Client Use of Blockchain Technology: Exploring Its Impact on Audit Quality of Egyptian Auditing Firms

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Abstract

This study explores the relationship between blockchain adoption and audit quality, focusing on the Big Four audit firms in Egypt. Through a structured questionnaire, the research sought to assess the impact of blockchain technology on the audit quality. A total of 94 valid responses were obtained from professionals in the auditing field. The data were analyzed using descriptive analysis, correlation coefficient matrix, and linear regression techniques. The findings indicate a statistically significant positive association between blockchain implementation and enhancements in audit quality, highlighting blockchain's potential to improve transparency, accuracy, and efficiency within audit practices in Egypt.

Keywords : Block chain technology - Audit Quality .

استخدام العملاء لتقنية البلوكشين: استكشاف تأثيرها على جودة المراجعة في شركات المراجعة المصرية.

المستخلص:

تستكشف هذه الدراسة العلاقة بين تبني تقنية البلوكشين وجودة المراجعة، مع التركيز على شركات المراجعة الأربعة الكبرى في مصر. من خلال استبيان منظم، سعى البحث إلى تقييم تأثير تقنية البلوكشين على جودة المراجعة. تم الحصول على ٩٤ استجابة صالحة من المهنيين العاملين في مجال المراجعة. تم تحليل البيانات باستخدام التحليل الوصفي، ومصفوفة معامل الارتباط، وتحليل الانحدار الخطي. تشير النتائج إلى وجود ارتباط إيجابي ذو دلالة إحصائية بين تطبيق تقنية البلوكشين وجودة المراجعة، مما يبرز إمكانيات البلوكشين في تعزيز الشفافية والدقة والكفاءة في ممارسات المراجعة في مصر.

كلمات مفتاحية : تقنية سلاسل الكتل - جودة المراجعه .

1. Introduction

The world is currently experiencing the Fourth Industrial Revolution (the Information Revolution), which is based on contemporary technologies and has assisted in transforming the economy from its traditional form to the digital economy. This transformation is due to the rapid and successive developments in the field of information systems. Cloud computing, the Internet of Things (IoT), artificial intelligence (AI), big data, and blockchain are some of the most significant of these technologies (Badr,2023).

Blockchain technology, widely regarded as one of the most transformative inventions of the digital era, has garnered significant attention in both national and international media, drawing interest from the private sector and public institutions alike. Some even posit that its potential impact could surpass that of the internet. As a highly anticipated technological advancement, blockchain operates through a distributed ledger system, enabling secure and transparent storage of transactions and data. This system consists of a chain of interconnected blocks, each containing verified data that is authenticated by a network of interconnected devices. Once entered, the data becomes immutable, enhancing its reliability. These characteristics make blockchain particularly suitable for applications such as cryptocurrencies and smart contracts (Gokoglan et al., 2022).

Even though businesses and nations today have only lately gained notoriety, we can observe that this technology has started to gradually permeate our daily lives, much like the internet did years ago. By converting our social and professional behaviors into digital data, the Internet creates a virtual world that streamlines workflow and communication while also saving time and money. The blockchain technology that has recently come to our attention has been given to the world in a manner akin to how the World Wide Web was given to the world without obtaining

any patents. The blockchain technology that has recently come to our attention has been gifted to the world in the same way (Gokoglan et al,2022).

The advent of the Internet has fundamentally transformed the global communication network, revolutionizing the way information is exchanged on a worldwide scale. However, with the continuous evolution of digital technologies, blockchain has emerged as a groundbreaking development. This distributed network, based on peer-to-peer (P2P) technology, ensures the secure and reliable registration and transfer of data. In the digital era, blockchain is increasingly viewed as a technology of the future, poised to have a profound impact on both society and business sectors (Dsouza, 2021).

Auditors are now able to leverage digital tools, such as big data analytics, to conduct comprehensive evaluations of all data within the audited firm, potentially reducing or even eliminating the reliance on traditional sampling methods. By detecting anomalies across the entire dataset and providing recommendations to address identified issues, auditors can enhance risk assessment processes and improve decision-making quality, driven by the digitization of audit procedures. Furthermore, by incorporating real-time metrics like sales performance and projected order bookings, audits can extend beyond historical data to adopt a forward-looking approach,

assessing the firm's sustainability. This broader analysis has the potential to significantly curtail managerial opportunism and strengthen corporate governance (Manita et al., 2020).

In the dynamic landscape of financial reporting and accountability, the integrity and accuracy of financial information hold paramount importance. At the heart of this assurance lies the audit process, a rigorous examination that ensures the credibility of financial statements and bolsters investor confidence. With the advent of technological innovations, the traditional audit landscape is undergoing a significant transformation. Among these innovations, blockchain technology has emerged as a transformative force, promising to reshape the audit process and potentially elevate the quality of audits to new heights. This research delves into the impact of audit clients' adoption of blockchain technology on audit quality.

1.1 Research Problem

With technological advancements in the modern era, enterprises have had to evolve their methods and tools to obtain accurate and appropriate information, ensuring their survival amid modern technological competition. The rapid development and digital transformation have led to the emergence of blockchain as a network facilitating easier and safer value exchanges between two or more parties (Akl et al ,2020).

Given the growing trend toward digitization and the increasing reliance of companies on advanced technologies to enhance operational efficiency and transparency, blockchain technology offers significant advantages in terms of security and precision when recording financial transactions. This has the potential to improve the reliability and transparency of financial data, which auditors heavily depend on for their assessments. The development of this technology provides a transformative opportunity to address challenges and potentially enhance audit quality. Therefore, this study seeks to explore the impact of blockchain technology integration in auditing processes and provide valuable insights to auditors, regulators, and stakeholders, enabling them to make informed decisions regarding the use of this technology to enhance audit quality. Accordingly, the main research problem question can be formulated as follows: How does an audit client's adoption of blockchain technology impact audit quality?

1.2 Research Objective

The aim of this study, considering the research problem, is to investigate the impact of an audit client’s adoption of blockchain technology on audit quality.

1.3 Research Importance

- **Academic Importance**

Studying how blockchain impact audit quality is important from an academic standpoint because it will expand our theoretical knowledge, offer real-world data, and inform future advancements in auditing procedures and curricula. This study informs the larger accounting profession and adds to the continuing conversation within the academic community. The scientific importance of the research lies in the existence of a knowledge gap about the impact of blockchain technology on audit quality, especially in light of the scarcity of studies that have addressed this topic. Therefore, the research seeks to bridge this gap by providing data and analyses derived from the practical application of this technology to find out how this technology can improve audit quality.

