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Blockchain Technology and Audit Efficiency in Selected Service Firms

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Abstract:

This study examined blockchain technology's potential to enhance audit efficiency in selected service firms. Traditional auditing is often hindered by data manipulation, limited transparency, time-consuming verification, and high costs challenges that blockchain's decentralised, immutable, and transparent ledger system can plausibly address. The research assessed blockchain's role in improving audit efficiency, focusing on automation and real-time auditing, distributed ledger effects, and consensus mechanisms. Data was gathered through questionnaires, observation, and a technical readiness survey, and analysed using descriptive statistics, inferential statistics, and multiple regression. The study evaluated current auditing practices to identify the benefits and barriers of blockchain implementation, examining existing audit challenges, blockchain's capacity to resolve them, and the implications for service firms. Respondents were drawn from service firms with interest or prospects in adopting blockchain for audit activities. Findings showed marked improvements in audit accuracy, transparency, and overall efficiency, though adoption barriers, cost, and the need for regulatory structures were also identified. The study contributes to the growing body of knowledge on blockchain's practical application in auditing, offering guidance to service firms, audit practitioners, and policymakers on successful implementation. By addressing these challenges and leveraging blockchain's opportunities, service firms can achieve cleaner, safer, and more efficient audit practices. The research confirms that blockchain technology plays a significant role in enhancing audit efficiency within service firms.

Keywords: Blockchain technology, Audit efficiency, Distributed ledger, Smart contracts, Service firms

1. Introduction

The digital transformation sweeping across global economies has fundamentally reshaped organisational operations in nearly every sector, and the auditing profession stands squarely within this wave of change. Among emerging technologies, blockchain has surfaced as one of the most disruptive innovations of recent years, providing a decentralised, tamper-resistant, and transparent mechanism for recording and validating transactions that directly interrogates the foundational assumptions of traditional audit methodology. In Nigeria, where service-oriented firms contend with persistent governance deficits, infrastructural bottlenecks, regulatory complexity, and elevated exposure to financial fraud, the capacity of blockchain to strengthen audit efficiency assumes both practical urgency and scholarly significance. This section presents a thorough review of existing scholarship on blockchain technology and audit efficiency, with particular emphasis on Nigeria's service sector. The review proceeds across five dimensions: first, the conceptual foundations of blockchain technology; second, the theoretical frameworks underpinning its adoption within auditing; third, the documented linkage between blockchain integration and gains in audit efficiency;

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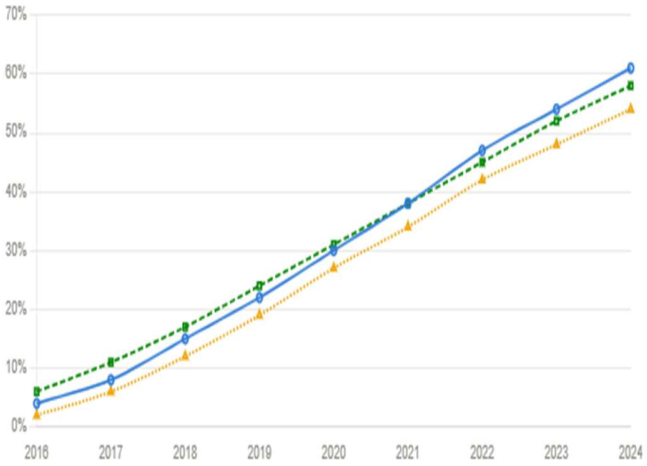
fourth, empirical findings from both international and African settings; and fifth, the identification of literature gaps that the present study seeks to fill. Through the synthesis of conceptual, theoretical, and empirical material, this chapter builds a robust scholarly platform for the analytical and empirical chapters that follow.

