opinions, or articles not providing relevant evidence were excluded. Second, each selected source was analyzed to identify trends and key findings, such as the specific applications of blockchain in auditing, regulatory challenges, and barriers to its implementation.

### 2.2 Selection Criteria for the Reviewed Literature

Strict criteria were established to ensure the quality and relevance of the information used. The selected publications had to address the use of blockchain in auditing, with a solid empirical or theoretical foundation, and be published in reputable academic journals. Priority was given to recent studies (2016-2024) due to the rapid advancement of blockchain technology. To avoid biased information, articles without empirical support, non-peer reviewed publications, or studies with conflicts of interest were excluded. This approach ensured that the document review was based on solid and relevant scientific evidence.

### 2.3 Study Limitations

Despite efforts to conduct aa comprehensive investigation, several limitations must be considered when interpreting the findings. These included restricted availability and access to key information, which limits the inclusion of certain critical studies; the focus on academic literature, which excludes practical perspectives from auditing firms; and the absence of a consolidated regulatory framework for blockchain, making it difficult to analyze the adaptation of accounting and auditing regulations across different jurisdictions. Additionally, since blockchain is a continuously evolving technology, the findings of this study may become outdated in the short term. Regulatory and economic differences between countries must also be considered, as they influence the feasibility of implementing blockchain in different regions.

Despite these limitations, the findings. Provide a solid foundation for future research on the impact of blockchain in auditing and its adaptation to existing regulatory frameworks.

## 3. Discussion and Analysis of Results

The application of blockchain in auditing faces various technological, economic, regulatory, and cultural barriers that limit its large-scale implementation. Based on the adopted methodology, key findings have been identified to better understand the implications of this technology in financial auditing.

However, the adoption of blockchain can begin gradually with actions such as integrating automated tools based on smart contracts to verify accounting transactions in real time. Likewise, companies can apply blockchain in internal audits as a first step toward its adoption in external and regulatory audits.

Despite these challenges, several auditing firms have begun exploring blockchain as an effective tool for financial data verification. Companies such as Deloitte, PwC, and Ernst & Young have developed blockchain-based auditing models, demonstrating its applicability in validating accounting records and detecting fraud. These advancements indicate that blockchain has the potential to be effectively integrated into auditing practices, requiring only regulatory adjustments and specialized training for large-scale adoption.

### 3.1 Technological Barriers and Factors

One of the most significant technological obstacles to implementing blockchain in auditing is scalability. Networks using the Proof of Work (PoW) consensus model—one of the most widely used protocols in blockchains like Bitcoin—have high energy consumption and limit transaction speeds, which could make their use in auditing inefficient. Audits require high speed and large volumes of data processed in real time, which may be hindered by PoW's scalability limitations. According to Cosby et al. (2016), "PoW-based systems present limitations in transaction processing speed, making large-scale auditing applications difficult. Latency and energy consumption are technological barriers that do not align with the speed and performance required in modern audits" (p. 17).

To mitigate these issues, transitioning to more sustainable and efficient models such as Proof of Stake (PoS) could be a viable solution. PoS significantly reduces energy consumption and enhances scalability by eliminating the intensive mining process characteristic of PoW. This would make the technology more efficient and suitable for

adoption in auditing, as it could process a higher number of transactions with fewer resources. However, PoS also requires a higher level of trust in validators and may be more susceptible to certain vulnerabilities, demanding greater confidence in validation systems.

Additionally, interoperability between blockchain and traditional accounting systems remains a technical challenge. Integrating these platforms may require significant adjustments to existing infrastructures, posing a barrier for many organizations still reliant on conventional systems. Dai & Vasarhelyi (2017) "argue that the lack of integration between blockchain and traditional accounting systems limits its adoption in auditing, as many companies still depend on centralized software and conventional databases. Companies using legacy accounting software, such as traditional database management systems, face difficulties linking these systems to blockchain networks without incurring high costs and additional complexities" (p. 6).

Regarding security, while blockchain is generally considered secure due to its decentralized structure and robust cryptography, smart contracts may contain coding errors that create vulnerabilities. Although blockchain ensure the immutability of recorded data, errors in smart contract programming can lead to incorrect or even malicious transactions. Coyne & McMickle (2017) "warn that the lack of specific regulations on smart contract auditing could pose a risk, as programming errors may compromise the validity of transactions and the integrity of financial records. This highlights the importance of continuous audits and the development of more rigorous coding practices for these contracts" (p. 107).

According to Table 1, the technological factors limiting blockchain adoption in auditing include scalability, interoperability, and vulnerabilities associated with smart contracts.