- **Practical Importance**

In practical terms, the research provides new and useful insights for companies and institutions on how to enhance audit quality by adopting blockchain technology. Companies adopting this technology can reduce errors and manipulation in financial statements, thus improving the accuracy of financial reports and increasing the confidence of investors and stakeholders. Furthermore, these improvements can aid auditors in increasing both the efficiency and effectiveness of their auditing processes.

Additionally, the research supports decision-makers and executives in making well-informed choices about the integration of blockchain technology, potentially elevating corporate competitiveness and driving substantial advancements in financial compliance practices.

2. Literature Review and Hypothesis Development

2.1 Blockchain Technology: An Overview

Blockchain technology, introduced in 2008, emerged from the integration of distributed computing, economic game theory, and software engineering. In its initial form, blockchain facilitated basic transactions, providing the foundation for cryptocurrencies like Bitcoin and enabling money transfer services via online platforms and payment systems. However, its primary function in this first generation was limited to maintaining a ledger for recording transactions. The second generation of blockchain, introduced in 2014, expanded its capabilities to support smart contracts and data transmission. Despite the initial limitations, blockchain represents a transformative technology with the potential to revolutionize business operations, particularly by addressing issues within financial and accounting systems, without the need for traditional intermediaries such as banks or auditing firms (Badr, 2023).

Blockchain has been defined in various ways in literature. According to Mousa,(2022), a "blockchain" is characterized as a distributed database comprising an expanding sequence of immutable data records, or a digital ledger where transactions are sequentially recorded in blocks that are added to the chain. In this model, the ledger is maintained collectively by all network participants, with no central authority overseeing updates. Similarly, Gokoglan et al,(2022) describe blockchain as a decentralized and replicated electronic file that records transactions through peer-to-peer protocols, utilizing rapid digital communication, substantial processing power, and advanced encryption techniques. This system connects separate computers via the internet to form a network.

Blockchain, according to the researchers, is a distributed, secure recording system that is used to capture, store, and record transactions. Blockchain is made up of interconnected data chains called "blocks." These blocks contain records of data and transactions in a single vertical format that is encrypted with cryptography.

Blockchain technology is composed of four fundamental components: blocks, data, hashes, and timestamps. Each blockchain is essentially a sequence of blocks, which form the primary unit of the chain. A block contains a set of transactions or activities carried out among network participants, such as financial transfers or records

of purchases. Once a block reaches its maximum transaction capacity, a new block is generated and appended to the chain. This process enables traceability of transactions and prevents the alteration or deletion of data. The data within each block reflects the processes or commands executed. A hash, often described as a digital signature, is a unique identifier for each block, created through a cryptographic hash function embedded in blockchain technology. The hash not only distinguishes each block but also uniquely identifies the transactions within it. Lastly, the timestamp records the exact moment when a transaction takes place. The blocks are sequentially linked via the hashes of preceding and succeeding blocks, ensuring data integrity and preventing modifications to block contents (Mahmoud & Al-Nadr, 2020; Mousa, 2022; Badr, 2023).

Both(Gokoglan et al,2022; Elommal & Manita ,2022; Hashem et al,2023; and Hakami et al,2023) agree that blockchain technology is characterized by three key features:

1. Transparency and Traceability: Blockchain provides a transparent and immutable ledger, ensuring that once data is recorded, it cannot be altered or erased. This system enables comprehensive tracking of transactions, allowing data to be traced from its origin to its endpoint. The integrity of the ledger is reinforced through its replication across multiple nodes in the network, ensuring reliability and boosting user trust.

2. Security and Data Protection: Blockchain enhances security through cryptographic encryption, safeguarding data by ensuring its authenticity and preventing unauthorized modifications. The decentralized architecture of blockchain minimizes the risks of tampering, malicious attacks, and unauthorized access. By requiring validation from a distributed network of nodes rather than a central authority, blockchain significantly reduces vulnerabilities. Additionally, the option for user anonymity further strengthens privacy protection.

3. Decentralization: Blockchain operates without the need for a central authority, distributing control across a network of nodes. This decentralized framework allows for peer-to-peer transactions governed by established rules, without relying on intermediaries. The integration of smart contracts enables automated transactions, improving efficiency and productivity, while reducing the costs associated with traditional verification and oversight processes.

Researchers emphasize that blockchain's unique attributes make it a disruptive technology with the potential to fundamentally transform business models, particularly in fields like auditing and accounting, where secure, transparent, and decentralized processes are essential.

Two primary types of blockchain technology have been identified based on permission mechanisms: public and private blockchains. Public Blockchains (e.g., Ethereum and Bitcoin) are open networks that allow unrestricted participation and operate without a central authority, enabling the deployment of smart contracts and distributed applications. Private Blockchains, in contrast, restrict access to authorized users and can be either public or permissioned. In permissioned systems, users engage in reconciliation processes without explicit authorization, but a central authority maintains control overrule modifications and transaction reversals. Private blockchains are used for specialized applications, cost reduction, and productivity improvements, with examples including Eris Industries and Multichain according to (Shrivas & Yeboah ,2018; Tan & Low ,2019; Bonsón & Bednárová ,2019; Gokoglan et al, 2022 ; Hakami et al, 2023; Lalwani ,2023; and Han et al, 2023).

Researchers have identified that the key differentiator among various blockchain types is the method for determining network access permissions. Specifically, private blockchains restrict access to a designated group of authorized individuals, whereas public blockchains are open to anyone with internet connectivity. In a public blockchain, the system operates in an open-access manner, allowing all devices to connect without prior authorization, and its ledger is publicly accessible. In

contrast, a private blockchain requires users to obtain permission from the blockchain authority before accessing the network, with participation being limited to those who have been explicitly invited.

The analysis of multiple prior studies reveals several benefits associated with blockchain technology. As highlighted by Jiang,(2018); Mousa,(2022); and Douglas,(2023), these Blockchain auditing offers several key advantages, First, it significantly enhances audit timeliness by eliminating the need for manual verification of financial data, providing auditors with real-time access to secure and immutable information, and reducing associated costs by minimizing reliance on hardware and software. Second, blockchain's distributed ledger system ensures data integrity by recording transactions across multiple nodes, safeguarding against data loss or corruption. Additionally, blockchain enables automatic auditing and real-time monitoring, allowing auditors to instantly track and verify transactions, reducing risks related to fraud and errors. The technology also improves risk management by offering real-time anomaly detection and preemptive alerts, enabling auditors to address potential issues proactively. Overall, blockchain represents a transformative approach to auditing, combining transparency, security, and efficiency to enhance audit quality.