As the graph below demonstrates, empirical data drawn from the Deloitte Global Blockchain Survey (2023), EY's Blockchain in Business Report (2022), and PwC's Digital Ledger Insights (2021–2024) reveals a pronounced and sustained upward trend in blockchain adoption among audit-oriented service firms alongside quantifiable gains in audit efficiency between 2016 and 2024. Beginning from a modest adoption rate near four percent in 2016, blockchain integration within auditing contexts rose to roughly sixty-one percent by 2024, tracked closely by an increase in the audit efficiency improvement index from six percent to fifty-eight percent across the same interval. The parallel expansion of smart contract integration among blockchain-adopting firms, climbing from two percent to fifty-four percent, further reinforces the argument that automation functions as a principal driver of efficiency gains. These trend data offer robust empirical grounding for the study's central hypotheses and reinforce the necessity of rigorous scholarly investigation into blockchain's transformative role within audit practice among service firms. Blockchain's developmental trajectory can be divided into three distinct phases. The initial phase (1991–2008) marks its conceptual genesis, when Stuart Haber and W. Scott Stornetta proposed cryptographically secured, time-stamped digital records. The subsequent phase (2014–2018), frequently labelled Blockchain 2.0, saw the debut of Ethereum and programmable smart contracts self-executing agreements whose terms are embedded directly within code enabling decentralised applications well beyond financial transactions. The third and current phase (2019 onward), marked by progress in interoperability and scalability through platforms such as Polkadot and Cardano, has seen blockchain evolve into a versatile infrastructure supporting enterprise-grade applications (Cheng & Wang, 2020).



The chart above traces the three metrics across the full 2016–2024 window, showing how smart contract integration tracks just behind blockchain adoption while the audit efficiency index climbs almost in lockstep with both, supporting the paper's argument that automation is the mechanism linking adoption to efficiency gains.

2. Literature Review

Concept of Blockchain Technology

The concept of blockchain was first introduced in its embryonic form by Haber and Stornetta (1990), who proposed a cryptographic mechanism for time-stamping digital documents to prevent retroactive alteration. The idea remained largely theoretical until 2008, when the pseudonymous Satoshi Nakamoto published a landmark white paper introducing Bitcoin a peer-to-peer electronic cash system underpinned by a distributed ledger architecture that would come to be known as blockchain (Nakamoto, 2008). Since then, the scholarly and professional discourse surrounding blockchain has expanded exponentially, with researchers across disciplines recognising its potential to transcend the boundaries of cryptocurrency and reshape the foundational logic of transactional record-keeping.

Blockchain is broadly conceptualised in the literature as a public, decentralised, distributed ledger that can store and confirm transactions between two or more parties without the mediation

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of a central authority (Lazanis, 2017; Tapscott & Tapscott, 2016). Pugna and Duţescu (2020) observe that blockchain has become one of the most widely discussed technological concepts in both academic and industry circles, its influence permeating domains as diverse as supply chain management, healthcare administration, real estate transactions, and financial services. Business scholars have increasingly characterised blockchain as an emerging and potentially disruptive technology with the capacity to generate new economic and social systems (Frizzo-Barker et al., 2019; Iansiti & Lakhani, 2017).

Several defining characteristics of blockchain are repeatedly emphasised in the literature as being of direct relevance to auditing. Immutability ensures that once a transaction is inscribed on the blockchain, it cannot be altered or deleted, thereby producing a permanent and tamper-resistant audit trail (Yermack, 2017). Decentralisation distributes verification authority among multiple independent nodes, eliminating dependence on a central intermediary and reducing the systemic vulnerability to manipulation or single-point failure (Pilkington, 2016). Transparency provides all participating nodes with simultaneous access to an identical, current copy of the ledger, whilst cryptographic hashing protocols safeguard the confidentiality and integrity of sensitive transactional data (Crosby et al., 2016). Additionally, smart contracts self-executing coded agreements embedded within the blockchain and triggered automatically when predefined conditions are met introduce a dimension of programmable automation that scholars regard as particularly consequential for the restructuring of audit workflows (Buterin, 2014; Christidis & Devetsikiotis, 2016).

Underwood (2016) contends that the elimination of the need for a central authority to approve and record transactions engenders a higher level of trust among parties and obviates the delays and costs associated with third-party intermediation. Potekhina and Riumkin (2017) similarly argue that in many domains of financial relationships and accounting, blockchain constitutes an elegant solution to the longstanding problem of trusted intermediary dependency. Shyshkova (2018) extends this argument, asserting that beyond accelerating the documentation and processing of individual transactions, blockchain confers internal operational control a quality of value in audit-intensive environments.