**Table 1.** Technological Barriers in Blockchain for Auditing

| Factor | Description |
|---|---|
| Scalability | PoW-based networks require high energy consumption and limit transaction speeds. |
| Interoperability | Difficulty integrating blockchain with traditional accounting systems. |
| Security | While blockchain is secure, errors in smart contracts may create vulnerabilities. |

Source: Own elaboration.

### 3.2 Economic Impact and Financial Barriers

Implementing blockchain requires a significant initial investment, particularly in terms of technological infrastructure and training. The adoption of new technologies—especially in organizations that rely on traditional processes—entails a considerable upfront cost. For many small and medium-sized audit firms, this cost can be a substantial barrier. The need to acquire high-capacity equipment and specialized software, along with expenses related to platform implementation, can be prohibitive for many companies.

However, adopting this technology may yield long-term financial benefits, as it could reduce fraud risks, enhance audit accuracy, and optimize operational processes. Automating certain tasks—such as transaction verification— and reducing human errors could improve operational efficiency and lower costs associated with error correction. Gavilán et al. (2021) "argue that while blockchain investment is high, its benefits in terms of fraud reduction and operational efficiency improvements can justify the costs in the long run. Potential savings from enhanced security and operational efficiency can offset the initial investment and generate a positive return over time" (p. 7).

Recurring costs related to maintaining technological infrastructure must also be considered, as blockchain platforms require periodic updates to keep up with technological advancements. Maintaining and upgrading blockchain system is essential to ensuring that the platform remains secure and efficient, which involves additional expenses over time. Training specialized personnel is another significant cost but is crucial to ensuring effective use of the technology. Blockchain audits require professionals with expertise in cryptography and Smart contract development, representing a continuous investment in human capital.

According to Table 2, the main costs associated with blockchain implementation in auditing include technological infrastructure, training, and maintenance expenses.

In the long run, the reduction of fraud and errors could justify this investment, enabling a favorable economic return.

**Table 2.** Implementation Costs of Blockchain in Auditing

| Concept | Estimated Cost |
|---|---|
| Technological Infrastructure | High initial investment in hardware and software. |
| Training | High initial investment in hardware and software. |
| Maintenance | Recurring costs for updating and maintaining the platform. |

Source: Own elaboration.

**Table 3.** Regulatory Barriers of Blockchain in Auditing

| Barrier | Implications |
|---|---|
| Lack of Regulation | No specific ISA or IFRS standards exist for auditing blockchain transactions. |
| Data Protection | GDPR and other regulations limit the storage of personal data on blockchain. |
| Variable Jurisdictions | Regulatory differences between countries hinder its adoption in international audits. |

Source: Own elaboration.

### 3.3 Regulatory and Legal Challenges

The regulatory framework for blockchain in auditing remains ambiguous, creating uncertainty regarding its applicability. Currently, there are no specific provisions within the International Standards on Auditing (ISA) or the Financial Reporting Standards (IFRS) that directly address blockchain-based transactions. This regulatory gap leads to inconsistencies in interpreting best practices for blockchain use in auditing. Coyne & McMickle (2017) state that "the ISA has yet to incorporate clear guidelines for auditing blockchain transactions, creating uncertainty about its applicability in financial auditing. The absence of clear directives may pose legal risks for companies and auditors, as there are no standardized rules on how to verify transactions recorded on blockchain" (p. 106).

Compliance with data protection regulations, such as the European Union's General Data Protection Regulation (GDPR), is another major concern, as blockchain enables decentralized data storage, which may conflict with privacy laws governing personal data storage and management. This immutable nature of blockchain also raises questions about how errors in recorded data can be corrected once they have been stored on the network.

Varying jurisdictional regulations further complicate blockchain adoption in international audits. Given blockchain's decentralized operation, a regulatory framework must account for differences in legal systems across countries. Audits involving cross-border transactions could be affected by national regulatory discrepancies, introducing additional complexities into the auditing process.

According to Table 3, the key regulatory barriers identified include the lack of specific regulations, data protection restrictions, and jurisdictional differences that impact the global implementation of blockchain.

### 3.4 Cultural and Trust Factors

The acceptance of blockchain in auditing also faces cultural and trust-related barriers. Although blockchain technology has proven to be secure and efficient, many auditors and accounting professionals remain skeptical about its adoption due to a lack of understanding of how it works. Peters & Panayi (2016) explain that "the lack of knowledge about blockchain and the absence of training in its use have led to resistance to change within the accounting profession. Blockchain transactions are perceived as complex and difficult to audit due to the decentralized nature of the technology and the need to understand advanced concepts such as cryptography and smart contracts" (p. 256).