The researchers concluded that the decentralization, consensus mechanisms, transparency, and immutability of blockchain technology enhance its applicability in auditing. These features contribute to improved audit effectiveness, reduced audit costs, and facilitate independent audits. Additionally, blockchain technology supports real-time monitoring and preemptive alerts. It is anticipated that these capabilities will drive significant advancements and reforms in the audit sector.

Although blockchain technology offers numerous benefits, it faces several challenges in its implementation, as noted by Mahmoud and Abu Al-Nadr,(2020); Mousa,(2022); and Badr,(2023). One major concern is identity theft, where if a private key is stolen, the assets associated with it are permanently lost, and the thief cannot be traced. Despite strong encryption, system hacking remains a critical threat, raising doubts about data security. Another challenge involves majority control, where participants controlling 51% of the network can influence transaction validation. Additionally, a lack of thorough understanding of blockchain technology can cause delays in its adoption, as operational risks and resistance to change hinder its implementation. Lastly, the high costs of transitioning to blockchain systems, including maintenance, monitoring, and employee training, present financial obstacles for organizations.

Blockchain technology has the potential to significantly enhance the efficacy, reliability, and efficiency of auditing. Its features enable a reorganization of auditing procedures and evidence collection methods. Continuous data flows facilitate real-time, ongoing audit testing, allowing all network participants to verify transactions and receive instant updates. This shift from sporadic to continuous and automated confirmations increases the likelihood of detecting fraud, material errors, or financial discrepancies. Furthermore, the integration of electronic tags and advanced technologies allows for the transition of inventory counts from a manual process to continuous automation (Appelbaum & Nehmar, 2017; La Querica, 2018; and Smith, 2019).

Additionally, blockchain can reduce the need for traditional audit procedures while enhancing the effectiveness of audit activities in critical areas. Auditors will increasingly focus on examining public ledgers and IT controls, placing greater emphasis on soft skills, analytical abilities, and advisory services that provide strategic value to the organization Jernack, (2018); and La Querica,(2018). The use of smart contracts further boosts audit efficiency by granting auditors access to both real-time information and the underlying contracts (Jernack, 2018; and Ibrahim, 2023).

Several scholars agree that blockchain technology can substantially enhance the auditing process. According to Bonsón and

Bednárová,(2019); Elommal and Manita,(2022); and Dyball and Seethamraju ,(2022), the use of a single archived ledger for all blockchain data enables auditors to automatically verify a large portion of the data. This automation reduces the need for labor-intensive manual reviews, thus shortening the time between transaction dates and verification. Consequently, it lowers the time and cost of the audit process and allows auditors to focus on more complex transactions, thereby adding greater value to their reports.

Gauthier and Brender (2021) affirm that blockchain technology can decrease fraud and human error in accounting records, enhance the quality of data used in financial reporting, and ultimately improve the quality, transparency, and reliability of that data. This leads to more efficient operations and a reduction in audit hours, which saves both time and money for auditors. Schmitz and Leon,(2019); and Ali (2023) suggest that the audit process, with blockchain, will involve extensive data mining activities, including pattern recognition and big data analysis. This reduces auditors' dependence on preliminary analyses and eliminates the need to predetermine the audit program based on expected findings. The use of blockchain in this context enhances the efficiency of the review process, achieving high levels of security, accuracy, and speed, thereby elevating the standard of the audit.

Ali(2023) also notes that blockchain technology can streamline data entry by eliminating repetitive tasks and accelerating data analysis and extraction, especially in IT-centric environments, such as those involving IBM Watson and KPMG's collaboration, thus supporting audit efficiency and quality. Furthermore, Brender et al,(201٩) highlight that the growing adoption of new technologies, including blockchain, necessitates a paradigm shift in auditing. This shift involves moving from merely certifying financial statements to testing information systems and verifying the correct implementation of blockchain. Additionally, auditing could evolve from a backward-looking activity to a forward-looking strategic analysis and consulting role, contingent on legal and regulatory frameworks.

The researchers conclude that integrating blockchain technology into the audit process significantly enhances both the procedures and the quality of evidence. Blockchain facilitates early detection of fraud and deception and helps in identifying business risks, thereby providing opportunities to improve the overall efficiency and effectiveness of the audit process.

2.2 Audit Quality: An Overview

Despite numerous attempts to define audit quality, a universally accepted definition remains elusive since DeAngelo's foundational work. Audit quality is a complex concept with

multiple dimensions, including the accuracy and fairness of financial statements, adherence to audit standards, and auditor competence and independence. DeAngelo (1981) defined it as the probability that an auditor will detect and report material breaches in a client's accounting system, incorporating both detection and reporting elements. The challenge in defining audit quality arises from the intangible nature of audit services, the lack of standardized auditing criteria, and varying levels of expertise among service recipients. Although the American Institute of Certified Public Accountants (AICPA) has established specialized centers to improve audit quality, a precise definition remains elusive. This difficulty is further compounded by the subjective nature of audit quality, which is shaped by individual interpretations of standards, ethical codes, and user expectations. Consequently, audit quality is a fluid concept, influenced by adherence to professional standards, thorough execution of the audit process, and the ability to meet the needs and expectations of stakeholders according to (El Badlaoui, et, al ,2021; and Sujana& Dharmawan ,2023).

Researchers note several challenges in defining and achieving audit quality. Despite its significance, there is no universally accepted definition, highlighting the complexity of audit quality, which encompasses both technical and qualitative aspects of the audit process. Key to high audit quality are the

auditor's expertise and experience, which play a crucial role in meeting stakeholder expectations and building confidence in financial statements. High audit quality is marked by the auditor's effectiveness in identifying and disclosing material misstatements and making informed professional judgments in line with auditing standards. However, these aspects are difficult to measure and standardize, complicating the development of a clear and consistent definition of audit quality.

Researchers identify several key shortcomings in ensuring audit quality, particularly concerning the implementation of policies and procedures within audit firms: according to (Svanberg & Öhman,2019; and Salih & Flayyih,2020).