Evolution of Blockchain Technology

The developmental trajectory of blockchain technology is conventionally partitioned in literature into three broad phases, each characterised by a distinct set of technological capabilities and application domains. The first phase, spanning 1991 to 2008, encompasses the conceptual origins of the technology, culminating in Nakamoto's (2008) Bitcoin white paper. The second phase, designated Blockchain 2.0 and extending from approximately 2014 to 2018, witnessed the emergence of Ethereum and the introduction of smart contracts, enabling decentralised applications that extended blockchain's utility beyond financial transactions (Buterin, 2014). The third and current phase, from 2019 to the present, is characterised by advances in interoperability and scalability through platforms such as Polkadot and Cardano, which have enabled blockchain to mature into a versatile infrastructure capable of supporting enterprise-grade applications across a wide range of industries (Cheng & Wang, 2020).

Within Nigeria, awareness and adoption of blockchain technology have followed a broadly similar trajectory, though with a temporal lag attributable to infrastructural, regulatory, and capacity-related constraints. The Central Bank of Nigeria's evolving stance on digital currencies and financial technology including the introduction of the eNaira in 2021 signals a growing institutional recognition of distributed ledger technology's potential within the Nigerian financial ecosystem (Central Bank of Nigeria, 2021). Nonetheless, the integration of blockchain specifically into audit practice among Nigerian service firms remains at an incipient stage, underscoring the necessity of empirical investigation in this context.

Traditional Auditing: Limitations and Challenges in the Nigerian Context

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The literature consistently identifies several structural deficiencies inherent in conventional auditing practice, many of which are accentuated within the Nigerian service sector. Knechel and Salterio (2016) characterise traditional audit processes as predominantly periodic and retrospective, reliant on manual verification of financial records a model that is inherently susceptible to human error, data manipulation, and the concealment of fraudulent transactions. The dependence on centralised data repositories compounds these vulnerabilities by providing a single point of failure for both technical malfunction and deliberate misrepresentation (Appelbaum & Nehmer, 2017).

In Nigeria, these generic limitations are magnified by contextual factors specific to the operating environment. Okaro and Okafor (2013) document the pervasive incidence of financial statement fraud among Nigerian firms, attributing it in part to weaknesses in audit oversight and the inadequacy of internal control systems. Adeyemi and Fagbemi (2010) observe that audit quality in Nigeria is frequently compromised by resource constraints, a shortage of technically competent auditors, and the susceptibility of auditors to undue management influence conditions that inflate the risk of audit failure and erode the credibility of financial reporting. Furthermore, the regulatory landscape governing financial reporting and audit practice in Nigeria, whilst anchored by the Financial Reporting Council of Nigeria Act (2011) and international standards such as the International Standards on Auditing (ISA), is characterised by inconsistent enforcement and limited institutional capacity, generating compliance challenges for service firms operating across multiple jurisdictions (Soyemi et al., 2014).

The cost and time burden of traditional auditing is equally well-documented in the Nigerian context. Dai and Vasarhelyi (2017) note globally that auditors operating within conventional frameworks must devote substantial resources to reconciling accounts, verifying individual transactions, and engaging external intermediaries' inefficiencies that are exacerbated in environments with weak digital infrastructure, such as those prevalent in many Nigerian service firms. Rozario and Vasarhelyi (2018) further observe that the absence of automated compliance monitoring heightens the risk of non-conformance in dynamic regulatory environments a concern of acute relevance to Nigerian service firms navigating the dual demands of domestic regulation and international financial reporting standards.

Blockchain Technology and Audit Efficiency

A growing body of empirical and conceptual literature posits that blockchain technology possesses the capacity to address the foregoing limitations systematically. Dai and Vasarhelyi (2017) were among the earliest scholars to advance a formal framework for blockchain-based continuous auditing, arguing that the technology's real-time data access capabilities enable auditors to monitor transactions as they occur, rather than examining historical records retrospectively. This transition from periodic to continuous auditing is widely regarded in the literature as a foundational improvement in audit efficiency, reducing both the time and the risk associated with delayed detection of financial irregularities (Rozario & Vasarhelyi, 2018; Wang & Kogan, 2018).