The limited knowledge of auditors on how to use blockchain is another key factor in the technology's low adoption rate. Many auditors have not received sufficient training to understand how to integrate blockchain into their auditing processes, raising doubts about their ability to use the technology effectively. Dai & Vasarhelyi (2017) suggest that "blockchain training should be a priority for audit firms, as technical ignorance is one of the main barriers to its adoption. As blockchain becomes more common, training in this area will be crucial to increasing auditors' confidence in its use" (p. 6).

Furthermore, the perception of complexity associated with blockchain may discourage audit firms from adopting the technology. The belief that blockchain is difficult to implement and manage could hinder its adoption despite its potential benefits. Gavilán et al. (2021) highlight that "although blockchain has the potential to improve the traceability of financial information, the lack of trained personnel and resistance to change in audit firms limit its implementation. Simplifying its deployment and developing more accessible

solutions could be key to overcoming these barriers" (p. 5).

According to Table 4, the main cultural factors affecting the adoption of blockchain include distrust in technology, lack of knowledge, and the perception of its complexity.

**Table 4.** Cultural Factors Affecting Blockchain Adoption in Auditing

| Factor | Impact |
|---|---|
| Distrust in technology | Skepticism about the security and reliability of blockchain in auditing. |
| Lack of knowledge | Few auditors deeply understand how blockchain works. |
| Perception of complexity | Blockchain is seen as a difficult technology to implement. |

Source: Own elaboration.

Training and education in blockchain will be key to increasing its acceptance in the accounting and auditing community.

### 3.5 Future Perspectives

Despite existing barriers, the results suggest that blockchain has the potential to transform financial auditing. As the technology matures, more efficient models are developed, and specific regulations are established, blockchain adoption in auditing will become more accessible and effective. Government incentives, increased specialized training, and improved technological infrastructures will facilitate its integration into auditing processes.

However, it is not necessary to wait for legislative changes to begin its implementation. Auditing firms can drive adoption through proof of concept (PoC), developing hybrid auditing models that combine blockchain records with traditional accounting systems. Additionally, collaboration with international organizations will help generate standards that facilitate its acceptance without exclusively relying on regulatory changes.

The creation of international standards and the harmonization of regulations between countries will allow companies to conduct international audits more efficiently and securely, leveraging blockchain's advantages in terms of transparency and traceability.

Although blockchain faces significant technological, economic, regulatory, and cultural barriers, future prospects are promising. If these limitations are resolved, blockchain could redefine how audits are conducted, providing greater transparency, security, and efficiency in the process.

## 4. Conclusions and Implications

The analysis of blockchain implementation in financial auditing allows us to conclude that, while this technology presents significant advantages in terms of transparency, security, and immutability, its adoption is limited by various technological, economic, regulatory, and cultural factors. The scalability of blockchain networks and the lack of interoperability with traditional accounting systems hinder its integration into current audits, requiring the evolution towards more efficient and flexible models. Additionally, security, although considered a strength of blockchain, can be compromised by errors in the programming of smart contracts, highlighting the need for more robust verification and validation protocols.

From an economic perspective, high implementation costs represent a considerable barrier, especially for small and medium-sized auditing firms that lack the necessary resources to invest in technological infrastructure and training. However, in the long term, process automation and fraud reduction could generate a positive return on investment, making the technology financially viable.

In the regulatory field, the lack of specific standards for blockchain-based auditing creates legal uncertainty and hinders its acceptance in financial and accounting environments. The absence of harmonized regulatory frameworks at an international level prevents its adoption in cross-border audits, making it urgent to develop global standards that allow its integration into International Standards on Auditing (ISA) and Financial Reporting Standards (FRS).

On the other hand, cultural barriers and resistance to change among auditing professionals have been identified as key obstacles to blockchain adoption. The lack of knowledge about this technology and the perception that its implementation is complex limit its acceptance in the sector. In this regard, training and educating auditors in blockchain-based tools are essential to bridging the adoption gap and promoting its widespread use.

The implications of these findings suggest that the future of auditing will be influenced by the

development of more accessible and efficient blockchain solutions, as well as by the evolution of regulations that allow its integration without affecting legal security. Collaboration between regulatory bodies, auditing firms, and technology developers will be key to creating an ecosystem where blockchain can add real value to financial auditing, optimizing processes and enhancing trust in accounting information.

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