Independence and Objectivity: It is essential for auditors to maintain both real and perceived independence and impartiality throughout the audit process. This includes verifying that auditors do not have conflicts of interest, such as holding shares in or being on the board of the audited entity. Regular surveys and assessments help ensure adherence to these standards.

Personnel Management: Audit quality is heavily dependent on assigning tasks to qualified auditors. This involves ensuring auditors possess the required technical skills, receive ongoing professional development, and are promoted based on

competence. Effective personnel management is critical for ensuring auditors are well-equipped to perform their roles.

Client Acceptance and Continuation: Audit firms must have strong policies for accepting and maintaining client relationships. These policies should ensure that the firm has the necessary resources and capabilities to conduct audits effectively and adhere to ethical standards. It is important to gather adequate information to assess client integrity and compliance with professional ethics.

Compliance with Audit Processes: Implementing policies that ensure compliance with legal and professional auditing standards is crucial. This includes setting guidelines for audit procedures and ensuring adherence to quality standards.

Monitoring and Follow-Up: Establishing robust monitoring and follow-up mechanisms is vital to ensure that all audit quality requirements are met consistently. Regular reviews and oversight of audit practices are necessary for maintaining high standards.

Consultation Practices: Regular consultations with experienced professionals, whether internal or external, should be conducted to support audit quality and provide expert advice when needed

Previous research highlights several critical factors affecting audit quality. **Audit industry specialization** is one such factor, where firms with expertise in specific industries can better address industry-related risks and regulations, often leading to superior service quality and increased market share. Another key element is **audit firm size**, with larger firms typically offering higher audit quality due to their greater resources, advanced technology, and increased independence, which enhances their ability to manage complex audits and identify issues. **Audit tenure** the duration of the auditor's relationship with a client can also influence audit quality, as prolonged relationships may impact auditor independence and objectivity, with effects varying by economic context. Additionally, regulations such as the SOX Act of 2002 restrict the provision of non-**audit services (NAS)** by auditors to prevent conflicts of interest and ensure that audit quality is maintained. Collectively, these factors shape the overall effectiveness and reliability of the auditing process according to (Hussein & Hanefah,2013; Salehi, et al ,2019; and Hai, et al ,2019).

2.3 The Impact of Blockchain on Audit Quality

The study by Jiang (2018) reviews the characteristics and fundamental principles of blockchain technology in the context of China. It identifies key elements such as distributed ledgers, consensus mechanisms, and timestamps as instrumental in

enhancing auditing processes. Specifically, the study highlights how blockchain can improve the timeliness of audits and reduce costs, ensure data integrity while enabling automated audit functions, and provide real-time monitoring and early warning systems to mitigate audit risks. Jiang underscores the advantages blockchain offers over traditional audit methods, presenting new opportunities for the development and transformation of the audit industry. Nonetheless, the study also addresses several challenges, including concerns related to data security, the need for specialized technical expertise, industry recognition, and the practical implementation of blockchain in audit practices.

Tan and Low (2019) foresee a significant transformation in the accounting profession with the adoption of blockchain technology. Their study suggests that blockchain will fundamentally alter the database structure of accounting information systems by digitizing traditional paper-based verification methods. In a blockchain-based system, the role of accountants is expected to shift from being a central authority to a regulatory oversight position, where they will remain responsible for preparing financial statements and play a key role in accrediting and selecting validators. While the immutability of blockchain holds promise for reducing fraud and digitizing verification processes, thereby minimizing errors and costs, the authors emphasize that blockchain cannot, on its own, guarantee

complete accuracy or fairness in financial reporting. Audit evidence will still be necessary to provide a reliable opinion on the integrity of financial statements.

Liu et al. (2019) explored the opportunities and challenges that both permissionless and permissioned blockchains present for auditors. The study highlights that blockchain introduces new audit tasks, such as verifying digital assets and ensuring the accuracy of data recorded on the blockchain and in the real world. However, the decentralized nature of blockchain complicates the verification of ownership and data integrity, necessitating the development of new audit methods. To adapt to the blockchain era, the study recommends that auditors focus on four key steps:

Mastering Blockchain Technology and Governance: Auditors need to gain expertise in evaluating the costs and benefits of blockchain adoption.

Advising Clients on Blockchain Implementation: Audit firms should adjust recruitment and training to prepare teams for blockchain-related tasks.

Contributing to Blockchain Development with Risk Awareness: Auditors should engage in blockchain system development, particularly addressing new risks associated with its use.

Focusing on Risk Management and Internal Controls: Auditors should enhance service quality by assessing risk management and providing internal control solutions as blockchain technology evolves.

In addition, the studies suggest that as fraud and errors decrease, audit quality is likely to improve. Bonsón and Bednárová (2019) expand on this concept by examining the impact of blockchain technology on the qualitative aspects of accounting information and its implications for auditing. They highlight several advantages of blockchain, such as decentralization, flexibility, and encryption, while also acknowledging challenges related to its effective implementation. Their research concludes that blockchain influences both the quality characteristics of accounting information and the nature of electronic audit processes, signaling a significant evolution in auditing practices as blockchain technology becomes more integrated across industries.

Schmitz and Leoni (2019) investigated the effects of blockchain technology on the fields of accounting and auditing by conducting an extensive review of scholarly articles, professional reports, and online resources. Their study identified several key emerging themes, highlighting how blockchain enhances governance, transparency, and trust within the blockchain ecosystem. The technology enables continuous

auditing and facilitates the use of smart contracts, leading to a shift in the roles and responsibilities of accountants and auditors. Furthermore, blockchain improves the efficiency of transaction recording, enhances the consistency and accuracy of accounting data, and significantly reduces both time and costs, as well as the risk of human error for accounting professionals.

The research by Cao et al. (2019) explores the impact of blockchain technology on financial reporting and auditing, suggesting that blockchain integration could significantly disrupt traditional audit pricing, reduce the chances of client misreporting, and lower audit costs. The study highlights the potential role of regulators in encouraging the adoption of blockchain to further reduce errors and audit expenses. Similarly, Rozario and Thomas (2019) propose using blockchain in external audits to support more advanced audit methodologies, envisioning a future where financial statement audits become more efficient and transparent. According to their study, the adoption of blockchain and smart contracts enhances business processes by improving efficiency and transparency across the value chain. Furthermore, these technologies are expected to transform auditing by automating key processes, thus increasing audit efficiency and quality, while helping to bridge the expectation gap between auditors, users of financial statements, and regulators.