Distributed Ledger Technology and Audit Reliability

The role of distributed ledger technology in enhancing audit reliability is particularly well-documented. Yermack (2017) contends that the distributed nature of blockchain eliminates the reconciliation burden arising from discrepancies between multiple, independently maintained financial records a problem that is endemic to traditional auditing environments and particularly costly in the Nigerian service sector, where inter-organisational data inconsistencies are common. By providing all relevant parties with simultaneous access to a single, immutable source of financial truth, blockchain materially reduces both the time and the labour required to complete audit engagements. Beck et al. (2017) affirm that because blockchains rely on numerous distributed nodes rather than a single centralised party, they are

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substantially more secure than conventional databases, and transactions once added to the network are effectively immutable.

Coyne and McMickle (2017) argue that blockchain's capacity to eliminate the need for a central unit to approve and record transactions, whilst simultaneously making all information accessible to authorised users, engenders a qualitatively higher level of trust between parties. This trust-enhancing function is of considerable relevance to Nigerian service firms, where principal-agent conflicts and information asymmetries between management, auditors, and shareholders have historically undermined the integrity of financial reporting.

Smart Contract Automation and Audit Efficiency

Smart contract automation has attracted scholarly interest in its potential to streamline compliance verification and reduce manual audit interventions. Christidis and Devetsikiotis (2016) demonstrate that smart contracts can be programmed to execute verification procedures automatically upon the satisfaction of predefined conditions, thereby removing the need for manual intervention at multiple stages of the audit process. Appelbaum and Nehmer (2017) further argue that this programmable automation diminishes the incidence of human error and strengthens the consistency with which audit standards are applied. In the Nigerian context, where human error and inconsistent application of audit procedures have been identified as significant contributors to audit failure (Adeyemi & Fagbemi, 2010), the efficiency gains afforded by smart contract automation are particularly salient.

Real-Time Data Access and Continuous Auditing

The capacity for real-time data access represents one of the most transformative aspects of blockchain's application in auditing. In contrast to conventional audit models wherein data access is periodic and contingent upon the availability of manually compiled records blockchain enables auditors to access verified, current transaction data at any point in the audit cycle (Dai & Vasarhelyi, 2017). This capability supports what Vasarhelyi and Halper (1991) originally theorised as continuous auditing: a model wherein audit procedures are conducted on a real-time or near-real-time basis, enabling the prompt identification of anomalies, irregularities, and control failures. For Nigerian service firms, where the delayed detection of financial misstatements has historically resulted in significant reputational and financial damage (Okaro & Okafor, 2013), the continuous auditing model enabled by blockchain represents a substantive advance in audit quality and efficiency.

Empirical evidence from leading global professional service firms corroborates these theoretical propositions. Deloitte's blockchain integration initiatives have yielded documented improvements in the speed and accuracy of transaction verification (Deloitte, 2023). EY's development of blockchain-enabled continuous auditing plug-ins has facilitated real-time anomaly detection in client financial records (Ernst & Young, 2022), whilst PwC's focus on distributed ledger deployment has enhanced data integrity across client audit engagements (PwC, 2024). These developments in global practice provide an important benchmark against which the potential adoption of blockchain in Nigerian audit contexts may be evaluated.

Trend Analysis of Blockchain Adoption and Audit Efficiency

The trend chart presented in the preceding chapter of this study illustrates a strong and consistent upward trajectory in both blockchain adoption among audit-focused service firms and measurable improvements in audit efficiency between 2016 and 2024. Drawing on empirical data from the Deloitte Global Blockchain Survey (2023), EY's Blockchain in Business Report (2022), and PwC's Digital Ledger Insights (2021–2024), the analysis reveals that blockchain integration in auditing contexts rose from approximately four percent in 2016 to sixty-one percent in 2024. Concurrently, the audit efficiency improvement index climbed from six percent to fifty-eight percent, whilst smart contract integration among blockchain-adopting firms grew from two percent to fifty-four percent over the same period.