Mahmoud and Al-Nadr (2020) examined the relationship between blockchain adoption by audit clients and accounting and auditing firms, focusing on its effects on audit testing, suitable audit models, and organizational structures. Utilizing a mix of inductive and deductive approaches, the study aimed to predict the future of audit practices and the profession. The research involved 145 participants, including auditors from firms in Cairo and Alexandria and researchers from Tanta and Kafr El Sheikh universities. The findings revealed a shift in audit testing toward a greater emphasis on control tests over traditional methods, the identification of key factors necessary for the success of the continuous review model, the emergence of new auditor roles, and significant changes in the organizational structures of accounting and auditing firms.

In addition, the study by Secinaro et al. (2021) seeks to provide a comprehensive bibliometric and coding analysis of blockchain-related literature within the fields of accounting, auditing, and accountability, particularly focusing on Australian research. Data were sourced from the Scopus database, utilizing bibliometric and qualitative coding methods with the keywords “blockchain” and either “accounting,” “auditing,” or “accountability.” From an initial dataset of 514 sources, a total of 93 peer-reviewed journal articles, book chapters, and conference proceedings in the domains of business, management, and

accounting were ultimately selected for analysis. Non-scientific sources, such as non-peer-reviewed books and white papers, were excluded to ensure academic rigor. The results demonstrate that blockchain technology, as an external force, has the potential to bridge multiple research domains, including accounting, auditing, accountability, business, management, computer science, and engineering. However, while the influence of blockchain on auditing and accounting is well-documented, its impact on the area of accountability remains less clearly defined and requires further empirical validation.

In a study by Al Batoush et al,(2021) the influence of blockchain technology on the auditing profession in audit firms across the Hashemite Kingdom of Jordan was examined. The research utilized both objective descriptive and analytical field methodologies. The study targeted a population of 51 audit offices and firms accredited by the Securities Commission and the Jordanian Institute for Auditing the Accounts of Companies Listed on the Amman Stock Exchange. A simple random sample of 44 audit offices and companies was selected for the study. Questionnaires were distributed among these firms, and the results indicated a statistically significant impact of blockchain technology characteristics on the auditing profession, concluded that blockchain’s decentralization and transparency

characteristics can improve the quality of accounting and auditing information.

Elommal and Manita (2022) investigate the potential impact of blockchain technology on the auditing sector. Their research, conducted through a qualitative survey involving 17 auditors from the Big Four and Mazars, the fifth-largest international firm in France by revenue and size, reveals six keyways blockchain could influence audit firms. These include: (1) enhancing audit efficiency and reducing time requirements, (2) transitioning from sampling methods to auditing entire data populations, (3) shifting the focus from transaction testing to control testing, (4) enabling continuous auditing processes, (5) positioning auditors to take on more strategic roles, and (6) facilitating the development of new advisory services. Additionally, the study emphasizes the need for updated audit standards and the establishment of a clear, consistent legal framework to effectively support the integration of blockchain technology and improve auditing practices.

In addition, the study by Jayathilake and Seneviratne (2022) conducted a study aiming to explore the level of awareness among auditors in Sri Lanka regarding the implementation of blockchain technology in audit trails. The study utilized a qualitative research methodology, gathering data through semi-structured interviews with auditors at KPMG Sri

Lanka. Focusing on auditors employed by KPMG, one of the largest audit firms in the country, the research included a sample of 30 participants. The study's findings highlighted the substantial potential of blockchain technology to enhance the quality of the audit process. Furthermore, the results provided auditors with valuable insights into how blockchain could contribute to creating a more reliable, cost-effective, and secure audit trail, thereby enabling auditors to achieve their objectives more efficiently and effectively.

Gokoglan et al. (2022) conducted a comprehensive literature review to examine the perception, effectiveness, historical development, types, key features, and applications of blockchain technology, with a particular focus on auditing. The study underscores blockchain's decentralized verification mechanism as a major driver of digital transformation. The research highlights the diverse applications of blockchain in sectors such as auditing, supply chain management, public health, education, and finance, particularly in Türkiye. In the auditing field, blockchain is noted for enhancing data accuracy, timeliness, and transparency, while also reducing the costs associated with monitoring and control processes. Furthermore, the study emphasizes that blockchain's decentralized, interconnected database structure creates a more reliable audit trail, distinguishing it from other technological solutions.

Metwally (2022) explored the impact of blockchain technology on audit procedures in Egypt, with a particular focus on how blockchain-derived information influences audit planning. The study utilized a two-part methodology: the first part conducted a quantitative analysis of blockchain applications in publicly listed companies on the Egyptian stock market, while the second part examined behavioral aspects related to the importance of audit planning. The findings, both theoretical and practical, indicate that blockchain technology improves data accuracy and speeds up verification processes by maintaining a complete and immutable record of transactions. This allows auditors to automatically verify a significant portion of financial statements. Additionally, the study found that integrating blockchain into audit planning reduces the need for modified audit opinions and narrows the scope for potential fraud detection, leading to more efficient and effective audit planning. As a result, blockchain enhances the quality of audit evidence and boosts overall audit process efficiency.

Dyball and Seethamraju (2022) conducted a study to explore the anticipated effects of blockchain technology adoption by clients on financial statement audits conducted by accounting firms in Australia. The research primarily utilized semi-structured interviews with audit partners from both first- and second-tier accounting firms. These interviews focused on how

blockchain technology might influence various aspects of audit engagement, including planning, risk assessment, evidence gathering, client retention, and reporting. The study applied the concepts of professionalism and commercialism to interpret these impacts. The results revealed that blockchain technology introduces novel risks to audits, potentially altering how firms organize their operations, develop audit procedures, and conduct financial statement audits. The study found that while professionalism and commercialism can both enhance and challenge audit practices in this new domain, they are not mutually exclusive and offer firms opportunities to expand and refine their auditing expertise.

Han et al (2023) examines how blockchain technology can improve transparency and trust in accounting by leveraging its features like shared data, immutability, and consensus-driven processes. The study combines a review of academic literature with insights from trade publications and news articles to assess blockchain's impact on accounting and auditing in the United States. It finds that blockchain technology has the potential to enhance audit effectiveness through its auditable and traceable data, and AI tools can further support this improvement. However, technology is still developing, posing challenges and risks for organizations. Further research is needed to explore additional applications of blockchain in accounting.