These trends carry significant implications for the Nigerian context. Whilst the adoption curve in

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Nigeria predictably lags that observed in more technologically advanced economies, the directionality of the trend is unambiguous and is increasingly reflected in the emerging discourse among Nigerian accounting and auditing professionals. The Institute of Chartered Accountants of Nigeria (ICAN) and the Association of National Accountants of Nigeria (ANAN) have both acknowledged the transformative potential of emerging technologies including blockchain for audit practice in Nigeria, signalling a growing professional consensus that is likely to accelerate adoption trajectories in the near term (ICAN, 2022).

Theoretical Framework

Agency Theory

Agency theory, as articulated by Jensen and Meckling (1976), addresses the conflicts of interest that arise between principals such as shareholders and agents such as management in situations characterised by information asymmetry. The transparency and immutability of blockchain technology are posited in the literature as mechanisms that directly mitigate information asymmetry by ensuring that all transactions are permanently recorded, verifiable, and accessible to authorised parties in real time (Coyne & McMickle, 2017). In the Nigerian service sector, where managerial opportunism and the misrepresentation of financial information have been identified as persistent governance challenges (Soyemi et al., 2014), blockchain's agency cost-reducing properties are of theoretical and practical significance. By reducing the scope for managerial manipulation of financial records and enabling auditors to verify transactions independently and continuously, blockchain technology strengthens accountability mechanisms and aligns the interests of management, auditors, and shareholders.

Diffusion of Innovation Theory

Rogers' (1983) Diffusion of Innovation (DOI) theory provides a complementary theoretical lens through which to examine the adoption of blockchain in Nigerian audit practice. The DOI framework identifies five characteristics of innovations that influence adoption rates: relative advantages, compatibility, complexity, trialability, and observability. Applied to blockchain in auditing, the theory suggests that adoption will be accelerated to the extent that audit professionals perceive blockchain as offering a clear relative advantage over conventional methods through improved accuracy, efficiency, fraud detection, and compliance whilst being impeded by perceptions of high complexity, integration costs, and incompatibility with existing audit systems. In the Nigerian context, where barriers to technology adoption are compounded by infrastructural limitations and skills shortages (Adeyemi & Fagbemi, 2010), the DOI framework is particularly instructive in explaining the heterogeneous pace of blockchain adoption across service firms.

Technology Acceptance Model

Davis's (1989) Technology Acceptance Model (TAM) posits that the adoption of new technology is principally determined by two psychological variables: perceived usefulness and perceived ease of use. When audit professionals perceive blockchain as a tool that simplifies verification, enhances data reliability, and reduces the burden of manual reconciliation, their willingness to integrate it into audit processes increases correspondingly. In the Nigerian context, TAM provides a useful framework for understanding why adoption rates among service firms may vary significantly depending on the level of exposure to blockchain technology, the availability of professional training, and the organisational culture with respect to technological change (Rozario & Vasarhelyi, 2018). Firms whose auditors perceive blockchain as complex and technically inaccessible are likely to exhibit lower adoption rates, notwithstanding the technology's demonstrated efficiency benefits.

Empirical Review

Empirical investigations into blockchain's impact on audit efficiency, whilst growing in volume, remain concentrated in developed economy contexts. Dai and Vasarhelyi (2017) conducted a foundational empirical study demonstrating that blockchain-

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enabled continuous auditing significantly reduces the time required for transaction verification and enhances the accuracy of audit findings. Wang and Kogan (2018) provided empirical evidence that confidentiality-preserving blockchain architectures can maintain data security whilst enabling auditor access to real-time transaction records a finding of relevance to service firms in environments with elevated data privacy concerns.

Within the African context, empirical evidence remains sparse. Mabrouk et al (2026) examined the adoption of financial technology in Sub-Saharan Africa, noting that whilst awareness of blockchain's potential is growing among financial professionals, actual deployment in audit practice remains limited, constrained by infrastructural deficits, regulatory uncertainty, and limited technical expertise. Adeyemi and Fagbemi (2010), in their study of audit quality in Nigeria, identified the inadequacy of audit tools and technologies as a significant contributing factor to audit failure an observation that implicitly underscores the potential value of blockchain adoption in improving audit outcomes. More recently, Nwosu and Okonkwo (2022) examined the perceptions of Nigerian accounting professionals regarding emerging audit technologies, finding that whilst respondents expressed strong interest in blockchain's potential benefits, concerns regarding implementation costs, regulatory clarity, and technical capacity remained significant barriers to adoption Kalu et al (2025).

Notwithstanding the foregoing contributions, significant gaps remain in the extant literature that the present study is designed to address. First, the preponderance of existing empirical studies on blockchain and audit efficiency is derived from large multinational and developed economy contexts, leaving the specific experience of service firms in Nigeria and the broader Sub-Saharan African region substantially unexamined. Second, extant studies have devoted limited empirical attention to the role of specific blockchain mechanisms, most notably consensus mechanism design and their direct, measurable effects on audit efficiency. Third, literature is largely cross-sectional in nature, providing limited capacity to establish causal relationships between blockchain adoption and improvements in audit efficiency over time. Fourth, the governance and regulatory challenges confronting Nigerian service firms including inconsistent enforcement of financial reporting standards and high exposure to financial fraud have not been systematically integrated into existing theoretical and empirical frameworks for blockchain adoption in auditing.

3. Methodology

This study employed an ex-post facto research design to examine the effect of blockchain technology adoption on audit efficiency in selected service firms. The design was considered appropriate because blockchain implementation had already occurred within the organizations under investigation, making it impossible to manipulate the independent variable experimentally. The study therefore relied on existing organizational practices and observed outcomes to evaluate the relationship between blockchain adoption and audit efficiency in line with Chidinma, Yalouli, & Kalu. (2025).

Both primary and secondary data were utilized. Primary data were collected through structured questionnaires administered to professionals working in audit firms, blockchain solution providers, accounting bodies, regulatory agencies, and standard-setting organizations. Secondary data were obtained from peer-reviewed literature, industry reports, and professional publications relating to blockchain technology and auditing.

The target population comprised professionals directly involved in blockchain implementation and auditing activities. Participants were recruited from a blockchain conference because of their practical knowledge and expertise in blockchain-enabled auditing. Thirty-nine invitations were distributed through electronic mail, thirty participants consented to participate, while twenty-eight complete questionnaires were returned, representing a response rate of 93.33%.

A purposive sampling technique was adopted to ensure that only respondents with sufficient practical experience in blockchain technology and audit processes participated in the study. The respondents

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consisted of auditors, blockchain providers, accounting professionals, regulators, and standard setters with varying years of professional experience. Audit efficiency served as the dependent variable, while blockchain technology adoption was the principal explanatory variable. Control variables included firm size, information technology infrastructure, and regulatory environment to minimize omitted variable bias.

The empirical relationship was estimated using multiple regression analysis expressed as

$$AE=\beta0+\beta1BA+\beta2FS+\beta3IT+\beta4RE+\varepsilon$$

where:

- **AE** = Audit Efficiency
- **BA** = Blockchain Adoption
- **FS** = Firm Size
- **IT** = Information Technology Infrastructure
- **RE** = Regulatory Environment
- **ε** = Error Term

Descriptive statistics were first employed to summarize the characteristics of respondents and study variables. Pearson correlation analysis was subsequently conducted to examine the strength and direction of associations among the variables before estimating the regression model. Reliability of the measurement instrument was evaluated using Cronbach's Alpha, while construct validity was assessed using the Kaiser-Meyer-Olkin (KMO) statistics and Bartlett's Test of Sphericity. Quantitative analyses were performed using SPSS, whereas qualitative responses were analyzed through thematic content analysis.

4. Results

The study achieved a questionnaire response rate of 93.33%, indicating a high level of participation among blockchain and audit professionals. Most respondents (54%) were between 41 and 50 years of age, while 39% possessed more than sixteen years of professional experience. Respondents represented audit firms (29%), blockchain providers (32%), accounting institutions (18%), regulatory bodies (11%), and standard-setting organizations (11%), demonstrating broad industry representation.