A Study Ali (2023) aims to test the relationship between the audit client's adoption of blockchain technology and the delay in the audit report from auditing the full annual financial statements in Egypt. then an experimental study on a sample of auditors in the Egyptian professional practice environment. The findings demonstrated that the audit client's use of blockchain technology has a major impact on the audit report's lag time for the examination of the complete annual financial statements. and that in the Egyptian professional practice environment, the relationship between the audit client's adoption of blockchain technology and the Audit Report Lag on the audit of the full annual financial statements is affected by the auditor's modified effect of registration with the Financial Supervisory Authority as well as the size of the accounting and auditing office.

The Lalwani (2023) study also examined how blockchain technology will impact AI-based accounting and auditing, focusing on properties of blockchain data such as immutability, append-only, sharing, verifiable, and agreed upon. The study identifies four themes related to how blockchain technology is changing record keeping in accounting, including event-based accounting, real-time data collection, three-entry accounting, and continuous auditing. Data is collected through a questionnaire collected from accounting firms. The sample size consists of approximately 200 people answering the questionnaire. It finds

that blockchain technology can reduce information asymmetry and enhance collaboration among stakeholders but warns companies of adoption challenges.

Matskiv et al. (2023) investigated the potential of blockchain technology within the realms of accounting and auditing In Ukraine, focusing on its functional attributes and its ability to enhance workflow efficiencies for professionals in these fields. The study detailed both the advantages and limitations of blockchain technology, comparing it with traditional accounting and auditing practices. It included a comparative analysis of platforms supporting smart contracts, examining their potential for integration into business operations. While the study acknowledged the benefits of blockchain technology, such as improving performance in accounting and auditing systems, it also highlighted its limitations. Notably, it was pointed out that transaction errors could lead to significant financial losses and that blockchain does not offer absolute protection against fraud. Nonetheless, with adherence to proper guidelines, blockchain technology has the potential to substantially improve the effectiveness of accounting and auditing processes.

Hashem et al. (2023) examined the impact of blockchain technology on the quality of the audit process in Egypt, focusing on its influence on the recording, processing, and storage of

financial transactions and information. The study involved an empirical analysis of Egyptian banks that have implemented blockchain technology from 2017 to 2021. The findings revealed a significant relationship between blockchain technology and audit quality within the banking sector.

Based on the presentation of the studies, the researchers propose the following research hypothesis:

H1: There is a statistically significant relationship between blockchain technology and audit quality.

The current body of research highlights the significant potential of blockchain technology in auditing due to its key attributes, such as data transparency, clarity, accuracy, and credibility. Blockchain offers a decentralized database system that supports continuous auditing and monitoring, while preventing data manipulation through encryption, thereby enhancing the collection of reliable audit evidence. Most studies have concentrated on blockchain's structural design, operational mechanisms, and the technology’s applications in accounting and auditing, focusing particularly on smart contracts, cryptocurrencies, and modern information systems that assist in audit processes. Blockchain’s immutability and ability to manage databases have been recognized as essential benefits.

However, there is a notable research gap concerning how blockchain's features, influence audit quality in Egypt. Existing research predominantly emphasizes the theoretical aspects of blockchain rather than practical implementations in auditing. To address this gap, the researcher utilizes a structured questionnaire inspired by Al Batoush et al. (2021), aiming to evaluate how blockchain's transparency and decentralization impact audit quality. The study aligns with the focus of Elommal and Manita (2022) on Big Four audit firms but diverges by conducting the investigation within the Egyptian context.

3. Research Model

Based on the above presentation of previous studies the researchers built a model that shows the most important variables included in the study, as shown in the figure (٣-1), where the independent variable represents blockchains, and the dependent variable represents audit quality.

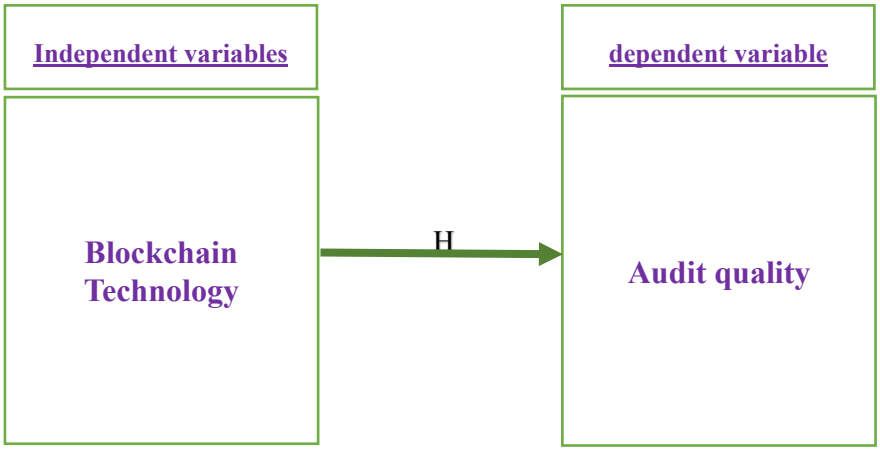

Figure (٣-1)

Research Model

Client Use of Blockchain Technology: Exploring Its Impact on Audit Quality of Egyptian Auditing Firms

4. Research Methodology

Data were gathered using a structured questionnaire distributed to all audit firms within the study sample. To assess the research model and examine the impact of the independent variable (blockchain technology) on the dependent variable (audit quality), several statistical methods were employed, including descriptive analysis, correlation coefficient matrix, and linear regression analysis. The study utilized the Statistical Package for the Social Sciences (SPSS) for statistical analysis. The study population comprised 20 audit firms accredited by the

Egyptian Stock Exchange. A selected sample of auditors from the Big Four auditing firms was chosen for this study due to their extensive client base comprising companies that utilize advanced technologies, particularly those listed on the stock exchange. Data collection was facilitated through a combination of telephone outreach and Google Forms, resulting in the distribution of 120 questionnaires. Of these, 116 responses were received, with 94 deemed appropriate for statistical analysis.

4.1 Data Collection and Study Tool

The researchers employed both secondary and primary data collection methods to construct the theoretical framework and assess the impact of blockchain technology on audit quality. Secondary data were sourced from academic journals and previous studies, while primary data were gathered through a questionnaire distributed among auditors from the Big Four firms. This questionnaire was designed to evaluate the key issues and measure blockchain's influence on audit quality. The study tool, the questionnaire, was developed by analyzing the relationships between study variables and identifying factors affecting the dependent variable, guided by practical theories and previous research. This approach allowed the researchers to test the hypothesis and measure the relationship between the independent and dependent variables.