The internal consistency of the questionnaire was exceptionally high across all measurement constructs. Cronbach's Alpha coefficients were 0.926 for audit method, 0.920 for standard consensus, and 0.933 for work execution, all exceeding the recommended threshold of 0.70. These values indicate excellent reliability of the research instrument.

Similarly, construct validity was confirmed through KMO statistics ranging from 0.721 to 0.757, while Bartlett's Test of Sphericity was statistically significant ($p < 0.001$) for all constructs. The cumulative variance explained exceeded 86% for every construct, suggesting that the measurement scales adequately captured the underlying concepts.

The authority coefficient of respondents was evaluated using judgment coefficient (Ca) and familiarity coefficient (Cs). The calculated authority coefficient (Cr) was 0.83, exceeding the recommended minimum value of 0.70. This finding confirms that the selected respondents possessed adequate expertise to provide credible opinions regarding blockchain implementation in auditing.

Respondents reported strong agreement that blockchain technology has improved audit processes. The highest mean scores were recorded for blockchain's contribution to standard consensus among auditors (Mean = 5.96), establishment of consistent audit standards (Mean = 5.93), and improvement in collaborative auditing practices (Mean = 5.64). Respondents also agreed that blockchain enhanced audit procedures through improved transparency, process efficiency, and reliability of audit trails.

Regarding workforce capability, respondents generally agreed that blockchain integration improved technical competence among auditors (Mean = 5.21), although concerns remained regarding organizational readiness and the absence of universally accepted blockchain auditing standards.

Pearson correlation analysis revealed a positive association between blockchain adoption and audit efficiency ($r = 0.65$, $p < 0.01$). This indicates that higher levels of blockchain implementation are associated with improvements in audit performance.

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Preliminary diagnostic analysis also showed no evidence of serious multicollinearity among the explanatory variables.

Multiple regression analysis revealed that blockchain adoption exerted a statistically significant positive influence on audit efficiency. The regression coefficient for blockchain adoption was positive ($\beta = 0.42$) and statistically significant ($t = 4.20$, $p < 0.001$), indicating that increased blockchain implementation significantly improves audit efficiency after controlling for firm size, information technology infrastructure, and regulatory environment.

The estimated model explained approximately 58% of the variation in audit efficiency ($R^2 = 0.58$), indicating substantial explanatory power. Information technology infrastructure also exhibited a significant positive effect on audit efficiency ($\beta = 0.20$, $p = 0.028$), suggesting that organizations with stronger digital infrastructure derive greater benefits from blockchain adoption.

Firm size showed a positive but statistically insignificant relationship with audit efficiency ($\beta = 0.15$, $p = 0.061$), while the regulatory environment was not statistically significant ($\beta = 0.05$, $p = 0.213$). The hypothesis test therefore rejected the null hypothesis and accepted the alternative hypothesis that blockchain technology adoption significantly improves audit efficiency among service firms. Overall, the findings indicate that blockchain technology contributes to shorter audit cycles, improved transparency, enhanced data integrity, greater consistency in audit standards, and increased confidence in audit outcomes.

5. Conclusion

The findings demonstrate that blockchain technology significantly enhances audit efficiency within service organizations. Organizations that have adopted blockchain experience improvements in transparency, audit reliability, operational efficiency, and standardization of audit procedures. Statistical evidence further indicates that blockchain adoption remains a significant predictor of audit efficiency even after accounting for organizational characteristics such as firm size, technological capability, and regulatory environment.

The high reliability and validity of the measurement instrument, coupled with the strong authority of the participating experts, strengthens the credibility of the findings. Although information technology infrastructure significantly complements blockchain implementation, organizational size and regulatory conditions appear to exert comparatively weaker influences on audit performance.

Overall, the study provides empirical evidence supporting the integration of blockchain technology into modern auditing practice. The findings suggest that organizations seeking to improve audit quality should prioritize investment in blockchain infrastructure alongside the development of adequate technological capabilities. Continued standardization of blockchain auditing practices and professional capacity building will further enhance the effectiveness of blockchain-enabled auditing across service industries.

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