4.2 Statistical Models Used in Testing Research Hypotheses

Simple linear regression models to test hypotheses regarding the relationship between blockchain technology (X) and audit quality (Y)

H١: There is a statistically significant relationship between blockchain technology (X) and audit quality (Y).

The regression model for this hypothesis would be as follows:

$Y=\beta 0+\beta 1X+\epsilon$

Where: Y: Audit quality, X: Blockchain technology, $\beta 0$: The constant (intercept), $\beta 1$: The regression coefficient representing the impact of blockchain technology on audit quality, ϵ: The random error.

4.3 Data Analysis and Hypothesis Testing

The use of descriptive analysis is presented to provide an initial overview of the data on blockchain adoption and audit quality. To further investigate the relationship between these variables, a correlation matrix is presented to assess the strength and direction of their association. Finally, a linear regression analysis procedure is presented to test causal relationships and assess the impact of blockchain adoption on audit quality improvements.

4.3.1 Descriptive Statistics

The table (4-1) below presents the results of the descriptive analysis conducted on the demographic variables of the study participants.

Table (4-1)

Variable	Category	Frequency	Percentage
Gender	Male	61	64.9
	Female	33	35.1
Qualification	Bachelor's	31	33
	Master's	59	62.8
	Ph.D	4	4.3
Name of company	Saleh, Barsoum, and Abdel Aziz- Deloitte	16	17
	PricewaterhouseCoopers Ezzedine, Diab and Partners -PWC	28	29.8
	Allied for Accounting and Auditing- E&Y	19	20.2
	Hazem Hassan- KPMG	31	33
Job title	External Auditor	94	100
Years of Experience	Less than 5 years	27	28.7
	from 5 to 10 years	46	48.9
	More than10 years	21	22.3

(Source: by researchers)

Table (4-1) presents a detailed breakdown of the study sample based on various demographic and professional characteristics. The sample includes both male and female auditors, reflecting gender diversity. Participants possess different academic qualifications, ranging from bachelor's to master's and doctoral degrees. In terms of company affiliation, all auditors are employed by major auditing firms, and their job titles are uniformly classified as external auditors. Lastly, the

participants' years of experience are distributed across three categories: less than five years, five to less than ten years, and more than ten years of experience.

The table (4-2) presents the results of the descriptive analysis of participants' responses to various statements concerning the blockchain variable in the study.

Table (4-2)

Statement	Strongly agree		Agree		Neutral		Disagreed		Strongly disagree		Mean	Std.	R.I	R.
	F	%	F	%	F	%	F	%	F	%				
X1	46	48.9	26	27.7	14	14.9	2	2.1	6	6.4	٤.١١	١.١٤	٨٢.٢	1
X2	32	34	40	42.6	19	20.2	-	-	3	3.2	٤.٠٤	0.91	٨٠.٨	3
X3	36	38.3	40	42.6	12	12.8	3	3.2	3	3.2	٤.١٠	0.96	٨٢	2
X4	7	7.4	14	14.9	13	13.8	39	41.5	21	22.3	٢.٤٤	١.٢٠	٤٨.٨	4
X5	34	36.2	44	46.8	11	11.7	3	3.2	2	2.1	٤.١٢	٠.٨٩	٨٢.٤	1
X6	35	37.2	38	40.4	16	17	2	2.1	3	3.2	٤.٠٦	٠.٩٥	٨١.٢	2
X7	32	34	40	42.6	17	18.1	2	2.1	3	3.2	٤.٠٢	٠.٩٣	٨٠.٤	3
X8	25	26.6	12	12.8	13	13.8	28	29.8	16	17	٣.٠٢	١.٤٨	٦٠.٤	4
Mean Average: Blockchain Technology											3.73	0.57	74.73	-

Source: by researchers

From the table (4-٢) it is clear, the general trend of the study sample towards the (Blockchain Technology), indicates that it is towards the (Agreement), with mean of (3.73), and the Std. Deviation (0.57), with Relative importance (74.73%). The most Important statements are, (X1), And the least important statement is, (X4), with Relative importance (48.8%). According to the responses of the study sample.

The table (4-3) presents the results of the descriptive analysis of participants' responses to various statements concerning the impact of blockchain technology on audit quality.

Table (4-3)

Statement	Strongly agree		Agree		Neutral		Disagree		Strongly disagree		Mean	Std.	R.I	R.
	F	%	F	%	F	%	F	%	F	%				
Y1	19	20.2	25	26.6	16	17	18	19.1	16	17	٣.١٤	١.٣٩	٦٢.٨٠	8
Y2	28	29.8	49	52.1	14	14.9	3	3.2	-	-	٤.١١	٠.٧٥	٨٢.٢٠	1
Y3	31	33	38	40.4	19	20.2	2	2.1	4	4.3	٣.٩٦	١.٠١	٧٩.٢٠	7
Y4	36	38.3	38	40.4	14	14.9	3	3.2	3	3.2	٤.٠٨	٠.٧٢	٨١.٦٠	2
Y5	32	34	40	42.6	16	17	3	3.2	3	3.2	٤.٠١	٠.٨٣	٨٠.٢٠	6
Y6	35	37.2	38	40.4	14	14.9	5	5.3	2	2.1	٤.٠٦	٠.٩٦	٨١.٢٠	4
Y7	36	38.3	34	36.2	18	19.1	4	4.3	2	2.1	٤.٠٤	٠.٩٧	٨٠.٨٠	5
Y8	33	35.1	39	41.5	16	17	5	5.3	1	1.1	٤.٠٧	٠.٩١	٨١.٤٠	3
Mean Average: Audit Quality											3.93	0.32	78.70	-

(Source: by researchers)

From the table(4-3) it is clear, it is evident that the general trend of the study sample regarding the "Audit Quality" indicates agreement, with a mean of 3.93, a standard deviation of 0.32, and a relative importance of 78.70%.The most important statements identified by the study sample are: (Y2), with Relative importance (82.20%),On the other hand, the least important statements were: (Y1), with Relative importance (62.80%), According to the responses of the study sample.

4.3.2 Correlation Between Variables

The table (4-4) presents the results of the correlation analysis examining the relationship between blockchain technology and audit quality.

Table (4-4)

Correlations

		x-Blockchain Technology
y-Audit Quality	Pearson Correlation	.765**
	Sig. (2-tailed)	.000
	N	94

**. Correlation is significant at the 0.01 level (2-tailed).

(Source: by researchers)

The data from Table (4-4) clearly indicate that there is a significant positive relationship between the use of blockchain technology and audit quality. The Pearson correlation coefficient value is 0.765 with a p-value of less than 0.01, indicating a strong and statistically significant relationship at the 1% significance level. This suggests that as the adoption of blockchain technology by audit clients increases, there is a similar positive impact on audit quality.

4.3.3 Hypothesis Testing

H١. There is a statistically significant relationship between blockchain technology X and audit quality Y.

The results of the main hypothesis test, using Model, are presented in the table below (4-5)

Table (4-5)

Independent variables	B	t. test		F. test		R^2
		Value	Sig.	Value	Sig.	
Constant	0.780	2.793	0.01**	130.180	.01*	58.6%
Blockchain Technology x	0.765	١١.٤١٠	0.01**			

**** Significant level 0.01 (Source: by researchers)**

Table (4-5) reveals that the coefficient of determination (R^2) indicates blockchain technology accounts for 58.6% of the total variation in audit quality, which is statistically significant. The t-test results confirm that all dimensions of blockchain technology significantly impact audit quality, with a t-value of 11.410 and a significance level below 0.01, demonstrating a strong relationship between the variables. Additionally, the F-test value of 130.180, significant at less than 0.01, underscores the high explanatory power of the regression model in predicting the effect of blockchain on audit quality. The regression coefficient (B) for blockchain technology is 0.765, indicating a positive and substantial contribution to improving audit quality.

Based on the above, the main hypothesis of the study is accepted, which states: There is a statistically significant relationship between blockchain technology and audit quality.

Equation of the form: Audit Quality Y= .780 + .765 Blockchain Technology X

Accordingly, we accept the statistical alternative hypothesis that there is an impact of blockchain technology on audit quality.

5. Discussion of Results, Recommendations, Research Limitations and Future Research

5.1 Research Results

The findings of this study demonstrate that blockchain technology has a significant impact on audit quality, enhancing it by increasing transparency and mitigating risks associated with data manipulation. The results indicate a statistically significant relationship between blockchain technology and audit quality. Moreover, the decentralization, transparency, and immutability of blockchain technology enhance its applicability in auditing. These features contribute to improved audit quality effectiveness, reduced audit costs, shift from sampling methods to auditing entire data sets, and facilitate independent audits. Additionally, blockchain technology supports real-time monitoring and preemptive alerts. It is anticipated that these capabilities will drive significant advancements and reforms in the audit sector.

This finding aligns with the study by Jayathilake and Seneviratne (2022), which demonstrated that blockchain technology provides auditors with valuable insights into creating a more reliable secure audit trail, thereby enabling auditors to achieve their objectives more efficiently and effectively.

Similarly, Cao et al. (2019) emphasized that blockchain facilitates the reduction of errors and audit expenses, promoting its adoption. Rozario and Thomas (2019) also found that financial statement audits become more efficient and transparent with blockchain, as its adoption, along with smart contracts, improves business processes by increasing efficiency and transparency throughout the value chain, enhancing both audit efficiency and quality. Additionally, the researchers also agreed with Elommal and Manita (2022) concurred, noting that blockchain technology can significantly improve audit efficiency, reduce time requirements, shift from sampling methods to auditing entire data sets, and enable continuous audits.

Blockchain technology has the potential to transform the auditing profession by enhancing reliability, speeding up access to information, and improving overall audit quality, which in turn leads to greater accuracy in financial reporting. These findings align with previous studies by Bonson and Bednarová (2019) and Al-Batoush et al. (2021), both of which concluded that blockchain can significantly enhance the quality of accounting and auditing information. Additionally, the results are consistent with Han et al. (2023), who demonstrated that blockchain's auditable transparency and traceable data features can improve audit effectiveness.

The decentralized nature of blockchain reduces human intervention and enhances independence in the audit process. This aligns with the findings of Gokoğlan et al. (2022), who emphasized that blockchain's decentralized verification mechanism is a key factor driving digital transformation. It also supports the conclusions of Bonson and Bednarová (2019) and Al-Batoush et al. (2021), both of whom noted that blockchain's decentralization improves the quality of accounting and auditing information.

5.2 Recommendations

Based on the study's findings, the researchers propose several key recommendations. Companies should adopt blockchain technology to leverage its ability to provide real-time, immutable transaction records, which can reduce fraud, enhance stakeholder trust, and streamline regulatory compliance, addressing issues like the agency problem. The decentralization of blockchain systems offers the potential to reduce reliance on intermediaries, allowing companies to eliminate operational bottlenecks, lower costs, and ensure data integrity. For audit firms, integrating blockchain is essential for improving audit quality through continuous, real-time auditing. Blockchain's transparency and immutability reduce the need for traditional verification processes, increasing audit efficiency and minimizing risks of error or fraud. The decentralized nature of

blockchain also enhances auditor independence by limiting human intervention. Audit firms should explore how blockchain can reduce biases and lead to more accurate, impartial audits, while also enabling real-time access to comprehensive data sets for more thorough and reliable audit outcomes.

5.3 Research Limitations

- The scope of the study was limited to the impact of blockchain technology on audit quality, as a questionnaire was used as the main tool for measuring audit quality, due to the ease of applying this method compared to other methods.
- The study was limited to the application within the framework of the four major audit firms only in Egypt, without expanding to include all audit firms operating in Egypt.

5.4 Future Research

- Future studies should expand the geographic scope to include audit firms from other regions and smaller firms within Egypt and globally. Additionally, exploring how blockchain impacts audit quality across various industries, such as healthcare, financial services, and supply chain management, could provide industry-specific insights.
- Given that this study used a questionnaire to assess audit quality, future research should consider alternative methods

like case studies, experimental designs, or real-time data analysis on blockchain platforms. A comparative analysis of blockchain-based audits versus traditional audit methods could offer deeper insights into the benefits and challenges of blockchain in diverse auditing contexts.

- Further research should also investigate the implications of blockchain technology on regulatory compliance and ethical standards in auditing. With its transparency and immutability, blockchain may influence audit ethics, corporate governance, and financial reporting reliability, making this an important area for future inquiry.
- Finally, cross-industry studies could be valuable in understanding how blockchain affects audit quality in sectors with varying degrees of digital maturity and complexity. Examining its impact on industries such as banking, manufacturing, government, and telecommunications could yield more targeted recommendations for blockchain adoption in auditing.

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